Tables

Table ES-1. Summary of COCs that Present Unacceptable Risk to at Least One Receptor Group

								Birds		Mammals	
COPC	Number of Sample Locations	COC Status	Count of HQ ≥ 1 for Plants[a]	Count of HQ ≥ 1 for Invertebrates[a]	Count of HQ ≥ 1 for Birds[b]	Count of HQ ≥ 1 for Mammals[b]	Count (percent) of Samples > BTV	Most Sensitive Endpoint	Receptor	Most Sensitive Endpoint	Receptor
Aluminum	253	Not retained	37 (15%)	37 (15%)	17 (7%)	219 (87%)	0 (0%)	Growth	American robin	Reproduction	Masked shrew
Antimony	253	Not retained	0 (0%)[c]	NA	NC	NC	179 (71%)	NA	NA	NA	NA
Arsenic	253	COC	***76 (30%)***	0 (0%)[c]	NA	NA	35 (14%)	NA	NA	NA	NA
Barium	253	COC	3 (1%)[c]	***103 (41%)***	0 (0%)[c]	NA	78 (31%)	Growth	California quail	NA	NA
Beryllium	253	Not retained	NA	NA	NC	NA	251 (100%)	NC	NC	NA	NA
Cadmium	253	COC	NA	NA	***139 (55%)***	***157 (62%)***	250 (99%)	Growth	American robin	Survival	Masked shrew
Chromium	253	Not retained	1 (0%)[c]	7 (3%)[c]	0 (0%)[c]	0 (0%)[c]	75 (30%)	Growth	American robin	Reproduction	Meadow vole
Cobalt	253	Not retained	1 (0%)[c]	0 (0%)[c]	NA	NA	4 (2%)	NA	NA	NA	NA
Copper	253	COC	0 (0%)[c]	2 (1%)[c]	0 (0%)[c]	***104 (41%)***	21 (8%)	Reproduction	Black-capped chickadee	Survival	Masked shrew
Iron	253	Not retained	6 (2%)[c]	6 (2%)[c]	0 (0%)[c]	0 (0%)[c]	8 (3%)	growth	American robin	Growth	Masked shrew
Lead	253	COC	***63 (25%)***	NA	***160 (63%)***	***195 (77%)***	253 (100%)	Reproduction	American robin	Reproduction	Masked shrew
Manganese	253	COC	***250 (99%)***	***221 (87%)***	NA	NA	70 (28%)	NA	NA	NA	NA
Mercury	253	COC	NA	NA	***130 (51%)***	0 (0%)[c]	37 (15%)	Reproduction	American robin	Reproduction	Masked shrew
Molybdenum	253	Not retained	0 (0%)[c]	0 (0%)[c]	0 (0%)[c]	0 (0%)[c]	37 (15%)	Reproduction	Black-capped chickadee	Reproduction	Meadow vole
Nickel	253	Not retained	3 (1%)[c]	NA	NA	NA	29 (11%)	NA	NA	NA	NA
Selenium	253	COC	***35 (14%)***	NA	9 (4%)[c]	***36 (14%)***	253 (100%)	Growth	Black-capped chickadee	Growth	Masked shrew
Silver	253	Not retained	NA	0 (0%)[c]	NA	NA	252 (100%)	NA	NA	NA	NA
Thallium	253	Not retained	0 (0%)[c]	0 (0%)[c]	NC	0 (0%)[c]	16 (6%)	NC	NC	Survival	Masked shrew
Vanadium	253	Not retained	NA	0 (0%)[c]	0 (0%)[c]	NA	12 (5%)	Growth	American robin	NA	NA
Zinc	253	COC	***194 (77%)***	***87 (34%)***	***74 (29%)***	***172 (68%)***	243 (96%)	Growth	Black-capped chickadee	Growth	Masked shrew

[a] Hazard quotients are based on the BAB if available, otherwise-the Eco-SSL or SSL.

[b] Hazard quotients are based on the most sensitive endpoint (survival, growth, or reproduction) for the most sensitive receptor.

[c] COPC not retained as a COC for receptor group due to negligible risks to the receptor group.

Notes:

Counts of HQs for retained COCs are in bold and italics.

> = greater than

≥ = greater than or equal to

BAB = bioavailability adjusted benchmark

BTV = background threshold value

COC = chemical of concern

COPC = chemical of potential concern

Eco-SSL = ecological soil screening level

HQ = hazard quotient

NA = not applicable (not a COPC)

NC = Not calculated because no acceptable TRV could be identified.

SSL = soil screening level

TRV = toxicity reference value

Table 2-1. Representative Plant Species in Ecosystems Present in the Terrestrial Study Area[a]

Common Name	Scientific Name	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	Northern Rocky Mountain Ponderosa Pine Woodland and Savanna	Northern Rocky Mountain Mesic Montane Mixed Conifer Forest	Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	Northern Rocky Mountain Montane-Foothill Deciduous Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Northern Rocky Mountain Lower Montane, Foothill and Valley Grassland	Inter-Mountain Basins Big Sagebrush Steppe	Northern Rocky Mountain Lower Montane Riparian Woodland and Shrubland	Rocky Mountain Alpine-Montane Wet Meadow	Rocky Mountain Subalpine-Montane Mesic Meadow	North American Arid West Emergent Marsh	Rocky Mountain Aspen Forest and Woodland
Trees															
Balsam poplar	*Populus balsamifera*										X				
Black spruce	*Picea mariana*										X				
Douglas-fir	*Pseudotsuga menziesii*	X	X	X		X									X
Engelman spruce	*Picea engelmannii*	X		X	X	X									X
Grand fir	*Abies grandis*	X	X	X							X				
Limber pine	*Pinus flexilis*		X												
Lodgepole pine	*Pinus contorta*	X		X		X									
Mountain hemlock	*Tsuga mertensiana*				X										
Paper birch	*Betula papyrifera*										X				
Ponderosa pine	*Pinus ponderosa*	X	X	X											X
Rocky Mountain fir	*Abies lasiocarpa*	X	X	X	X	X									X
Trembling aspen	*Populus tremuloides*					X					X				X
Water birch	*Betula occidentalis*										X				
Western hemlock	*Tsuga heterophylla*			X							X				
Western larch	*Larix occidentalis*	X		X											
Western red cedar	*Thuja plicata*			X							X				
Western white pine	*Pinus monticola*	X		X											
White spruce	*Picea glauca*	X									X				
Whitebark pine	*Pinus albicaulis*					X									
Shrubs															
Antelopebrush	*Purshia tridentata*		X					X		X					
Birchleaf spirea	*Spiraea betulifolia*	X		X			X								
Bitter cherry	*Prunus emarginata*						X								
Black hawthorn	*Crataegus douglasii*						X								
Canada buffaloberry	*Shepherdia canadensis*						X								X
Cascade azalea	*Rhododendron albiflorum*				X	X									
Chokecherry	*Prunus virginiana*		X				X								X
Common juniper	*Juniperis communis*	X				X		X	X						X
Common snowberry	*Symphoricarpos albus*	X	X				X				X				
Creeping mahonia	*Mahonia repens*					X									X
Creeping snowberry	*Symphoricarpos hesperius*			X											
Crowberry	*Empetrum nigrum*					X									
Curl-leaf mountain mahogany	*Cercocarpus ledifolius*		X												
Devil's club	*Oplopanax horridus*										X				
Greasewood	*Sarcobatus vermiculatus*							X		X					
Greenleaf manzanita	*Arctostaphylos patula*		X												
Grouse whortleberry	*Vaccinium scoparium*					X									
Horsebrush	*Tetradymia* spp.									X					
Kinninnick	*Arctostaphylos uva-ursi*		X												X
Labrador tea	*Ledum glandulosum*				X										
Mallow nine bark	*Physocarpus malvaceus*	X	X				X								
Mountain maple	*Acer glabrum*	X		X			X				X				X
Mountain snowberry	*Symphoricarpos oreophilus*		X				X	X							X
Ocean spray	*Holodiscus discolor*						X								
Oregon boxleaf	*Paxistima myrsinites*			X											
Pink mountain-heath	*Phyllodoce empetriformis*				X										
Red osier dogwood	*Cornus sericea*										X				
Rose	*Rosa* spp.		X				X		X						X
Rubber rabbitbrush	*Ericameria nauseosa*							X		X					
Shrubs (continued)															

Table 2-1. Representative Plant Species in Ecosystems Present in the Terrestrial Study Area[a]

Common Name	Scientific Name	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	Northern Rocky Mountain Ponderosa Pine Woodland and Savanna	Northern Rocky Mountain Mesic Montane Mixed Conifer Forest	Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	Northern Rocky Mountain Montane-Foothill Deciduous Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Northern Rocky Mountain Lower Montane, Foothill and Valley Grassland	Inter-Mountain Basins Big Sagebrush Steppe	Northern Rocky Mountain Lower Montane Riparian Woodland and Shrubland	Rocky Mountain Alpine-Montane Wet Meadow	Rocky Mountain Subalpine-Montane Mesic Meadow	North American Arid West Emergent Marsh	Rocky Mountain Aspen Forest and Woodland
Rusty menziesia	*Menziesia ferruginea*			X	X										
Sagebrush	*Artemisia tridentata*		X			X		X	X	X					X
Saltbush	*Atriplex* spp.							X							
Saskatoon berry	*Amelanchier alnifolia*		X		X		X		X						X
Shadscale saltbrush	*Atriplex confertifolia*									X					
Silver sagebrush	*Artemisia cana*									X					
Smooth sumac	*Rhus glabra*														
Snowbrush ceanothus	*Ceanothus velutinus*						X								
Gray alder	*Alnus incana*			X							X				
Thimbleberry	*Rubus parviflorus*			X	X		X								X
Thinleaf huckleberry	*Vaccinium membranaceum*	X		X	X	X									
Threetip sagebrush	*Artemisia tripartita*									X					
Twinflower	*Linnaea borealis*			X		X									
Willow	*Salix* spp.				X										
Yellow rabbitbrush	*Chrysothamnus viscidiflorus*							X		X					
Herbs and Graminoids															
Common yarrow	*Achillea millefolium*														X
Indian ricegrass	*Achnatherum hymenoides*							X	X	X					
Western needlegrass	*Achnatherum occidentale*								X						
Richardson's needlegrass	*Achnatherum richardsonii*								X						
Thurber's needlegrass	*Achnatherum thurberianum*						X								
Red baneberry	*Actaea rubra*			X	X										
Northern maidenhair fern	*Adiantum pedatum*			X											
Piper's anemone	*Anemone piperi*			X											
Littleleaf pussytoes	*Antennaria microphylla*								X						
Pussytoes	*Antennaria* spp.								X						
Wild sarsaparilla	*Aralia nudicaulis*			X											
Sandwort	*Arenaria* spp.									X					
Prairie sagewort	*Artemisia frigida*								X	X					
Wild ginger	*Asarum caudatum*			X											
Common lady fern	*Athyrium filix-femina*										X				
Arrowleaf balsamroot	*Balsamorhiza sagittata*						X						X		
Blue grama grass	*Bouteloua gracilis*							X		X					
Water shield	*Brasenia* spp.													X	
California brome	*Bromus carinatus*														X
Smooth brome	*Bromus inermis*								X						X
Japanese brome	*Bromus japonicus*								X	X					
Pumpelly's brome	*Bromus pumpellianus*								X						
Cheatgrass	*Bromus tectorum*							X		X					X
Bluejoint grass	*Calamagrostis canadensis*				X										
Plains reedgrass	*Calamagrostis montanensis*									X					
Pinegrass	*Calamagrostis rubescens*	X	X				X								X
Slimstem reedgrass	*Calamagrostis stricta*											X			
White marsh marigold	*Caltha leptosepala*											X			
Bellflower	*Campanula* spp.								X				X		
Heartleaf bittercress	*Cardamine cordifolia*											X			
Needleleaf sedge	*Carex duriuscula*									X					
Threadleaf sedge	*Carex filifolia*								X	X					

Table 2-1. Representative Plant Species in Ecosystems Present in the Terrestrial Study Area[a]

Common Name	Scientific Name	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	Northern Rocky Mountain Ponderosa Pine Woodland and Savanna	Northern Rocky Mountain Mesic Montane Mixed Conifer Forest	Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	Northern Rocky Mountain Montane-Foothill Deciduous Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Northern Rocky Mountain Lower Montane, Foothill and Valley Grassland	Inter-Mountain Basins Big Sagebrush Steppe	Northern Rocky Mountain Lower Montane Riparian Woodland and Shrubland	Rocky Mountain Alpine-Montane Wet Meadow	Rocky Mountain Subalpine-Montane Mesic Meadow	North American Arid West Emergent Marsh	Rocky Mountain Aspen Forest and Woodland
Herbs and Graminoids (continued)															
Geyer's sedge	*Carex geyeri*	X	X				X								X
Sheep sedge	*Carex illota*											X			
Long-stolon sedge	*Carex inops*		X												
Smallwing sedge	*Carex microptera*											X			
Black alpine sedge	*Carex nigricans*											X			
Liddon sedge	*Carex petasata*								X						
Ross's sedge	*Carex rossii*	X													X
Mountain sedge	*Carex scopulorum*											X			
Dryspike sedge	*Carex siccata*														X
Northwest Territory sedge	*Carex utriculata*											X			
Native sedge	*Carex vernacula*											X			
Knapweed	*Centaurea* spp.								X						
Coontail	*Ceratophyllum* spp.													X	
Bride's bonnet	*Clintonia uniflora*			X											
Idaho goldthread	*Coptis occidentalis*			X											
Canadian bunchberry	*Cornus canadensis*			X	X										
Purple prairie clover	*Dalea purpurea*									X					
Timber oatgrass	*Danthonia intermedia*								X						
Tufted hair grass	*Deschampsia caespitosa*											X	X		
Fewflower spikerush	*Eleocharis quinqueflora*											X			
Water weed	*Elodea* spp.													X	
Thickspike wheatgrass	*Elymus lanceolatus*							X		X					
Slender wheatgrass	*Elymus trachycaulus*								X						X
Spruce-fir fleabane	*Erigeron eximius*				X										
Fleabane	*Erigeron* spp.						X						X		
Buckwheat	*Eriogonum* spp.						X								
Engelmann's aster	*Eucephalus engelmannii*														X
Leafy spurge	*Euphorbia esula*								X						
Rough fescue	*Festuca campestris*		X				X		X						
Idaho fescue	*Festuca idahoensis*		X				X	X	X						
Thurbur's fescue	*Festuca thurberi*														X
Northern bedstraw	*Galium boreale*								X						
Sticky purple geranium	*Geranium viscosissimum*								X						X
Prairie smoke	*Geum triflorum*						X		X						
Common oak fern	*Gymnocarpium dryopteris*			X	X						X				
Eltrot	*Heracleum sphondylium*														X
Needle-and-thread grass	*Hesperostipa comata*							X	X	X					X
Shortbristle needle-and-thread grass	*Hesperostipa curtiseta*								X						
Rush	*Juncus* spp.											X		X	
Junegrass	*Koeleria macrantha*						X		X	X			X		
Basin wild rye	*Leymus cinereus*						X	X	X						
Dotted blazing star	*Liatris punctata*									X					
Licorice-root	*Ligusticum* spp.												X		X
Nineleaf biscuitroot	*Lomatium triternatum*						X								
Lupine	*Lupinus* spp.				X								X		X
Smooth woodrush	*Luzula glabrata*				X										
False Solomon's seal	*Maianthemum stellatum*				X										
Bluebell	*Mertensia* spp.												X		

Table 2-1. Representative Plant Species in Ecosystems Present in the Terrestrial Study Area[a]

Common Name	Scientific Name	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	Northern Rocky Mountain Ponderosa Pine Woodland and Savanna	Northern Rocky Mountain Mesic Montane Mixed Conifer Forest	Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	Northern Rocky Mountain Montane-Foothill Deciduous Shrubland	Inter-Mountain Basins Big Sagebrush Shrubland	Northern Rocky Mountain Lower Montane, Foothill and Valley Grassland	Inter-Mountain Basins Big Sagebrush Steppe	Northern Rocky Mountain Lower Montane Riparian Woodland and Shrubland	Rocky Mountain Alpine-Montane Wet Meadow	Rocky Mountain Subalpine-Montane Mesic Meadow	North American Arid West Emergent Marsh	Rocky Mountain Aspen Forest and Woodland
Herbs and Graminoids (continued)															
Water milfoil	*Myriophyllum* spp.													X	
Green needlegrass	*Nassella viridula*									X					
Aquatic lilly	*Nuphar* spp.													X	
Pricklypear cactus	*Opuntia* spp.								X	X					
Sweetcicely	*Osmorhiza berteroi*														X
Western wheatgrass	*Pascopyrum smithii*							X	X	X					
Beardtongue	*Penstemon* spp.												X		
Canary grass	*Phalaris* spp.													X	
Icegrass	*Phippsia algida*											X			
Timothy grass	*Phleum pratense*						X		X						
Spiny phlox	*Phlox hoodii*									X					
Phlox	*Phlox* spp.						X								
Kentucky bluegrass	*Poa pratensis*						X		X						X
Sandberg bluegrass	*Poa secunda*						X	X		X					
Knotweed	*Polygonum* spp.													X	
Western sword fern	*Polystichum munitum*			X											
Pondwort	*Potamogeton* spp.													X	
Slender cinquefoil	*Potentilla gracilis*						X		X						
Sulphur cinquefoil	*Potentilla recta*								X						
Bluebunch wheatgrass	*Pseudoroegneria spicata*	X	X				X	X	X	X					
Western brackenfern	*Pteridium aquilinum*														X
Alpine yellowcress	*Rorippa alpina*											X			
Five-leaved bramble	*Rubus pedatus*				X										
Western coneflower	*Rudbeckia occidentalis*												X		X
Yellowdot saxifrage	*Saxifraga bronchialis*				X										
Bulrush	*Schoenoplectus* spp.													X	
Clubrush	*Scirpus* spp.													X	
Lesser spikemoss	*Selaginella densa*								X						
Arrowleaf ragwort	*Senecio triangularis*										X	X			
Goldenrod	*Solidago* spp.												X		
Scarlet globemallow	*Sphaeralcea coccinea*									X					
Fendler's meadow-rue	*Thalictrum fendleri*														X
Western meadow-rue	*Thalictrum occidentale*			X									X		
Threeleaf foamflower	*Tiarella trifoliata*			X	X										
Starflower	*Trientalis borealis*			X											
Parry's clover	*Trifolium parryi*											X			
Wake robin	*Trillium ovatum*			X											
American globeflower	*Trollius laxus*														
Cattail	*Typha* spp.													X	
Western valerian	*Valeriana occidentalis*														X
Sitka valerian	*Valeriana sitchensis*				X								X		
Stream violet	*Viola glabella*			X											
Mule-ears	*Wyethia amplexicaulis*												X		X

Source: NatureServe. 2009. International ecological classification standard: Classifications. NatureServe Central Databases. Arlington, VA.

[a] X in cell indicates species is present in the given ecosytem type; blank cell indicates species is not present in the given ecosystem type.

Table 2-2. Soil Invertebrate Orders of the UCR Region

Scientific Order Name	Common Name
Archaeognatha	Jumping bristletail
Araneae	Spiders
Blattodea	Termites
Chordeumatida	Millipedes
Coleoptera	Beetles
Collembola	Springtails
Diptera	Flies
Lumbriculata	Earthworms, potworms
Hemiptera	True bugs
Hymenoptera	Ants, bees, sawflies, wasps
Isopoda	Woodlice
Lithobiomorpha	Centipedes
Orthoptera	Grasshoppers, crickets
Scopiones	Scorpions
Stylommatophora	Snails, slugs, terrestrial pulmonate gastropod molluscs
Tricladida	Flatworms

Sources:

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Notes:

There are no invertebrate species with federal or state status in the UCR Terrestrial Study Area.

UCR = Upper Columbia River

Table 2-3. Bird Species of the UCR Region

Scientific Name	Common Name	Feeding Guild
Accipiter cooperii	Cooper's hawk	Carnivore
Accipiter gentilis	Northern goshawk	Carnivore
Accipiter striatus	Sharp-shinned hawk	Carnivore
Aegolius acadicus	Northern saw-whet owl	Carnivore
Aegolius funereus	Boreal owl	Carnivore
Aeronautes saxatalis	White-throated swift	Aerial insectivore
Agelaius phoeniceus	Red-winged blackbird	Omnivore
Aquila chrysaetos	Golden eagle	Carnivore
Archilochus alexandri	Black-chinned hummingbird	Herbivore
Asio flammeus	Short-eared owl	Carnivore
Asio otus	Long-eared owl	Carnivore
Athene cunicularia	Burrowing owl	Carnivore
Bombycilla cedrorum	Cedar waxwing	Omnivore
Bombycilla garrulus	Bohemian waxwing	Omnivore
Bonasa umbellus	Ruffed grouse	Herbivore
Bubo virginianus	Great-horned owl	Carnivore
Buteo jamaicensis	Red-tailed hawk	Carnivore
Callipepla californica	California quail	Herbivore
Carduelis pinus	Pine siskin	Omnivore
Carduelis tristis	American goldfinch	Herbivore
Carpodacus cassinii	Cassin's finch	Omnivore
Cathartes aura	Turkey vulture	Carnivore
Catharus fuscescens	Veery	Omnivore
Catharus guttatus	Hermit thrush	Omnivore
Catharus ustulatus	Swainson's thrush	Omnivore
Catherpes mexicanus	Canyon wren	Invertivore
Certhia americana	Brown creeper	Invertivore
Chaetura vauxi	Vaux's swift	Aerial insectivore
Chordeiles minor	Common nighthawk	Aerial insectivore
Circus cyaneus	Northern harrier	Carnivore
Coccothraustes vespertinus	Evening grosbeak	Omnivore
Coccyzus americanus	Yellow-billed cuckoo[a]	Invertivore
Colaptes auratus	Northern flicker	Invertivore
Columba livia	Rock pigeon	Herbivore
Contopus borealis	Olive-sided flycatcher	Aerial insectivore
Contopus sordidulus	Western wood-pewee	Aerial insectivore
Corvus brachyrhynchos	American crow	Omnivore
Corvus corax	Common raven	Omnivore
Cyanocitta cristata	Blue jay	Omnivore
Cyanocitta stelleri	Steller's jay	Omnivore
Dendragapus canadensis	Spruce grouse	Herbivore
Dendragapus obscurus	Dusky grouse	Herbivore
Dolichonyx oryzivorus	Bobolink	Omnivore
Dryocopus pileatus	Pileated woodpecker	Omnivore
Dumetella carolinensis	Gray catbird	Omnivore
Empidonax hammondii	Hammond's flycatcher	Aerial insectivore
Empidonax oberholseri	Dusky flycatcher	Aerial insectivore
Empidonax occidenetalis	Cordilleran flycatcher	Aerial insectivore
Empidonax traillii	Willow flycatcher	Aerial insectivore
Eremophila alpestris	Horned lark	Omnivore

Table 2-3. Bird Species of the UCR Region

Scientific Name	Common Name	Feeding Guild
Euphagus cyanocephalus	Brewer's blackbird	Omnivore
Falco columbarius	Merlin	Carnivore
Falco mexicanus	Prairie falcon	Carnivore
Falco peregrinus	Peregrine falcon	Carnivore
Falco rusticolus	Gyrfalcon	Carnivore
Falco sparverius	American kestrel	Carnivore
Geothlypis trichas	Common yellowthroat	Invertivore
Glaucidium gnoma	Northern pygmy-owl	Carnivore
Haliaeetus leucocephalus	Bald eagle	Carnivore
Hirundo pyrrhonota	Cliff swallow	Aerial insectivore
Hirundo rustica	Barn swallow	Aerial insectivore
Ixoreus naevius	Varied thrush	Omnivore
Junco hyemalis	Dark-eyed junco	Omnivore
Leucosticte tephrocotis	Gray-crowned rosy-finch	Omnivore
Loxia curvirostra	Red crossbill	Herbivore
Loxia leucoptera	White-winged crossbill	Herbivore
Megaceryle alcyon	Belted kingfisher	Carnivore
Melanerpes lewis	Lewis' woodpecker	Omnivore
Meleagris gallopavo	Wild turkey	Herbivore
Melospiza lincolnii	Lincoln's sparrow	Omnivore
Melospiza melodia	Song sparrow	Omnivore
Molothrus ater	Brown-headed cowbird	Omnivore
Myadestes townsendi	Townsend's solitaire	Omnivore
Nucifraga columbiana	Clark's nutcracker	Omnivore
Numenius americanus	Long-billed curlew	Invertivore
Oporornis tolmiei	Macgillivray's warbler	Invertivore
Otus flammeolus	Flammulated owl	Invertivore
Otus kennicottii	Western screech-owl	Carnivore
Passer domesticus	House sparrow	Omnivore
Passerculus sandwichensis	Savannah sparrow	Omnivore
Passerella iliaca	Fox sparrow	Omnivore
Passerina amoena	Lazuli bunting	Omnivore
Perisoreus canadensis	Canada jay	Omnivore
Phasianus colchicus	Ring-necked pheasant	Herbivore
Pheucticus melanocephalus	Black-headed grosbeak	Omnivore
Pica pica	Black-billed magpie	Omnivore
Picoides arcticus	Black-backed woodpecker	Invertivore
Picoides pubescens	Downy woodpecker	Omnivore
Picoides tridactylus	Three-toed woodpecker	Invertivore
Picoides villosus	Hairy woodpecker	Omnivore
Pipilo maculatus	Spotted towhee	Omnivore
Piranga ludoviciana	Western tanager	Omnivore
Plectrophenax nivalis	Snow bunting	Omnivore
Poecile atricapillus	Black-capped chickadee	Omnivore
Poecile gambeli	Mountain chickadee	Omnivore
Poecile hudsonicus	Boreal chickadee	Omnivore
Poecile rufescens	Chestnut-backed chickadee	Omnivore
Pooecetes gramineus	Vesper sparrow	Omnivore
Regulus calendula	Ruby-crowned kinglet	Invertivore
Regulus satrapa	Golden-crowned kinglet	Invertivore

Table 2-3. Bird Species of the UCR Region

Scientific Name	Common Name	Feeding Guild
Riparia riparia	Bank swallow	Aerial insectivore
Salpinctes obscoletus	Rock wren	Invertivore
Sayornis saya	Say's phoebe	Invertivore
Selasphorus rufus	Rufous hummingbird	Herbivore
Setophaga coronata	Yellow-rumped warbler	Omnivore
Setophaga petechia	Yellow warbler	Invertivore
Setophaga ruticilla	American redstart	Invertivore
Setophaga townsendi	Townsend's warbler	Invertivore
Sialia currucoides	Mountain bluebird	Omnivore
Sialia mexicana	Western bluebird	Omnivore
Sitta canadensis	Red-breasted nuthatch	Omnivore
Sitta carolinensis	White-breasted nuthatch	Omnivore
Sitta pygmaea	Pygmy nuthatch	Omnivore
Sphyrapicus nuchalis	Red-naped sapsucker	Omnivore
Spizella arborea	American tree sparrow	Omnivore
Spizella passerina	Chipping sparrow	Omnivore
Stelgidopteryx serripennis	Northern rough-winged swallow	Aerial insectivore
Stellula calliope	Calliope hummingbird	Herbivore
Strix nebulosa	Great gray owl	Carnivore
Strix varia	Barred owl	Carnivore
Sturnella neglecta	Western meadowlark	Invertivore
Sturnus vulgaris	European starling	Omnivore
Tachycineta bicolor	Tree swallow	Aerial insectivore
Tachycineta thalassina	Violet-green swallow	Aerial insectivore
Troglodytes aedon	House wren	Invertivore
Turdus migratorius	American robin	Invertivore
Tyrannus tyrannus	Eastern kingbird	Invertivore
Tyrannus verticalis	Western kingbird	Invertivore
Vermivora celata	Orange-crowned warbler	Invertivore
Vermivora ruficapilla	Nashville warbler	Invertivore
Vireo gilvus	Warbling vireo	Invertivore
Vireo olivaceus	Red-eyed vireo	Omnivore
Wilsonia pusilla	Wilson's warbler	Invertivore
Xanthocephalus xanthocephalus	Yellow-headed blackbird	Omnivore
Zenaida macroura	Mourning dove	Herbivore
Zonotrichia albicollis	White-throated sparrow	Omnivore
Zonotrichia atricapilla	Golden-crowned sparrow	Omnivore
Zonotrichia leucophrys	White-crowned sparrow	Omnivore

Sources:

Cornell Lab of Ornithology. 2023. "Yellow-billed cuckoo sightings map." All About Birds. Cornell University, Ithaca, NY. Accessed December 2022. https://www.allaboutbirds.org/guide/Yellow-billed_Cuckoo/maps-sightings.

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Washington Department of Fish and Wildlife (WDFW). 2023c. Species in Washington. Washington Department of Fish and Wildlife, Olympia, WA. https://wdfw.wa.gov/species-habitats/species

[a] The yellow-billed cuckoo is listed as federally listed threatened and state-listed endangered.

Note:

Not all species may occur within the Terrestrial Study Area.

UCR = Upper Columbia River

Table 2-4. Mammal Species of the UCR Region

Scientific Name	Common Name	Feeding Guild
Alces alces	Moose	Herbivore
Callospermophilus lateralis	Golden-mantled ground squirrel	Omnivore
Canis latrans	Coyote	Carnivore
Canis lupus	Gray wolf	Carnivore
Castor canadensis	Beaver	Herbivore
Cervus elaphus	Elk	Herbivore
Cervus elaphus nelsoni	Rocky Mountain elk	Herbivore
Corynorhinus townsendii	Townsend's big-eared bat	Aerial insectivore
Eptesicus fuscus	Big brown bat	Aerial insectivore
Erethizon dorsata	Porcupine	Herbivore
Euderma maculatum	Spotted bat	Aerial insectivore
Glaucomys sabrinus	Northern flying squirrel	Omnivore
Gulo gulo	Wolverine	Carnivore
Lasionycteris noctivagans	Silver-haired bat	Aerial insectivore
Lasiurus cinereus	Hoary bat	Aerial insectivore
Lepus americanus	Snowshoe hare	Herbivore
Lynx canadensis	Canada lynx[a,b]	Carnivore
Lynx rufus	Bobcat	Carnivore
Marmota caligata	Hoary marmot	Herbivore
Martes americana	Marten	Carnivore
Martes pennanti	Fisher[b]	Carnivore
Mephitis mephitis	Striped skunk	Omnivore
Microtus longicaudus	Long-tailed vole	Herbivore
Microtus montanus	Montane vole	Herbivore
Microtus pennsylvanicus	Meadow vole	Herbivore
Mus musculus	House mouse	Omnivore
Mustela erminea	Short-tailed weasel	Carnivore
Mustela frenata	Long-tailed weasel	Carnivore
Myodes gapperi	Southern red-backed vole	Herbivore
Myotis californicus	Californian myotis	Aerial insectivore
Myotis ciliolabrum	Small-footed myotis	Aerial insectivore
Myotis evotis	Long-eared myotis	Aerial insectivore
Myotis lucifugus	Little brown bat	Aerial insectivore
Myotis thysanodes	Fringed myotis	Aerial insectivore
Myotis volans	Long-legged myotis	Aerial insectivore
Myotis yumanensis	Yuma myotis	Aerial insectivore
Neotoma cinerea	Bushy-tailed woodrat	Omnivore
Neovison vison	Mink	Carnivore
Ochotona princeps	Pika	Herbivore
Odocoileus hemionus hemionus	Mule deer	Herbivore
Odocoileus virginianus	White-tailed deer	Herbivore
Odocoileus virginianus ochrourus	Northwest white-tailed deer	Herbivore
Ovis canadensis	Bighorn sheep	Herbivore
Perognathus parvus	Great Basin pocket mouse	Omnivore
Peromyscus maniculatus	Deer mouse	Omnivore
Phenacomys intermedius	Heather vole	Herbivore

Table 2-4. Mammal Species of the UCR Region

Scientific Name	Common Name	Feeding Guild
Procyon lotor	Raccoon	Omnivore
Puma concolor	Cougar	Carnivore
Rattus norvegicus	Norway rat	Omnivore
Sorex cinereus	Masked shrew	Invertivore
Sorex hoyi	Pygmy shrew	Invertivore
Sorex monticolus	Dusky shrew	Invertivore
Sorex vagrans	Vagrant shrew	Invertivore
Spermophilus columbianus	Columbian ground squirrel	Herbivore
Sylvilagus nuttallii	Nuttall's cottontail	Herbivore
Synaptomys borealis	Northern bog lemming	Omnivore
Tamias amoenus	Yellow-pine chipmunk	Omnivore
Tamias ruficaudus	Red-tailed chipmunk	Omnivore
Tamiasciurus hudsonicus	Red squirrel	Omnivore
Taxidea taxus	Badger	Carnivore
Thomomys talpoides	Northern pocket gopher	Herbivore
Ursus americanus	Black bear	Omnivore
Ursus arctos	Grizzly bear[a,b]	Omnivore
Vulpes vulpes	Red fox	Carnivore
Zapus princeps	Western jumping mouse	Herbivore

Sources:

Montana Fish, Wildlife, and Parks (MFWP). n.d. Montana Field Guides. mt.gov. Montana Natural Heritage Program and Montana Fish, Wildlife, and Parks. http://fieldguide.mt.gov/default.aspx.

Teck American Incorporated (TAI). 2012. *Upper Columbia River Expansion of the Problem Formulation Chapter of the UCR Baseline Ecological Risk Assessment (BERA) Work Plan* . Prepared for TAI by Parametrix, Exponent, and Hydroqual, Bellevue, WA.

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Washington Department of Fish and Wildlife (WDFW). 2023. Species in Washington. https://wdfw.wa.gov/species-habitats/species

Notes:

[a] Federally listed threatened species include the Canada lynx and the grizzly bear.

[b] State-listed endangered species include the Canada lynx, fisher, and grizzly bear.

Not all species may occur within the Terrestrial Study Area.

UCR = Upper Columbia River

Table 2-5. Herpetofauna Species of the UCR Region

Scientific Name	Common Name
Amphibians	
Ambystoma macrodactylum	Long-toed salamander
Anaxyrus boreas	Western toad
Pseudacris regilla	Pacific tree frog
Rana luteiventris	Columbia spotted frog
Reptiles	
Charina bottae	Rubber boa
Coluber constrictor	North American racer
Crotalus oreganus	Western rattlesnake
Elgaria coerulea	Northern alligator lizard
Eumeces skiltonianus	Western skink
Pituophis catenifer	Gophersnake
Thamnophis elegans	Terrestrial gartersnake
Thamnophis sirtalis	Common gartersnake

Sources:

Montana Fish, Wildlife, and Parks (MFWP). n.d. Montana Field Guides. mt.gov. Montana Natural Heritage Program and Montana Fish, Wildlife, and Parks. http://fieldguide.mt.gov/default.aspx.

Teck American Incorporated (TAI). 2012. *Upper Columbia River Expansion of the Problem Formulation Chapter of the UCR Baseline Ecological Risk Assessment (BERA) Work Plan* . Prepared for TAI by Parametrix, Exponent, and Hydroqual, Bellevue, WA.

U.S. Fish and Wildlife Service (USFWS). n.d.a. "Listed Species with Spatial Current Range Believed to or Known to Occur in Washington." Environmental Conservation Online System. U.S. Fish and Wildlife Service, Washington, DC. https://ecos.fws.gov/ecp/report/species-listings-by-state?stateAbbrev=WA&stateName=Washington&statusCategory=Listed.

Washington Department of Fish and Wildlife (WDFW). 2022. Priority Habitats and Species (PHS). https://wdfw.wa.gov/species-habitats/at-risk/phs.

Table 2-6. Federal and State Listed Species Potentially Occurring in the Terrestrial Study Area

Scientific Name	Common Name	Federal Status	State Status
Mammals			
Canis lupus	Gray wolf [a]	FE delisted[a]	SE
Plants			
Pellaea gastonyi	Gastony's cliffbrake[b]	Not listed	SE

Sources:

Teck American Incorporated (TAI). 2012. *Upper Columbia River Expansion of the Problem Formulation Chapter of the UCR Baseline Ecological Risk Assessment (BERA) Work Plan* . Prepared for TAI by Parametrix, Exponent, and Hydroqual, Bellevue, WA.

U.S. Fish and Wildlife Service (USFWS). n.d.a. “Listed Species with Spatial Current Range Believed to or Known to Occur in Washington.” Environmental Conservation Online System. U.S. Fish and Wildlife Service, Washington, DC. https://ecos.fws.gov/ecp/report/species-listings-by-state?stateAbbrev=WA&stateName=Washington&statusCategory=Listed.

U.S. Fish and Wildlife Service (USFWS). n.d.b. Washington Fish and Wildlife Office: Feature Species. Accessed December 2022. https://www.fws.gov/office/washington-fish-and-wildlife/species.

Washington Natural Heritage Program (WNHP). WNHP Historical Element Occurrences (accessed July 15, 2021). https://www.dnr.wa.gov/NHPdataexplorer

Washington Department of Fish and Wildlife (WDFW). 2022. Priority Habitats and Species (PHS). https://wdfw.wa.gov/species-habitats/at-risk/phs.

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[a] The gray wolf was delisted in eastern Washington in February 2022 including throughout the UCR Site (USFWS 2022a).

[b] Gastony's cliffbrake is not evaluated in the Upland BERA due to minimal exposure to soil.

BERA = baseline ecological risk assessment

FE = federally listed endangered

SE = state-listed endangered

UCR = Upper Columbia River

Table 2-7. Soil COPCs and COIs for the Terrestrial Study Area

	Terrestrial Receptors			
COPC/COI	**Plants**	**Invertebrates**	**Birds**	**Mammals**
Aluminum	COPC	COPC	COI	COI
Antimony	COI	x	COI	COPC
Arsenic	COPC	COI	x	x
Barium	COPC [a]	COPC	COI	x
Beryllium	x	x	COI	x
Cadmium	x	x	COPC	COPC
Chromium	COI	COI	COPC	COPC
Cobalt	COPC	COI	x	x
Copper	COPC	COPC	COPC	COPC
Iron	COPC	COPC	COI	COI
Lead	COPC	x	COPC	COPC
Manganese	COPC	COPC	x	x
Mercury	x	x	COI	COI
Molybdenum	COI	COI	COI	COI
Nickel	COPC	x	x	x
Selenium	COPC	x	COPC	COPC
Silver	x	COI	x	x
Thallium	COI	COI	COI	COI
Vanadium	x	COI	COPC	x
Zinc	COPC	COPC	COPC	COPC

Source:

Teck American Incorporated (TAI). 2019b. *Upper Columbia River Final Chemicals of Potential Concern Refinement for Aquatic and Terrestrial Receptors* . Prepared for TAI by Windward Environmental LLC, Seattle, WA.

[a] Barium was originally identified as a COI in the COPC refinement, but is now identified as a COPC at the request of EPA (Appendix D, Attachment D2).

Notes:

Green shaded cells indicate COPCs and COIs identified in the COPC refinement (TAI, 2019b) that are quantitatively evaluated as COPCs in this Upland BERA.

Blue shaded cells indicate metals that cannot be quantitatively evaluated in this BERA due to a lack of toxicity data.

BERA = baseline ecological risk assessment

COI = chemical of interest

COPC = chemical of potential concern

EPA = U.S. Environmental Protection Agency

X = chemical screened out during the COPC refinement (TAI, 2019b).

Table 2-8. Summary of BTVs for Soil

COPC/COI	BTV used in the Upland BERA (mg/kg)[a]
Aluminum	40,500
Antimony	0.41
Arsenic	23.3[b]
Barium	395
Cadmium	0.74
Chromium	23.8[b]
Cobalt	20.4
Copper	41.5
Iron	31,200
Lead	27.2
Manganese	1,240
Mercury	0.12
Molybdenum	1.4[b]
Nickel	35
Selenium	0.098[b]
Silver	0.078
Thallium	0.56
Vanadium	47.5
Zinc	111

Source:

Teck American Incorporated (TAI). 2020. *Technical Memorandum: Assessment of Background Concentrations of Metals and Metalloids in Upland Soils* . Final. Prepared for TAI by ERM and Exponent, Seattle, WA.

[a] BTVs were developed by TAI (TAI, 2020) and approved by EPA. Values for metals other than mercury are the partial digestion BTVs.

[b] BTVs calculated with outliers removed.

BERA = baseline ecological risk assessment

BTV = background threshold value

COI = chemical of interest

COPC = chemical of potential concern

EPA = U.S. Environmental Protection Agency

mg/kg = milligram(s) per kilogram

Table 2-9. Summary of EAEs

Receptor Group	Ecological Entity	Assessment Endpoint
Terrestrial plants	Plant community	Survival, growth, and reproduction of terrestrial plants
Soil invertebrates	Soil invertebrate community	Survival, growth, and reproduction of soil invertebrates
Birds	Terrestrial avian populations	Survival, growth, and reproduction of birds
Mammals	Terrestrial mammalian populations, individual gray wolves	Survival, growth, and reproduction of mammals

EAE = exposure assessment endpoint

Table 2-10. EAEs and Representative Species for Birds

Receptor Feeding Guild/EAE	Surrogate Species	Other UCR Species in Feeding Guild	Dietary Composition	Estimated Size of Home Range	Present During the Breeding Season?	Toxicity Data Available for Surrogate?
Herbivore	California quail	Upland gamebirds, hummingbirds, crossbills, pigeons, and doves	Their diet consists largely of seeds and leaves of broad-leafed plants, but also includes catkins, flowers, grain, berries, and acorns. The California quail favors legume seeds such as lupine and geranium, which grow in moist open meadows or deciduous environments (Duncan, 1968). California quail will also consume small amounts of terrestrial invertebrates (approximately 1 to 6% of their diet). This includes caterpillar, cricket, beetle, and snail species. Chicks that are less than 3 weeks old consume primarily invertebrate material (Leopold, 1977).	Up to 49 acres	Yes	No
Invertivore	American robin	Warblers, wrens, kingbirds	They forage on the ground by probing at the soil for worms, insects, snails, and fruit. Their diet is dependent on season and time of year. Beyer and Sample (2017) concluded that the American robin diet during the breeding season (spring and summer) is 40% earthworms, 50% other ground-dwelling invertebrates, and 10% fruits. This species also eats other invertebrates such as grasshoppers, flies, crickets, beetles, caterpillars, moths, spiders, millipedes, and some snails. Nestlings are mainly fed butterfly or moth larvae, grass, and earthworms from the soil on an average of 34 to 40 times a day (Canadian Wildlife Federation, 2023; Howell, 1942). During fall and winter, their diet changes and is comprised mainly of fruit and seeds. Commonly consumed fruits include berries from shrubs of the genera *Prunus* (e.g., chokecherry), *Rubus* (e.g., raspberry), and *Juniperus* (e.g., common juniper) (Howell, 1942; Wheelwright, 1986).	5 acres	Yes	No
Aerial insectivore	tree swallow	Other swallows, flycatchers, nighthawks, and swifts	Their diet consists primarily of flying insects over waterbodies. Most of the adult and nestling tree swallow diet consists of true flies, dragonflies, mayflies, and caddisflies (Winkler et al., 2020). It may also include ants, bees, beetles, bugs, butterflies, mollusks, moths, spiders, vertebrates, wasps, and to a lesser extent roundworms. They occasionally eat berries and other vegetation, usually during the nonbreeding season.	Within 3 miles from the nest (~18,000 acres)	Yes	No
Omnivore	black-capped chickadee	Other chickadees, nuthatches, sparrows, thrushes, blackbirds, and corvids	Adults feed on a combination of terrestrial invertebrates, fruit, and seeds. During the breeding season, approximately 80 to 90% of their diet is composed of terrestrial invertebrate sources and the remaining 10 to 20% is seeds and fruits (Foote et al., 2020). The majority of their diet is caterpillars, in addition to spiders, snails, slugs, and centipedes. Fruits consumed include honeysuckle (*Lonicera* spp.) and blueberries. In the winter, their diet is roughly 50% terrestrial invertebrates and 50% plants (seeds and fruits). This consists primarily of insects, spiders, seeds from conifers and weed species, berries when available, and occasionally dead animal fat (e.g., deer, skunk, and fish) (Foote et al., 2020). Nestlings are fed mainly caterpillars, in addition to some spiders, larvae, termites, butterflies, flies, and pupae (Foote et al., 2020).	7 acres	Yes	No
Carnivore	American kestrel	Hawks, eagles, owls, falcons, and vultures	Both adults and nestlings feed on a combination of terrestrial arthropods and small vertebrates such as worms, spiders, scorpions, beetles, other large insects, amphibians, reptiles, and a wide variety of small- to medium-sized birds and mammals. They also consume brook trout and fingerlings (Parkhurst and Brooks, 1988). Diet composition in the summer is approximately 33% invertebrates, 33% mammals, 31% birds, and 3% reptiles (EPA, 1993). They favor terrestrial arthropods such as grasshoppers, and in their absence, small terrestrial mammals such as rodents and bats (EPA, 1993). During the winter, mammals and birds comprise most of their diet.	500-1,200 acres	Yes	Yes

Sources:

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Winkler, D.W., K.K. Hallinger, D.R. Ardia, R.J. Robertson, B.J. Stutchbury, and R.R. Cohen. 2020. Tree swallow, *Tachycineta bicolor*. Birds of the World. Cornell Lab of Ornithology, online. https://doi.org/10.2173/bow.treswa.01

EAE = ecological assessment endpoint

UCR = Upper Columbia River

Table 2-11. EAEs and Representative Species for Mammals

Receptor Feeding Guild/EAE	Surrogate Species	Other UCR Species in Feeding Guild	Dietary Compositions	Estimated Size of Home Range	Present During the Breeding Season?	Toxicity Data Available for Surrogate?
Herbivore	Meadow vole	Other voles, herbivorous rodents (porcupines, marmots, gophers), lagomorphs (hares, rabbits, and pikas), ungulates (bighorn sheep, deer, moose, and elk), and beaver (*Castor canadensis*)	The diet of meadow voles consist of mostly terrestrial vegetation and a small amount of terrestrial invertebrates (Lindroth and Batzli, 1984). This includes fresh grasses, sedges, herbs, seeds, grains, fungi, roots, and bark from small shrubs/trees, and sometimes arthropods or insects (Johnson and Johnson, 1982). Roots, seeds, and fungi increase in their diet during the fall and winter months (EPA, 1993).	Up to 2.5 acres	Yes	Yes
Invertivore	Masked shrew	Other shrews	Masked shrews consume a variety of invertebrates, including insect larvae, ants, beetles, crickets, grasshoppers, spiders, harvestmen, centipedes, slugs, and snails. Seeds and fungi are also consumed (Nagorsen, 1996). Masked shrews are also important predators of forest insect pests, such as jack pine budworm and larch sawfly.	1.5 acres	Yes	No
Aerial insectivore	Little brown bat	Other bats	Little brown bats typically feed on swarms of insects while flying. They also prey on insects that are on water surfaces. They primarily consume midges but will also feed on beetles, caddisflies, mayflies, moths, lacewings, and occasionally mosquitoes (Havens, 2006).	1 to 14 km from roost to forage (~780 to 150,000 acres)	Yes	No
Omnivore	Deer mouse	Striped skunk (*Mephitis mephitis*), squirrels, chipmunks, raccoon (*Procyon lotor*), bears, and rodents (mice, rats [*Rattus norvegicus*])	Deer mice eat primarily seeds, arthropods, and some green terrestrial vegetation, roots, fruits, and fungi as available. In a year, the amount of terrestrial plants and terrestrial invertebrates consumed is equal (EPA, 1993). During the spring, summer, and fall, butterfly and moth larvae are a large portion of their diet (Whitaker, 1966). In the winter, deer mice mainly consume wheat seeds. During both spring and winter, soybeans and miscellaneous vegetation account for a larger percentage of their diet as well.	0.05 to 0.74 acre	Yes	No
Carnivore	Short-tailed weasel	Badger (*Taxidea taxus*), bobcat (*Lynx rufus*), coyote (*Canis latrans*), fisher (*Martes pennanti*), foxes, lynx (*Lynx canadensis*), marten (*Martes americana*), mink (*Mustela vison*), cougar (*Felis concolor*), weasels, and wolverine (*Gulo gulo*)	The diet of short-tailed weasels comprise only small (rabbit size or smaller) warm-blooded terrestrial animals (Eder, 2002). These can include voles, shrews, rats, chipmunks, nestlings, and rabbits. When small mammals are scarce, the short-tailed weasel diet can also include eggs, frogs, fish, and insects. In the winter, short-tailed weasels feed entirely on small rodents, including lemmings (King, 1983).	49.5 acres	Yes	No
	Gray wolf		The diet of gray wolves consist of only mammals. Large ungulates, such as elk, deer, and moose, make up 90% of their diet (USFWS, 1987; Wiles et al., 2011; Stahler et al., 2006). They will occasionally hunt smaller prey, such as beavers, rodents, and rabbits; hunt livestock; and scavenge on carrion. Gray wolves are highly territorial, and occasionally wolves from other packs or coyotes will prey on lone or young individuals.	54,000 acres	Yes	No

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EAE = ecological assessment endpoint

km = kilometer(s)

UCR = Upper Columbia River

Table 2-12. Risk Questions, Evidence, and Measures for Each EAE

EAE	Ecological Entity	Representative species		Risk Question	LOE	Measure of Exposure	Measure of Effect
Survival, growth, and reproduction of terrestrial plants	Terrestrial plant community	NA	1	Are the concentrations of COPCs in soils in the Terrestrial Study Area greater than soil screening benchmarks for the survival, growth, and reproduction of terrestrial plants such that adverse effects to the local community are expected?	COPC concentrations in soil compared to bulk soil screening-level benchmarks	Soil concentrations	Soil screening levels
			2	Are the concentrations of COPCs in soils in the Terrestrial Study Area greater than bioavailability-adjusted soil benchmarks for the survival, growth, and reproduction of terrestrial plants such that adverse effects to the local community are expected?	COPC concentrations in soil compared to bioavailability-adjusted benchmarks	Soil concentrations	Bioavailability-adjusted benchmarks
Survival, growth, and reproduction of soil invertebrates	Soil invertebrate community	NA	1	Are the concentrations of COPCs in soils in the Terrestrial Study Area greater than soil screening benchmarks for the survival, growth, and reproduction of soil invertebrates such that adverse effects to the local community are expected?	COPC concentrations in soil compared to bulk soil screening-level benchmarks	Soil concentrations	Soil screening levels
			2	Are the concentrations of COPCs in soils in the Terrestrial Study Area greater than bioavailability-adjusted soil benchmarks for the survival, growth, and reproduction of soil invertebrates such that adverse effects to the local community are expected?	COPC concentrations in soil compared to bioavailability-adjusted benchmarks	Soil concentrations	Bioavailability-adjusted benchmarks
Survival, growth, and reproduction of birds	Carnivore populations	American kestrel		Do the daily doses of COPCs received by birds (represented by guilds focused on specific avian species) from consumption of the tissues of prey, plants, and soil in the Terrestrial Study Area exceed the TRVs for survival, growth or reproduction of birds such that adverse effects to the local population are expected?	Dietary doses of COPCs compared to TRVs and dose-response information	Average daily dose	Avian TRVs (survival, growth, and reproduction of individual organisms)
	Aerial-feeding insectivore populations	Tree swallow					
	Invertivore populations	American robin					
	Omnivore populations	Black-capped chickadee					
	Herbivore populations	California quail					
Survival, growth, and reproduction of mammals	Carnivore populations	Short-tailed weasel and gray wolf		Do the daily doses of COPCs received by mammals (represented by guilds focused on specific mammalian species) from consumption of the tissues of prey, plants, and soil in the Terrestrial Study Area exceed the TRVs for survival, growth or reproduction of mammals such that adverse effects to the local population are expected?	Dietary doses of COPCs compared to TRVs and dose-response information	Average daily dose	Mammalian TRVs (survival, growth, and reproduction of individual organisms)
	Aerial-feeding insectivore populations	Little brown bat					
	Invertivore populations	Masked shrew					
	Omnivore populations	Deer mouse					
	Herbivore populations	Meadow vole					

COPC = chemical of potential concern

LOE = line of evidence

NA = not applicable

TRV = toxicity reference value

Table 3-1. Summary of Environmental Chemistry DUA

Study/Data Source	Study Name used in Upland BERA	Study Name in UCR Project Database	Sampling Date(s)	Media Type	Number of Samples, Including Replicates	Sampling Approach	Analyte	Screening Criteria[a]	Data Quality[b]	Data Suitability[c]	Data Comparability[d]
Soil Chemistry											
Le Roi Smelter Removal Action Report (EPA, 2005)	NA	LeRoi2005	5/2004–9/2004	Soil	Not clear; 192 properties sampled in and near Northport	Five-point composite	Select metals (arsenic, cadmium, copper, and lead) (subset) SPLP extract metals (subset) TAL metals (subset)	Met	Not acceptable	NA	NA
Upper Columbia River Upland Soil Sampling Study (Ecology, 2013)	2012 Ecology Upland Soil Study	HARTC13A	10/30/2012–11/10/2012	Soil	119 surface soil composite samples and 51 vertical profile samples	Four-point composite for ~0.025 acre	TAL metals Mercury TOC Solids pH	Met	Acceptable	Suitable	Not comparable
Soil Study (TAI, 2015)	2014 UCR Upland Soil Study	Teck_2014_UplandSoil	9/8/2014–10/29/2014	Soil	173	30 point ISM composite for ~25 acres	TAL metals and molybdenum Mercury pH (bulk soil only) CEC TOC Percent moisture	Met	Acceptable	Suitable, with the exception of data collected from WSDAs, RFDAs and ADA 140	Not comparable
Bossburg Flat Beach Refined Sediment and Soil Study (TAI, 2016)	2015 Bossburg Study	Teck_2015_Bossburg	4/14/2015–5/7/2015	Soil	6	30 point ISM composite for 1–3 acres	TAL metals Mercury Grain size (bulk soil only) pH (bulk soil only) CEC TOC Percent moisture	Met	Acceptable	Suitable	Not comparable
IVBA											
Studies with Data for Soil Samples in the Soil Chemistry Inventory											
Soil Study (TAI,2015)	2014 UCR Upland Soil Study	Teck_2014_UplandSoil	9/8/2014–10/29/2014	Soil	25	30 point ISM composite for ~25 acres	TAL metals and molybdenum Mercury IVBA (TAL metals and molybdenum) pH (bulk soil only) TOC (< 2 mm fraction only) Percent moisture	Met	Acceptable	Suitable	Not comparable
Bossburg Flat Beach Refined Sediment and Soil Study (TAI, 2016)	2015 Bossburg Study	Teck_2015_Bossburg	4/14/2015–5/7/2015	Soil	10	30 point ISM composite for 1–3 acres	Arsenic and lead IVBA (arsenic and lead) pH (bulk soil only) TOC (< 2 mm fraction only)	Met	Acceptable	Suitable	
Studies with Data for Regressions											
2009-2011 Beach Sediment Study (TAI, 2014b)	2009-2011 Beach Sediment Study	Teck_2009_BeachSD Teck_2010_BeachSD Teck_2011_BeachSD	9/2009, 4/2010, and 4/2011–5/2011	Sediment	33	Composite (either 7 or 12 points)	Arsenic and lead IVBA (arsenic and lead) pH (< 2 mm fraction only) TOC (< 2 mm fraction only)	Met	Acceptable	Suitable	Comparable (for regression analyses)
Soil Study (TAI, 2015)	2014 UCR Upland Soil Study	Teck_2014_UplandSoil	9/8/2014–10/29/2014	Soil	25	30 point ISM composite for ~25 acres	TAL metals and molybdenum mercury IVBA (TAL metals and molybdenum) pH (bulk soil only) TOC (< 2 mm fraction only) Percent moisture	Met	Acceptable	Suitable	
Bossburg Flat Beach Refined Sediment and Soil Study (TAI, 2016)	2015 Bossburg Study	Teck_2015_Bossburg	4/14/2015–5/7/2015	Soil and sediment	10	30 point ISM composite for 1–3 acres	Arsenic and lead IVBA (arsenic and lead) pH (bulk soil only) TOC (< 2 mm fraction only)	Met	Acceptable	Suitable	

Table 3-1. Summary of Environmental Chemistry DUA

Study/Data Source	Study Name used in Upland BERA	Study Name in UCR Project Database	Sampling Date(s)	Media Type	Number of Samples, Including Replicates	Sampling Approach	Analyte	Screening Criteria[a]	Data Quality[b]	Data Suitability[c]	Data Comparability[d]
Bioaccumulation											
Plant Tissue Study (TAI, 2019b)	2018 Plant Tissue Study	Teck_2017_PlantTissue	4/25/2018–8/28/2018	Co-located soil and plant tissue	156	Point or composite	TAL metals (except calcium, potassium, manganese, and sodium) Mercury (subset) Total solids	Met	Acceptable	Suitable	NA

Sources:

Washington State Department of Ecology (Ecology). 2013. *Upper Columbia River Upland Soil Sampling Study, Stevens County, Washington* . 17800 36. Prepared by Hart Crowser, Seattle, WA.

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[a] The screening criteria for data inclusion are:

Soil Chemistry–All of the following criteria must be met for inclusion: grain size < 2 mm, sample depth < 12 inches, sample media type of soil, and location above pre-1973 maximum flood extent.

In vitro bioaccessibility (IVBA)–One of the following criterion must be met for inclusion: sample-specific bioavailability data from included soil chemistry data set, or pH and/or TOC data for regression-based estimation.

Bioaccumulation–Co-located soil chemistry concentration data and tissue data.

[b] The data quality evaluation was conducted for data meeting screening criteria.

[c] The data suitability evaluation was conducted for data of acceptable or conditionally acceptable quality.

[d] The data comparability evaluation was conducted for data of suitable quality.

< = less than

ADA = aerial deposition area

BERA = baseline ecological risk assessment

CEC = cation exchange capacity

DUA = data usability assessment

ISM = incremental sampling method

mm = millimeter(s)

NA = not applicable

RFDA = relict floodplain deposition area

SPLP = synthetic precipitation leach procedure

TAL = target analyte list

TOC = total organic carbon

UCR = Upper Columbia River

WSDA = windblown sediment deposition area

Table 3-2. BERA Soil Data Set Summary Statistics

Analyte	Number of Samples	Number of Detected Results	Analyte Concentration (mg/kg unless otherwise noted)								Sample ID(s) of Maximum Detected Value
			Minimum	Mean	Standard Deviation	Median	95th Percentile	Maximum Detected Value	Maximum MDL or MRL for Nondetects	Maximum of Detected Values, MDLs, or MRLs	
2012 Ecology Upland Soil Study											
Entire Study Area Included in the Upland BERA											
Aluminum	106	106	4590	17313	5869	17150	27850	34600	NA	34600	SA12-1C
Antimony	106	61	0.200	0.621	1.70	0.300	1.50	17.2	0.300	17.2	SA11-7C
Arsenic	106	106	5.30	17.7	9.67	15.6	37.1	55.5	NA	55.5	SA10-2C
Barium	106	106	34.8	349	290	295	738	2590	NA	2590	SA9-2C
Cadmium	106	106	0.6	6.94	5.80	5.47	17.1	37.3	NA	37.3	SA10-2C
Chromium	106	106	7.00	30.4	49.7	20.7	60.0	470	NA	470	SA9-2C
Cobalt	106	106	2.10	8.36	4.22	8.00	18.4	24.2	NA	24.2	SA9-2C
Copper	106	106	6.40	26.5	11.4	24.4	48.8	62.9	NA	62.9	SA10-2C
Iron	106	106	7620	20779	7319	20900	37800	41500	NA	41500	SA5-2C
Lead	106	106	31.0	351	324	249	1014	1920	NA	1920	SA11-7C
Manganese	106	106	43.6	1184	800	1040	2690	5490	NA	5490	SA10-2C
Mercury	106	106	0.0150	0.0918	0.0690	0.0735	0.192	0.527	NA	0.527	SA11-7C
Nickel	106	106	5.90	24.3	21.1	19.6	55.1	178	NA	178	SA9-2C
Selenium[a]	106	10	0.500	0.605	0.515	0.500	0.925	5.2	2.00	5.2	SA10-4C
Silver	106	67	0.200	0.341	0.257	0.300	0.825	2.00	0.200	2.00	SA11-7C
Thallium	106	84	0.200	0.373	0.214	0.300	0.875	1.2	0.200	1.2	SA10-2C
Vanadium	106	106	9.00	27.8	11.7	25.9	44.0	75.0	NA	75.0	SA7-8C
Zinc	106	106	70.0	373	253	291	845	1330	NA	1330	SA10-2C
% OC	106	106	1.21	6.21	3.91	5.26	12.2	23.4	NA	23.4	SA11-7C
pH (H20)	106	106	4.69	5.88	0.381	5.91	6.51	6.79	NA	6.79	SA5-3C
pH (0.01 M $CaCl_2$)	106	106	4.15	5.34	0.381	5.37	5.97	6.25	NA	6.25	SA5-3C

Table 3-2. BERA Soil Data Set Summary Statistics

Analyte	Number of Samples	Number of Detected Results	Analyte Concentration (mg/kg unless otherwise noted)								Sample ID(s) of Maximum Detected Value
			Minimum	Mean	Standard Deviation	Median	95th Percentile	Maximum Detected Value	Maximum MDL or MRL for Nondetects	Maximum of Detected Values, MDLs, or MRLs	
2014 UCR Upland Soil Study											
Entire Study Area Included in the Upland BERA											
Aluminum	141	141	5510	14857	4190	15200	21400	26200	NA	26200	ADA-107-C
Antimony	141	141	0.636	3.02	1.81	2.58	6.91	10.1	NA	10.1	ADA-162
Arsenic	141	141	5.59	15.4	4.95	14.7	24.3	28.8	NA	28.8	ADA-131-A
Barium	141	141	56.2	353	245	289	811	1470	NA	1470	ADA-055-B
Cadmium	141	141	0.701	5.40	2.92	5.13	10.7	14.3	NA	14.3	ADA-183
Chromium	141	141	7.32	20.4	9.63	18.6	35.7	78.7	NA	78.7	ADA-061
Cobalt	141	141	2.26	7.53	2.54	7.36	11.4	15.5	NA	15.5	ADA-103
Copper	141	141	8.22	21.4	8.27	19.7	40.8	51.8	NA	51.8	ADA-126
Iron	141	141	7440	17808	4771	18000	25700	30900	NA	30900	ADA-103
Lead	141	141	44.5	216	131	176	497	681	NA	681	ADA-162
Manganese	141	141	220	976	450	913	1920	2350	NA	2350	ADA-061
Mercury	141	141	0.0230	0.0793	0.0300	0.0780	0.132	0.164	NA	0.164	ADA-076
Molybdenum	141	141	0.32	1.36	1.34	0.77	4.01	7.81	NA	7.81	ADA-183
Nickel	141	141	5.59	21.7	10.4	19.6	40.2	64.7	NA	64.7	ADA-044
Selenium	141	141	0.14	0.370	0.301	0.31	0.78	3.32	NA	3.32	ADA-183
Silver	141	141	0.0690	0.315	0.187	0.271	0.590	1.18	NA	1.18	ADA-184
Thallium	141	141	0.124	0.274	0.090	0.256	0.438	0.549	NA	0.549	ADA-050
Vanadium	141	141	13.5	29.6	9.27	29.4	47.9	63.2	NA	63.2	ADA-050
Zinc	141	141	72.4	298	131	276	514	1070	NA	1070	ADA-085
% Clay	141	141	0.404	3.39	2.12	2.95	7.03	14.7	NA	14.7	ADA-018
% OC	141	141	1.75	6.15	2.55	5.83	10.3	16.3	NA	16.3	ADA-172
eCEC (cmolc/kg)	141	141	5.85	15.1	5.56	14.7	24.9	32.3	NA	32.3	ADA-172
pH (H20)	141	141	4.82	5.95	0.453	5.98	6.56	8.00	NA	8.00	ADA-101
pH (0.01 M $CaCl_2$)	141	141	4.28	5.41	0.453	5.44	6.02	7.46	NA	7.46	ADA-101

Table 3-2. BERA Soil Data Set Summary Statistics

Analyte	Number of Samples	Number of Detected Results	Analyte Concentration (mg/kg unless otherwise noted)								Sample ID(s) of Maximum Detected Value
			Minimum	Mean	Standard Deviation	Median	95th Percentile	Maximum Detected Value	Maximum MDL or MRL for Nondetects	Maximum of Detected Values, MDLs, or MRLs	
2015 Bossburg Flat Beach Study											
Entire Study Area Included in the Upland BERA											
Aluminum	6	6	8820	10437	1353	10335	12025	12100	NA	12100	UDU-05-ICS
Antimony	6	6	0.652	8.69	18.4	0.932	35.3	46.2	NA	46.2	UDU-03-ICS
Arsenic	6	6	5.86	7.26	1.86	6.34	10.0	10.7	NA	10.7	UDU-06-ICS
Barium	6	6	106	144	35.9	144	189	196	NA	196	UDU-06-ICS
Cadmium	6	6	0.909	1.21	0.374	1.10	1.76	1.93	NA	1.93	UDU-04-ICS-B
Chromium	6	6	11.8	16.4	5.80	13.2	24.0	24.1	NA	24.1	UDU-05-ICS
Cobalt	6	6	3.99	5.15	1.55	4.22	7.27	7.42	NA	7.42	UDU-05-ICS
Copper	6	6	13.4	24.6	15.5	19.3	47.4	55.4	NA	55.4	UDU-03-ICS
Iron	6	6	11600	13900	2575	13250	17650	18600	NA	18600	UDU-05-ICS
Lead	6	6	38.4	581	974	220	2015	2550	NA	2550	UDU-04-ICS-A
Manganese	6	6	277	333	38.7	328	383	396	NA	396	UDU-05-ICS
Mercury	6	6	0.0310	0.105	0.0975	0.0800	0.245	0.287	NA	0.287	UDU-04-ICS-A
Nickel	6	6	9.77	14.0	5.43	11.1	21.0	21.0	NA	21.0	UDU-06-ICS
Selenium	6	6	0.11	0.228	0.213	0.145	0.543	0.660	NA	0.66	UDU-06-ICS
Silver	6	6	0.129	0.465	0.653	0.206	1.42	1.79	NA	1.79	UDU-04-ICS-A
Thallium	6	6	0.115	0.148	0.030	0.136	0.188	0.189	NA	0.189	UDU-05-ICS
Vanadium	6	6	22.0	25.5	6.13	22.6	34.8	37.5	NA	37.5	UDU-05-ICS
Zinc	6	6	102	122	27.3	115	163	176	NA	176	UDU-04-ICS-B
% Clay	6	6	1.53	3.24	3.19	1.65	8.04	9.58	NA	9.58	UDU-05-ICS
% OC	6	6	1.08	1.88	1.08	1.53	3.43	4.05	NA	4.05	UDU-06-ICS
eCEC (cmolc/kg)	6	6	3.43	6.89	4.75	4.31	13.9	15.2	NA	15.2	UDU-06-ICS
pH (H_20)	6	6	5.61	6.58	0.901	6.23	7.85	8.02	NA	8.02	UDU-06-ICS
pH (0.01 M $CaCl_2$)	6	6	5.07	6.04	0.901	5.69	7.31	7.48	NA	7.48	UDU-06-ICS

[a] The majority of selenium results from 2012 Ecology Upland Soil Study samples are nondetected with elevated MRLs.

BERA = baseline ecological risk assessment

$CaCl_2$ = calcium chloride

cmolc/kg = centimol positive charge per kg of soil

eCEC - effective cation exchange capacity (centimol positive charge per kg of soil)

ID = identification

MDL = method detection limit

mg/kg = milligram(s) per kilogram

MRL = method reporting limit

NA = not applicable

OC = organic carbon

UCR = Upper Columbia River

Table 4-1. Wildlife Exposure Assumptions for Upland BERA Calculations

	Body Weight		Wet Weight Food Ingestion Rate		Dry Weight Food Ingestion Rate		Soil Ingestion (as % of dw food ingestion rate)		Soil Ingestion Rate
Receptor	**Value (kg)**	**Source**	**Value (kg ww/day)**	**Source**	**Value (kg ww/day)**	**Source**	**Value (%)**	**Source**	**Value (kg dw/day)**
Terrestrial Birds									
California quail	0.177	Average of male and females (Calkins et al., 2020)	0.073	Nagy, 2001 (all birds)	0.022	Nagy, 2001 (all birds)	6.1	Assumed comparable to mourning dove; median value from EPA (2007b) used	0.0013
Tree swallow	0.0195	Mean body mass of adults during breeding season (Winkler et al., 2020)	0.0133	Nagy, 2001 (insectivorous birds)	0.0044	Nagy, 2001 (insectivorous birds)	0	BPJ	0
American robin	0.0804	Average adult males and females (EPA, 1993)	0.036	Nagy, 2001 (insectivorous birds)	0.012	Nagy, 2001 (insectivorous birds)	10.4	Assumed comparable to American woodcock from Beyer et al. (1994)	0.0012
Black-capped chickadee	0.012	Average weight (Foote et al., 2010)	0.0094	Nagy, 2001 (insectivorous birds)	0.0031	Nagy, 2001 (insectivorous birds)	0	BPJ	0
American kestrel	0.116	Average of males and females from Bloom (1973 as cited in EPA 1993)	0.0719	Nagy, 2001 (carnivorous birds)	0.0198	Nagy, 2001 (carnivorous birds)	2	BPJ	0.00040
Terrestrial Mammals									
Meadow vole	0.0369	Nagy, 2001	0.0349	Nagy, 2001 (meadow vole)	0.0115	Nagy, 2001 (meadow vole)	2.4	Beyer et al., 1994	0.00028
Little brown bat	0.0075	Gould, 1955 (as cited in Sample and Suter, 1994)	0.0045	Nagy, 2001 (Chiroptera - bats)	0.0014	Nagy, 2001 (Chiroptera - bats)	0	Soil ingestion by little brown bat is negligible (Sample and Suter, 1994)	0
Masked shrew	0.0042	Silva and Downing, 1995	0.0058	Buckner, 1964	0.0017	Buckner, 1964; EPA, 1993	3	EPA, 2007b	0.000051
Deer mouse	0.0179	Nagy, 2001	0.0119	Nagy, 2001 (deer mouse)	0.00381	Nagy, 2001 (deer mouse)	2	Assumed comparable to white-footed mouse from Beyer et al. (1994) (< 2%)	0.000076
Short-tailed weasel	0.076	Eder, 2002	0.018	Nagy, 2001 (carnivorous mammals)	0.0057	Nagy, 2001 (carnivorous mammals)	2.8	Assumed comparable to red fox from Beyer et al. (1994)	0.00016
Gray wolf	37.3	Nagy, 2001	3.51	Nagy, 2001 (gray wolf)	1.05	Nagy, 2001 (gray wolf)	2.8	Assumed comparable to red fox from Beyer et al. (1994)	0.0295

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< = less than

BERA = baseline ecological risk assessment

BPJ = best professional judgment

dw = dry weight

kg = kilogram(s)

ww = wet weight

Table 4-2. Dietary Composition for Upland BERA Calculations

	Proportion of Diet							
Receptor	Aboveground Terrestrial Plants	Belowground Terrestrial Plants	Terrestrial Arthropods	Terrestrial Flying Insects	Earthworms	Terrestrial Mammals	Rationale	Presented in EPA-Approved Document?
Terrestrial Birds								
California quail	0.97	0	0.03	0	0	0	Diet is primarily plants but can feed on small amounts of insects (1-6%) (Calkins et al., 2014)	NA
Tree swallow - terrestrial	0	0	0	1.0	0	0	Feeds mostly on flying insects (Winkler et al., 2011)	COPC Refinement (TAI, 2019b)
American robin	0.10	0	0.50	0	0.40	0	Beyer and Sample (2017) evaluated the literature on American robin's diet and concluded that the approximate diet in the spring and early summer (i.e., breeding season) is 40% earthworms, 50% other ground-dwelling invertebrates, and 10% fruit.	NA
Black-capped chickadee	0.20	0	0.80	0	0	0	In the winter about 50% insects and 50% plants (seeds and berries); during the breeding season 80-90% caterpillars, the rest seeds and fruits (Foote et al., 2010). Breeding season data used for selected dietary proportions.	NA
American kestrel	0	0	0.33	0	0	0.67	Diet is 33% invertebrates, 33% mammals, 31% birds, and 3% reptiles; reported for birds from California based on percent wet weight, estimated from Meyer and Balgooyen (1987), as cited in EPA (1993). Invertebrates consumed are primarily arthropods. Selected dietary proportions assume mammals as surrogate for birds and reptiles.	NA
Terrestrial Mammals								
Meadow vole	0.89	0.09	0.02	0	0	0	Diet is primarily vegetation, including shoots, seeds, roots, and fungi. On an average year-round basis, 9% of the vole diet is roots and 1–3% is insects, based on data from Lindroth and Batzli (1984) as cited in EPA (1993).	NA
Little brown bat	0	0	0	1.0	0	0	Feed entirely on insects (Eder, 2002; Anthony and Kunz, 1977; Fenton and Barclay 1980 as cited in Sample and Suter 1994)	COPC Refinement (TAI, 2019b)
Masked shrew	0	0	1.0	0	0	0	Diet is predominantly insects, particularly coleoptera and insect larva. Vertebrates and vegetation may be consumed in small quantities (Whitaker, 2004)	NA
Deer mouse	0.50	0	0.50	0	0	0	Diet is omnivorous and highly opportunistic; principally feed on seeds, arthropods, some green vegetation, and occasionally fruit and fungi if available (EPA, 1993).	NA
Short-tailed weasel	0	0	0	0	0	1.0	Prey almost entirely on small, warm blooded vertebrates, such as voles, shrews, rabbits (Eder, 2002)	NA
Gray wolf	0	0	0	0	0	1.0	Primarily feed on large ungulates, such as elk, deer, moose (Wiles et al., 2011; Stahler et al., 2006)	NA

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BERA = baseline ecological risk assessment
COPC = chemical of potential concern
NA = not applicable

Table 4-3. Available Bioaccumulation Models and/or Data from Ranked Sources for Prey Items

Dietary COPC or COI for Birds and/or Mammals	Ranked Sources for Models and/or Data			
	1. Site-Specific (2018 Plant Tissue Study)[a]	2. Oak Ridge National Laboratory Reports (Sample et al., 1998a, 1998b)	3. USACHPPM (2004) Raw Database (Appendix C)	4. Other Peer-Reviewed Literature
Terrestrial Plant Prey - Aboveground Plant Parts				
Aluminum	Data available (N = 99)	NA	NA	NA
Barium	Data available (N = 112)	NA	NA	NA
Cadmium	Data available (N = 111)	NA	NA	NA
Chromium	Data available (N = 109)	NA	NA	NA
Copper	Data available (N = 112)	NA	NA	NA
Iron	Data available (N = 112)	NA	NA	NA
Lead	Data available (N = 105)	NA	NA	NA
Mercury	Data available (N = 49)	NA	NA	NA
Molybdenum	No model or data available	No model or data available	Data available (N = 10)	NA
Selenium	Data available (N = 32)	NA	NA	NA
Thallium	Data available (N = 45)	NA	NA	NA
Vanadium	Data available (N = 73)	NA	NA	NA
Zinc	Data available (N = 112)	NA	NA	NA
Terrestrial Plant Prey - Belowground Plant Parts				
Aluminum	Data available (N = 36)	NA	NA	NA
Barium	Data available (N = 36)	NA	NA	NA
Cadmium	Data available (N = 36)	NA	NA	NA
Chromium	Data available (N = 36)	NA	NA	NA
Copper	Data available (N = 36)	NA	NA	NA
Iron	Data available (N = 36)	NA	NA	NA
Lead	Data available (N = 36)	NA	NA	NA
Mercury	Surrogate data available (N = 49) [b]	NA	NA	NA
Molybdenum	No model or data available	No model or data available	Data available (N = 8)	NA
Selenium	Data available (N = 27)	NA	NA	NA
Thallium	Data available (N = 36)	NA	NA	NA
Vanadium	Data available (N = 36)	NA	NA	NA
Zinc	Data available (N = 36)	NA	NA	NA

Table 4-3. Available Bioaccumulation Models and/or Data from Ranked Sources for Prey Items

Dietary COPC or COI for Birds and/or Mammals	Ranked Sources for Models and/or Data			
	1. Site-Specific (2018 Plant Tissue Study)[a]	2. Oak Ridge National Laboratory Reports (Sample et al., 1998a, 1998b)	3. USACHPPM (2004) Raw Database (Appendix C)	4. Other Peer-Reviewed Literature
Terrestrial Arthropod Prey				
Aluminum	No model or data available	No model or data available	Data available (N = 24)	NA
Barium	No model or data available	No model or data available	Data available (N = 33)	NA
Cadmium	No model or data available	No model or data available	Data available (N = 299)	NA
Chromium	No model or data available	No model or data available	Data available (N = 35)	NA
Copper	No model or data available	No model or data available	Data available (N = 274)	NA
Iron	No model or data available	No model or data available	Data available (N = 30)	NA
Lead	No model or data available	No model or data available	Data available (N = 268)	NA
Mercury	No model or data available	No model or data available	Data available (N = 30)	NA
Molybdenum	No model or data available	No model or data available	No model or data available	Model available
Selenium	No model or data available	No model or data available	Data available (N = 22)	NA
Thallium	No model or data available	No model or data available	Data available (N = 14)	NA
Vanadium	No model or data available	No model or data available	Data available (N = 19)	NA
Zinc	No model or data available	No model or data available	Data available (N = 258)	NA
Flying Insect Prey				
Aluminum	No model or data available	No model or data available	Data available (N = 17)	NA
Barium	No model or data available	No model or data available	Data available (N = 19)	NA
Cadmium	No model or data available	No model or data available	Data available (N = 94)	NA
Chromium	No model or data available	No model or data available	Data available (N = 21)	NA
Copper	No model or data available	No model or data available	Data available (N = 78)	NA
Iron	No model or data available	No model or data available	Data available (N = 17)	NA
Lead	No model or data available	No model or data available	Data available (N = 64)	NA
Mercury	No model or data available	No model or data available	Data available (N = 17)	NA
Molybdenum	No model or data available	No model or data available	No model or data available	Model available
Selenium	No model or data available	No model or data available	Data available (N = 14)	NA
Thallium	No model or data available	No model or data available	Data available (N = 4)	NA
Vanadium	No model or data available	No model or data available	Data available (N = 6)	NA
Zinc	No model or data available	No model or data available	Data available (N = 60)	NA

Table 4-3. Available Bioaccumulation Models and/or Data from Ranked Sources for Prey Items

Dietary COPC or COI for Birds and/or Mammals	Ranked Sources for Models and/or Data			
	1. Site-Specific (2018 Plant Tissue Study)[a]	2. Oak Ridge National Laboratory Reports (Sample et al., 1998a, 1998b)	3. USACHPPM (2004) Raw Database (Appendix C)	4. Other Peer-Reviewed Literature
Earthworm Prey				
Aluminum	No model or data available	Model available	NA	NA
Barium	No model or data available	Model available	NA	NA
Cadmium	No model or data available	Model available	NA	NA
Chromium	No model or data available	Model available	NA	NA
Copper	No model or data available	Model available	NA	NA
Iron	No model or data available	Model available	NA	NA
Lead	No model or data available	Model available	NA	NA
Mercury	No model or data available	Model available	NA	NA
Molybdenum	No model or data available	Model available	NA	NA
Selenium	No model or data available	Model available	NA	NA
Thallium	No model or data available	No model or data available	No model or data available	No model or data available
Vanadium	No model or data available	Model available	NA	NA
Zinc	No model or data available	Model available	NA	NA
Small Mammal and Ungulate Prey				
Aluminum	No model or data available	Model available	NA	NA
Barium	No model or data available	Model available	NA	NA
Cadmium	No model or data available	Model available	NA	NA
Chromium	No model or data available	Model available	NA	NA
Copper	No model or data available	Model available	NA	NA
Iron	No model or data available	Model available	NA	NA
Lead	No model or data available	Model available	NA	NA
Mercury	No model or data available	Model available	NA	NA
Molybdenum	No model or data available	No model or data available	No model or data available	No model or data available
Selenium	No model or data available	Model available	NA	NA
Thallium	No model or data available	Model available	NA	NA

Table 4-3. Available Bioaccumulation Models and/or Data from Ranked Sources for Prey Items

Dietary COPC or COI for Birds and/or Mammals	Ranked Sources for Models and/or Data			
	1. Site-Specific (2018 Plant Tissue Study)[a]	2. Oak Ridge National Laboratory Reports (Sample et al., 1998a, 1998b)	3. USACHPPM (2004) Raw Database (Appendix C)	4. Other Peer-Reviewed Literature
Small Mammal and Ungulate Prey (continued)				
Vanadium	No model or data available	Model available	NA	NA
Zinc	No model or data available	Model available	NA	NA

Sources:

Bechtel Jacobs Company LLC. 1998. *Empirical Models for the Uptake of Inorganic Chemicals from Soil by Plants* . Report No. BJC/OR 133. Oak Ridge National Laboratory, Oak Ridge, TN.

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[a] Counts of available data points for the 2018 Plant Tissue Study report the number of detected pairs of data between soil and plant parts. Nondetected results were excluded from the analysis.

[b] Belowground plant samples were not analyzed for mercury, because the highest concentrations were expected in aboveground plant parts (TAI, 2019a). Aboveground plant parts are thus used as conservative surrogate data for belowground plant parts.

Notes:

Orange highlight indicates that no model or data are available for the given diet type, COPC, and source.

Light green highlight indicates that co-located soil and biota data are available for the given prey type, COPC, and source.

Dark green highlight indicates that a calculated model is available for the given prey type, COPC, and source.

COI = chemical of interest

COPC = chemical of potential concern

N = number of data points

NA = not applicable; model was chosen in previous source

Table 4-4. Bioaccumulation Models Used for the Upland BERA

COPC	Equation [a]	Variable A	Variable B	Source	Notes
Aboveground Terrestrial Plant Parts					
Aluminum	$C_{tissue} = A * C_{soil}$	0.0009	NA	2018 UCR Plant Tissue Study (TAI, 2019a)	Median BAF using fines-bulk corrected soil chemistry (Appendix C)
Barium	$C_{tissue} = A * C_{soil}$	0.1244	NA	2018 UCR Plant Tissue Study (TAI, 2019a)	Median BAF using fines-bulk corrected soil chemistry (Appendix C)
Cadmium	$C_{tissue} = A * C_{soil}$	0.0128	NA	2018 UCR Plant Tissue Study (TAI, 2019a)	Median BAF using fines-bulk corrected soil chemistry (Appendix C)
Chromium	$C_{tissue} = A * C_{soil}$	0.0203	NA	2018 UCR Plant Tissue Study (TAI, 2019a)	Median BAF using fines-bulk corrected soil chemistry (Appendix C)
Copper	$C_{tissue} = A * C_{soil}$	0.1103	NA	2018 UCR Plant Tissue Study (TAI, 2019a)	Median BAF using fines-bulk corrected soil chemistry (Appendix C)
Iron	$C_{tissue} = A * C_{soil}$	0.0017	NA	2018 UCR Plant Tissue Study (TAI, 2019a)	Median BAF using fines-bulk corrected soil chemistry (Appendix C)
Lead	$C_{tissue} = A * C_{soil}$	0.0010	NA	2018 UCR Plant Tissue Study (TAI, 2019a)	Median BAF using fines-bulk corrected soil chemistry (Appendix C)
Mercury	$C_{tissue} = A * C_{soil}$	0.0694	NA	2018 UCR Plant Tissue Study (TAI, 2019a)	Median BAF using fines-bulk corrected soil chemistry (Appendix C)
Molybdenum	$C_{tissue} = A * C_{soil}$	1.25	NA	USACHPPM, 2004	Median BAF; developed from raw data (Appendix C)
Selenium	$C_{tissue} = A * C_{soil}$	0.0917	NA	2018 UCR Plant Tissue Study (TAI, 2019a)	Median BAF using fines-bulk corrected soil chemistry (Appendix C)
Thallium	$C_{tissue} = A * C_{soil}$	0.0164	NA	2018 UCR Plant Tissue Study (TAI, 2019a)	Median BAF using fines-bulk corrected soil chemistry (Appendix C)
Vanadium	$C_{tissue} = A * C_{soil}$	0.0015	NA	2018 UCR Plant Tissue Study (TAI, 2019a)	Median BAF using fines-bulk corrected soil chemistry (Appendix C)
Zinc	$C_{tissue} = A * C_{soil}$	0.0637	NA	2018 UCR Plant Tissue Study (TAI, 2019a)	Median BAF using fines-bulk corrected soil chemistry (Appendix C)
Belowground Terrestrial Plant Parts					
Aluminum	$C_{tissue} = A * C_{soil}$	0.0327	NA	2018 UCR Plant Tissue Study (TAI, 2019a)	Median BAF using fines-bulk corrected soil chemistry (Appendix C)
Barium	$C_{tissue} = A * C_{soil}$	0.2608	NA	2018 UCR Plant Tissue Study (TAI, 2019a)	Median BAF using fines-bulk corrected soil chemistry (Appendix C)
Cadmium	$C_{tissue} = A * C_{soil}$	0.4915	NA	2018 UCR Plant Tissue Study (TAI, 2019a)	Median BAF using fines-bulk corrected soil chemistry (Appendix C)
Chromium	$\ln(C_{tissue}) = A * \ln(C_{soil}) + B$	2.2830	-7.4983	2018 UCR Plant Tissue Study (TAI, 2019a)	Used fines-bulk corrected soil chemistry (Appendix C)
Copper	$C_{tissue} = A * C_{soil}$	0.1229	NA	2018 UCR Plant Tissue Study (TAI, 2019a)	Median BAF using fines-bulk corrected soil chemistry (Appendix C)
Iron	$C_{tissue} = A * C_{soil}$	0.0208	NA	2018 UCR Plant Tissue Study (TAI, 2019a)	Median BAF using fines-bulk corrected soil chemistry (Appendix C)
Lead	$C_{tissue} = A * C_{soil}$	0.0895	NA	2018 UCR Plant Tissue Study (TAI, 2019a)	Median BAF using fines-bulk corrected soil chemistry (Appendix C)
Mercury	$C_{tissue} = A * C_{soil}$	0.0694	NA	2018 UCR Plant Tissue Study (TAI, 2019a)	Median BAF using fines-bulk corrected soil chemistry (Appendix C)
Molybdenum	$C_{tissue} = A * C_{soil}$	1.7030	NA	USACHPPM, 2004	Median BAF; developed from raw data (Appendix C)
Selenium	$C_{tissue} = A * C_{soil}$	0.0714	NA	2018 UCR Plant Tissue Study (TAI, 2019a)	Median BAF using fines-bulk corrected soil chemistry (Appendix C)
Thallium	$C_{tissue} = A * C_{soil}$	0.2783	NA	2018 UCR Plant Tissue Study (TAI, 2019a)	Median BAF using fines-bulk corrected soil chemistry (Appendix C)
Vanadium	$\ln(C_{tissue}) = A * \ln(C_{soil}) + B$	2.4603	-9.6464	2018 UCR Plant Tissue Study (TAI, 2019a)	Used fines-bulk corrected soil chemistry (Appendix C)
Zinc	$C_{tissue} = A * C_{soil}$	0.4788	NA	2018 UCR Plant Tissue Study (TAI, 2019a)	Median BAF using fines-bulk corrected soil chemistry (Appendix C)
Terrestrial Arthropods					
Aluminum	$\ln(C_{tissue}) = A * \ln(C_{soil}) + B$	3.8816	-33.549	Appendix B-1 of USACHPPM, 2004	Developed from raw data (Appendix C)
Barium	$C_{tissue} = A * C_{soil}$	0.0310	NA	Appendix B-1 of USACHPPM, 2004	Median BAF; developed from raw data (Appendix C)
Cadmium	$\ln(C_{tissue}) = A * \ln(C_{soil}) + B$	0.5884	0.506	Appendix B-1 of USACHPPM, 2004	Developed from raw data (Appendix C)
Chromium	$C_{tissue} = A * C_{soil}$	0.0643	NA	Appendix B-1 of USACHPPM, 2004	Median BAF; developed from raw data (Appendix C)
Copper	$C_{tissue} = A * C_{soil}$	0.9416	NA	Appendix B-1 of USACHPPM, 2004	Median BAF; developed from raw data (Appendix C)
Iron	$C_{tissue} = A * C_{soil}$	0.0060	NA	Appendix B-1 of USACHPPM, 2004	Median BAF; developed from raw data (Appendix C)
Lead	$\ln(C_{tissue}) = A * \ln(C_{soil}) + B$	0.7985	-1.494	Appendix B-1 of USACHPPM, 2004	Developed from raw data (Appendix C)
Mercury	$C_{tissue} = A * C_{soil}$	0.7292	NA	Appendix B-1 of USACHPPM, 2004	Median BAF; developed from raw data (Appendix C)
Molybdenum	$C_{tissue} = A * C_{soil}$	0.9800	NA	Hargreaves et al., 2011	Mean BAF (Median BAF not reported)
Terrestrial Arthropods (continued)					
Selenium	$C_{tissue} = A * C_{soil}$	1.6129	NA	Appendix B-1 of USACHPPM, 2004	Median BAF; developed from raw data (Appendix C)
Thallium	$C_{tissue} = A * C_{soil}$	0.0560	NA	Appendix B-1 of USACHPPM, 2004	Median BAF; developed from raw data (Appendix C)
Vanadium	$C_{tissue} = A * C_{soil}$	0.0098	NA	Appendix B-1 of USACHPPM, 2004	Median BAF; developed from raw data (Appendix C)
Zinc	$C_{tissue} = A * C_{soil}$	0.8269	NA	Appendix B-1 of USACHPPM, 2004	Median BAF; developed from raw data (Appendix C)

Table 4-4. Bioaccumulation Models Used for the Upland BERA

COPC	Equation [a]	Variable A	Variable B	Source	Notes
Flying Insects					
Aluminum	$C_{tissue} = A * C_{soil}$	0.0020	NA	Appendix B-1 of USACHPPM, 2004	Median BAF; developed from raw data (Appendix C)
Barium	$C_{tissue} = A * C_{soil}$	0.0240	NA	Appendix B-1 of USACHPPM, 2004	Median BAF; developed from raw data (Appendix C)
Cadmium	$\ln(C_{tissue}) = A * \ln(C_{soil}) + B$	0.6006	-0.311	Appendix B-1 of USACHPPM, 2004	Developed from raw data (Appendix C)
Chromium	$C_{tissue} = A * C_{soil}$	0.0561	NA	Appendix B-1 of USACHPPM, 2004	Median BAF; developed from raw data (Appendix C)
Copper	$\ln(C_{tissue}) = A * \ln(C_{soil}) + B$	0.469	1.521	Appendix B-1 of USACHPPM, 2004	Developed from raw data (Appendix C)
Iron	$C_{tissue} = A * C_{soil}$	0.004	NA	Appendix B-1 of USACHPPM, 2004	Median BAF; developed from raw data (Appendix C)
Lead	$\ln(C_{tissue}) = A * \ln(C_{soil}) + B$	0.6873	-2.283	Appendix B-1 of USACHPPM, 2004	Developed from raw data (Appendix C)
Mercury	$C_{tissue} = A * C_{soil}$	0.5556	NA	Appendix B-1 of USACHPPM, 2004	Median BAF; developed from raw data (Appendix C)
Molybdenum	$C_{tissue} = A * C_{soil}$	0.98	NA	Hargreaves et al., 2011	Mean BAF (median BAF not reported)
Selenium	$C_{tissue} = A * C_{soil}$	1.3871	NA	Appendix B-1 of USACHPPM, 2004	Median BAF; developed from raw data (Appendix C)
Thallium	$C_{tissue} = A * C_{soil}$	0.054	NA	Appendix B-1 of USACHPPM, 2004	Median BAF; developed from raw data (Appendix C)
Vanadium	$C_{tissue} = A * C_{soil}$	0.0081	NA	Appendix B-1 of USACHPPM, 2004	Median BAF; developed from raw data (Appendix C)
Zinc	$\ln(C_{tissue}) = A * \ln(C_{soil}) + B$	0.2344	3.978	Appendix B-1 of USACHPPM, 2004	Developed from raw data (Appendix C)
Earthworms					
Aluminum	$C_{tissue} = A * C_{soil}$	0.043	NA	Sample et al., 1998a	Median BAF from validation dataset
Barium	$C_{tissue} = A * C_{soil}$	0.091	NA	Sample et al., 1998a, as reported in EPA, 2007b	Median BAF
Cadmium	$\ln(C_{tissue}) = A * \ln(C_{soil}) + B$	0.795	2.114	Sample et al., 1998a, as reported in EPA, 2007b	NA
Chromium	$C_{tissue} = A * C_{soil}$	0.306	NA	Sample et al., 1998a, as reported in EPA, 2007b	Median BAF
Copper	$C_{tissue} = A * C_{soil}$	0.515	NA	Sample et al., 1998a, as reported in EPA, 2007b	Median BAF
Iron	$C_{tissue} = A * C_{soil}$	0.036	NA	Sample et al., 1998a	Median BAF from validation dataset
Lead	$\ln(C_{tissue}) = A * \ln(C_{soil}) + B$	0.807	-0.218	Sample et al., 1998a, as reported in EPA, 2007b	NA
Mercury	$C_{tissue} = A * C_{soil}$	1.693	NA	Sample et al., 1998a	Median BAF
Molybdenum	$C_{tissue} = A * C_{soil}$	0.953	NA	Sample et al., 1998a	Median BAF from validation dataset
Selenium	$\ln(C_{tissue}) = A * \ln(C_{soil}) + B$	0.733	-0.075	Sample et al., 1998a, as reported in EPA, 2007b	NA
Thallium	$C_{tissue} = A * C_{soil}$	1	NA	Default BAF	NA
Vanadium	$C_{tissue} = A * C_{soil}$	0.042	NA	Sample et al., 1998a, as reported in EPA, 2007b	Median BAF from validation dataset
Zinc	$\ln(C_{tissue}) = A * \ln(C_{soil}) + B$	0.328	4.449	Sample et al., 1998a, as reported in EPA, 2007b	NA
Small Mammals and Ungulates					
Aluminum	$C_{tissue} = A * C_{soil}$	0.0263	NA	Sample et al., 1998b	Median BAF
Barium	$C_{tissue} = A * C_{soil}$	0.0566	NA	Sample et al., 1998b	Median BAF
Cadmium	$\ln(C_{tissue}) = A * \ln(C_{soil}) + B$	0.4723	-1.2571	Sample et al., 1998b, as reported in EPA, 2007b	NA
Chromium	$\ln(C_{tissue}) = A * \ln(C_{soil}) + B$	0.7338	-1.4599	Sample et al., 1998b, as reported in EPA, 2007b	NA
Copper	$\ln(C_{tissue}) = A * \ln(C_{soil}) + B$	0.1444	2.0420	Sample et al., 1998b, as reported in EPA, 2007b	NA
Iron	$\ln(C_{tissue}) = A * \ln(C_{soil}) + B$	0.5969	-0.2879	Sample et al., 1998b	NA

Table 4-4. Bioaccumulation Models Used for the Upland BERA

COPC	Equation [a]	Variable A	Variable B	Source	Notes
Small Mammals and Ungulates (continued)					
Lead	$\ln(C_{tissue}) = A * \ln(C_{soil}) + B$	0.4422	0.0761	Sample et al., 1998b, as reported in EPA, 2007b	NA
Mercury	$C_{tissue} = A * C_{soil}$	0.0543	NA	Sample et al., 1998b	Median BAF
Molybdenum	$C_{tissue} = A * C_{soil}$	1	NA	Default BAF	NA
Selenium	$\ln(C_{tissue}) = A * \ln(C_{soil}) + B$	0.3764	-0.4158	Sample et al., 1998b, as reported in EPA, 2007b	NA
Thallium	$C_{tissue} = A * C_{soil}$	0.1124	NA	Sample et al., 1998b	Median BAF
Vanadium	$C_{tissue} = A * C_{soil}$	0.0123	NA	Sample et al., 1998b, as reported in EPA, 2007b	NA
Zinc	$\ln(C_{tissue}) = A * \ln(C_{soil}) + B$	0.0706	4.3632	Sample et al., 1998b, as reported in EPA, 2007b	NA

Sources:

Hargreaves, A.L., D.P. Whiteside, and G. Gilchrist. 2011. "Concentrations of 17 elements, including mercury, in the tissues, food and abiotic environment of Arctic shorebirds." *Science of the Total Environment* . Vol. 409, No. 19. pp 3757-3770.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, and G.W. Suter. 1998a. *Development and Validation of Bioaccumulation Models for Small Mammals* . Lockheed Martin Report No. ES/ER/TM 219. Oak Ridge National Laboratory, Oak Ridge, TN.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, G.W. Suter, and T.L. Ashwood. 1998b. *Development and Validation of Bioaccumulation Models for Earthworms* . Lockheed Martin Report No. ES/ER/TM 220. Oak Ridge National Laboratory, Oak Ridge, TN.

Teck American Incorporated (TAI). 2019a. *Upper Columbia River Final Plant Tissue Study Data Summary Report* . Prepared for TAI by Ramboll, Seattle, WA.

U.S. Army Center for Health Promotion and Preventative Medicine (USACHPPM). 2004. *Development of Terrestrial Exposure and Bioaccumulation Information for the Army Risk Assessment Modeling System (ARAMS)* .

U.S. Environmental Protection Agency (EPA). 2007b. *Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs): Attachment 4-1, Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs* . OSWER Directive 9285.7-55. Office of Solid Waste and Emergency Response.

[a] All calculations performed as dry weight.

BAF = bioaccumulation factor

BERA = baseline ecological risk assessment

COPC = chemical of potential concern

C_{soil} = concentration in soil

C_{tissue} = concentration in dietary item tissue

ln = natural logarithm

NA = not applicable

Table 4-5. Plant and Invertebrate Soil Benchmarks

	Soil Benchmark (mg/kg-dw)	
COPC	**Eco-SSL or SSL**	**BAB[a]**
Plants		
Aluminum	pH <5.5	NA
Antimony	1900[b]	NA
Arsenic	18	NA
Barium	1414[b]	NA
Chromium	190[b]	NA
Cobalt		8.0 - 149.4
Copper	70	86.5 - 413.7
Iron	pH <5.0	NA
Lead	120	176.9 - 612.9
Manganese	220	NA
Molybdenum	26[b]	0.6 - 467.7
Nickel	38	15.0 - 187.4
Selenium	0.52	NA
Thallium	3.2[b]	NA
Zinc	160	51.9 - 511.3
Invertebrates		
Aluminum	pH <5.5	NA
Arsenic	153[b]	NA
Barium	330	NA
Chromium	57 [b]	NA
Cobalt	130 [b]	51.5 - 167.4
Copper	80	38.6 - 131.9
Iron	pH <5.0	NA
Manganese	450	NA
Molybdenum	233 [b]	1.8 - 115.7
Silver	58 [b]	NA
Thallium	30 [b]	NA
Vanadium	294 [b]	NA
Zinc	120	104.1 - 694.7

Sources:

Teck American Incorporated (TAI). 2019b. *Upper Columbia River Final Chemicals of Potential Concern Refinement for Aquatic and Terrestrial Receptors*. Prepared for TAI by Windward Environmental LLC, Seattle, WA.

Teck American Incorporated (TAI). 2020b. *Final Chemicals of Potential Concern Refinement for Aquatic and Terrestrial Receptors, Addendum No. 1*. Prepared for TAI by Windward Environmental LLC, Seattle, WA.

Notes:

[a] Ranges presented are the calculated bioavailability-adjusted sample specific benchmarks for sample locations within the 2014 UCR Upland Soil Study and 2015 Bossburg Study data sets where the necessary soil parameters were measured.

[b] Ecological soil screening levels (Eco-SSLs) were not available for these chemical of potential concern (COPC) receptors. Soil screening levels (SSLs) were developed and used instead (TAI 2019b, 2020b) (Appendix D, Attachment D1).

< = less than

BAB = bioavailability adjusted benchmark

mg/kg-dw = milligram(s) per kilogram dry weight

NA = not applicable

UCR = Upper Columbia River

Table 4-6. Reliability and Relevance Review for Soil Benchmarks for Terrestrial Plants and Soil Invertebrates

Benchmark Type	COPC	Qualities that Inform Reliability	Qualities that Inform Relevance	Location of Additional Discussion and/or Documentation
Terrestrial Plants LOE 1				
Eco-SSL or SSL	Aluminum	• Developed by EPA in accordance with EPA Eco-SSL guidance (EPA, 2005a). • Alternative approach of screening measured soil pH < 5.5 used, as total aluminum concentrations are not reliably predictive of toxicity and bioaccumulation	• Methodology is irrespective of species, bioavailability, chemical form, and endpoint.	EPA, 2003b
	Antimony	• Developed by TAI using methodology similar to Eco-SSL guidance (EPA, 2005a). Toxicity data identified from Eco-SSL documents and via literature search; studies reviewed and scored as per Eco-SSL acceptance criteria; only studies with a score of 10 or greater were used to derive the SSL (Eco-SSL requires a score of 11 or greater); SSL derived using a minimum of two data points (Eco-SSL requires a minimum of three); selected SSL is the lowest of the data points. • Two studies. • EC10.	• Tested species were lettuce and summer barley (species not identified at UCR; however, closely related species likely are present). • Medium bioavailability conditions (score = 1). • Chemical form was antimony trioxide. • Growth endpoint.	Appendix D
	Arsenic	• Developed by EPA in accordance with EPA Eco-SSL guidance (EPA, 2005a). • Three studies. • Geometric mean of MATC.	• Tested species were ryegrass, cotton, and rice (species not identified at UCR; however, closely related species likely are present). • High/very high bioavailability conditions (scores = 2). • Growth endpoint.	EPA, 2005d
	Barium	• Developed by TAI using methodology similar to Eco-SSL guidance (EPA, 2005a). Toxicity data identified from Eco-SSL documents and via literature search; studies reviewed and scored as per Eco-SSL acceptance criteria; only studies with a score of 10 or greater were used to derive the SSL (Eco-SSL requires a score of 11 or greater); SSL derived using a minimum of one data point (Eco-SSL requires a minimum of three). • One study. • MATC.	• Tested species were bush bean (species not identified at UCR; however, closely related species likely are present). • Low bioavailability conditions (score = 0). • Chemical form was barium nitrite. • Growth endpoint.	Appendix D
	Chromium	• Developed by TAI using methodology similar to Eco-SSL guidance (EPA, 2005a). Toxicity data identified from Eco-SSL documents and via literature search; studies reviewed and scored as per Eco-SSL acceptance criteria; only studies with a score of 10 or greater were used to derive the SSL (Eco-SSL requires a score of 11 or greater). • Six studies. • Geometric mean of MATC.	• Tested species were carrot (species not identified at UCR; however, closely related species likely are present.). • High/very high bioavailability conditions (scores = 2). • Chemical form was chromium chloride. • Growth endpoint.	Appendix D
	Cobalt	• Developed by EPA in accordance with EPA Eco-SSL guidance (EPA, 2005a). • Six studies. • Geometric mean of EC20.	• Tested species were alfalfa, barley, radish (species not identified at UCR; however, closely related species likely are present). • High/very high bioavailability conditions (scores = 2). • Growth endpoint.	EPA, 2005g
	Copper	• Developed by EPA in accordance with EPA Eco-SSL guidance (EPA, 2005a). • Six studies. • Geometric mean of EC10 and MATC.	• Tested species were alfalfa, black bindweed, citrus cultivar, and perennial ryegrass (species not identified at UCR). However, three Orders may be present in the UCR. • High/very high bioavailability conditions (scores = 2). • Reproduction and growth endpoints.	EPA, 2007d
	Iron	• Developed by EPA in accordance with EPA Eco-SSL guidance (EPA, 2005a). • Alternative approach recommended by EPA of concurrent site-specific field measurement of pH and Eh to approximate valence state and associated bioavailability and toxicity.	• Iron is essential and regulated by plants. In well-aerated soils with pH 5-8, the iron demand of plants is higher than the amount available and toxicity is not expected. • Toxicity effects vary by plant (e.g. stunted growth, discoloration, necrotic spotting).	EPA, 2003c
	Lead	• Developed by EPA in accordance with EPA Eco-SSL guidance (EPA, 2005a). • Four studies. • Geometric mean of MATC.	• Tested species were loblolly pine, red maple, berseem clover, and ryegrass (species not identified at UCR; however, closely related species likely are present). • High/very high bioavailability conditions (scores = 2). • Growth endpoint.	EPA, 2005h
	Manganese	• Developed by EPA in accordance with EPA Eco-SSL guidance (EPA, 2005a). • Four studies. • Geometric mean of MATC.	• Tested species were barley, cotton, and Nile grass (species not identified at UCR; however, closely related species likely are present). • High/very high and medium bioavailability conditions (scores = 2 and 1). • Growth endpoint.	EPA, 2007e

Table 4-6. Reliability and Relevance Review for Soil Benchmarks for Terrestrial Plants and Soil Invertebrates

Benchmark Type	COPC	Qualities that Inform Reliability	Qualities that Inform Relevance	Location of Additional Discussion and/or Documentation
Terrestrial Plants LOE 1 (continued)				
Eco-SSL or SSL	*Molybdenum*	• Developed by TAI using methodology similar to Eco-SSL guidance (EPA, 2005a). • Toxicity data extracted from ARCHE threshold calculator (v.2; 2018). • Twenty five studies. • Geometric mean of EC20.	• Tested species were rapeseed, barley, ryegrass, tomato, and red clover (species not identified at UCR; however, closely related species likely are present). • High/very high bioavailability conditions (scores = 2). • Chemical form was sodium molybdate. • Growth endpoint	Appendix D
	Nickel	• Developed by EPA in accordance with EPA Eco-SSL guidance (EPA, 2005a). • Eleven studies. • Geometric mean of EC20 and MATC.	• Tested species were alfalfa, barley, brassica, red oak, ryegrass, and oat (species not identified at UCR; however, closely related species likely are present). • High/very high bioavailability conditions (scores = 2). • Reproduction and growth endpoints.	EPA, 2007f
	Selenium	• Developed by EPA in accordance with EPA Eco-SSL guidance (EPA, 2005a). • Eight studies. • Geometric mean of EC20 and MATC.	• Tested species were alfalfa, barley, brassica, raya, berseem, and cowpea (species not identified at UCR; however, closely related species likely are present). • High/very high bioavailability conditions (scores = 2). • Growth endpoint.	Appendix D
	Thallium	• Developed by TAI using methodology similar to Eco-SSL guidance (EPA, 2005a). Toxicity data identified from Eco-SSL documents and via literature search; studies reviewed and scored as per Eco-SSL acceptance criteria; only studies with a score of 10 or greater were used to derive the SSL (Eco-SSL requires a score of 11 or greater); SSL derived using a minimum of two data points (Eco-SSL requires a minimum of three); selected SSL is the lowest of the data points. • Two studies. • Lowest MATC.	• Tested species was garden cress (species not identified at UCR; however, closely related species likely are present). • Medium bioavailability conditions (score = 1). • Chemical form was thallium carbonate. • Growth endpoint.	Appendix D
	Zinc	• Developed by EPA in accordance with EPA Eco-SSL guidance (EPA, 2005a). • Five studies. • Geometric mean of MATC.	• Tested species were soybean, oats, and lettuce (species not identified at UCR; however, closely related species likely are present). • High/very high and medium bioavailability conditions (scores = 2 and 1). • Growth endpoint.	EPA, 2007h
Bioavailability-adjusted Benchmark	Cobalt	• Developed by ARCHE Consulting using soil data sets developed for the European REACH dossiers and is analogous to EPA's approach to calculating hardness-based ambient water quality criteria. • Five studies, using a total of seven species. • Fifth percentile of the species sensitivity distribution of EC20s. • Reliability and relevance criteria for selection of terrestrial ecotoxicity data are clearly defined.	• Of the plants species used in the development of the bioavailability-adjusted benchmark, one, *Elymus lanceolatu* s, is present at the site. However, all four plant Orders used in the development of the bioavailability-adjusted benchmark are present at the site (Asterales, Capparales, Cyperales, and Fabales). • Bioavailability adjustments (such as pH, percent OC, percent clay, and eCEC) were included. • Chemical forms were cobalt chloride, cobalt chloride hexahydrate, and cobalt sulfate. • Endpoints were yield (roots and shoots).	ARCHE, 2020; Appendix D
	Copper	• Developed by ARCHE Consulting using soil data sets developed for the European REACH dossiers and is analogous to EPA's approach to calculating hardness-based ambient water quality criteria. • Eight studies, using a total of 10 species of grasses and flowering plants. • Fifth percentile of the species sensitivity distribution of EC20s. • Reliability and relevance criteria for selection of terrestrial ecotoxicity data are clearly defined.	• Plants species used in the development of the bioavailability-adjusted benchmark are not present at the site. However, all three plant orders used in the development of the bioavailability-adjusted benchmark are present at the site (Asterales, Cyperales, and Polygonales). • Bioavailability adjustments (such as pH, percent OC, percent clay, and eCEC) were included in the bioavailability-adjusted benchmark. • Chemical forms were copper sulfate or copper acetate. • Endpoints included mortality, reproduction, seedling emergence, and yield (seeds, roots, and shoots).	ARCHE, 2020; Appendix D
	Lead	• Developed by ARCHE Consulting using soil data sets developed for the European REACH dossiers and is analogous to EPA's approach to calculating hardness-based ambient water quality criteria. • Twelve studies, using a total of 16 species of grasses, flowering plants, and evergreen trees. • Fifth percentile of the species sensitivity distribution of EC20s. • Reliability and relevance criteria for selection of terrestrial ecotoxicity data are clearly defined.	• Plant species used in the development of the bioavailability-adjusted benchmark are not present at the site. However, some species with the same genus are (*Pinus* and *Picea*). All six plant orders used in the development of the bioavailability-adjusted benchmark are present at the site (Asterales, Capparales, Cyperales, Pinales, Solanales, and Violales). • Chemical forms were lead chloride, lead nitrate, or artificial runoff solution. • Bioavailability adjustments (such as pH, percent OC, percent clay, and eCEC) were included in the bioavailability-adjusted benchmark. • Endpoints included photosynthesis and yield (roots, shoots, and total plant).	ARCHE, 2020; Appendix D

Table 4-6. Reliability and Relevance Review for Soil Benchmarks for Terrestrial Plants and Soil Invertebrates

Benchmark Type	COPC	Qualities that Inform Reliability	Qualities that Inform Relevance	Location of Additional Discussion and/or Documentation
Terrestrial Plants LOE 1 (continued)				
Bioavailability-adjusted Benchmark	Molybdenum	• Developed by ARCHE Consulting using soil data sets developed for the European REACH dossiers and is analogous to EPA's approach to calculating hardness-based ambient water quality criteria. • Two studies, using a total of five species. • Fifth percentile of the species sensitivity distribution of EC20s. • Reliability and relevance criteria for selection of terrestrial ecotoxicity data are clearly defined.	• Of the plants species used in the development of the bioavailability-adjusted benchmark, none are present at the site. However, all four plant orders used in the development of the bioavailability-adjusted benchmark are present at the site (Asterales, Capparales, Cyperales, and Fabales). • Bioavailability adjustments (such as pH, percent OC, percent clay, and eCEC) were included in the bioavailability-adjusted benchmark. • Chemical form was sodium molybdate. • Endpoints included yield (roots and shoots).	ARCHE, 2020; Appendix D
	Nickel	• Developed by ARCHE Consulting using soil data sets developed for the European REACH dossiers and is analogous to EPA's approach to calculating hardness-based ambient water quality criteria. • Nine studies, using a total of 11 species of grasses and flowering plants. • Fifth percentile of the species sensitivity distribution of EC20s. • Reliability and relevance criteria for selection of terrestrial ecotoxicity data are clearly defined.	• Plant species used in the development of the bioavailability-adjusted benchmark are not present at the site. However, all seven plant orders used in the development of the bioavailability-adjusted benchmark are present at the site (Asterales, Capparales, Caryophyllales, Cyperales, Fabales, Liliales, and Solanales). • Chemical species were nickel sulfate, nickel chloride, nickel chloride hexahydrate, or nickel acetate. • Bioavailability adjustments (such as pH, percent OC, percent clay, and eCEC) were included in the bioavailability-adjusted benchmark. • Endpoints included the yield of seeds, roots, and shoots.	ARCHE, 2020; Appendix D
	Zinc	• Developed by ARCHE Consulting using soil data sets developed for the European REACH dossiers and is analogous to EPA's approach to calculating hardness-based ambient water quality criteria. • Eleven studies, using a total of 18 species of grasses, flowering plants, and root vegetables. • Fifth percentile of the species sensitivity distribution of EC20s. • Reliability and relevance criteria for selection of terrestrial ecotoxicity data are clearly defined.	• Plant species used in the development of the bioavailability-adjusted benchmark are not present at the site. However, one species with the same genus (Trifolium) is present at the Site. All seven plant orders used in the development of the bioavailability-adjusted benchmark are present at the site (Asterales, Capparales, Caryophyllales, Cyperales, Fabales, Liliales, and Solanles). • Chemical forms are zinc sulfate, zinc sulfate heptahydrate, zinc sulfate hydrate, zinc nitrate hexahydrate, zinc chloride, or zinc acetate. • Bioavailability adjustments (such as pH, percent OC, percent clay, and eCEC) were included in the bioavailability-adjusted benchmark. • Endpoints included first bloom and yield of seeds, roots, and shoots.	ARCHE, 2020; Appendix D
Terrestrial Invertebrates LOE 1				
Eco-SSL or SSL	Aluminum	• Developed by EPA in accordance with EPA Eco-SSL guidance (EPA, 2005a). • Alternative approach of screening measured soil pH<5.5 used, as total aluminum concentrations are not reliably predictive of toxicity and bioaccumulation.	• Methodology is irrespective of species, bioavailability, chemical form, and endpoint.	EPA, 2003a
	Arsenic	• Developed by TAI using methodology similar to Eco-SSL guidance (EPA, 2005a). Toxicity data identified from Eco-SSL documents and via literature search; studies reviewed and scored as per Eco-SSL acceptance criteria; only studies with a score of 10 or greater were used to derive the SSL (Eco-SSL requires a score of 11 or greater); SSL derived using a minimum of two data points (Eco-SSL requires a minimum of three); and selected SSL is the lowest of the data points. • Two studies. • Lowest EC20.	• Tested species were oligochaete (*Eisenia andrei)* and springtail (*Folsomia candida*). Closely related species likely present in the Terrestrial Study Area. • High bioavailability conditions (scores = 2). • Chemical form was sodium arsenate. • Reproduction endpoint.	Appendix D
	Barium	• Developed by EPA in accordance with EPA Eco-SSL guidance (EPA, 2005a). • Three studies. • Geometric mean of EC20.	• Tested species were potworm (*Enchytraeus crypticus*), springtail (*Folsomia candida*), and earthworm (*Eisenia fetida*). Closely related species likely present in the Terrestrial Study Area. • High/very high bioavailability conditions (scores = 2). • Reproduction endpoint.	EPA, 2005e
	Chromium	• Developed by TAI using methodology similar to Eco-SSL guidance (EPA, 2005a). Toxicity data identified from Eco-SSL documents and via literature search; studies reviewed and scored as per Eco-SSL acceptance criteria; only studies with a score of 10 or greater were used to derive the SSL (Eco-SSL requires a score of 11 or greater); SSL derived using a minimum of two data points (Eco-SSL requires a minimum of three); and selected SSL is the lowest of the data points. • Two studies. • MATC.	• Tested species: oligochaete (*Eisenia andrei*). Closely related species likely present in the Terrestrial Study Area. • Medium bioavailability conditions (score = 1). • Chemical form was chromium (III) nitrate. • Reproduction endpoint.	Appendix D
	Cobalt	• Developed by TAI using methodology similar to Eco-SSL guidance (EPA, 2005a). Toxicity data extracted from ARCHE threshold calculator (v.2; 2018). • Four studies. • Geometric mean of EC20.	• Tested species was springtail (*Folsomia candida*). Closely related species likely present in the Terrestrial Study Area. • High/very high bioavailability conditions (scores = 2). • Chemical form was cobalt chloride. • Reproduction endpoint.	Appendix D
	Copper	• Developed by EPA in accordance with EPA Eco-SSL guidance (EPA, 2005a). • Ten studies. • Geometric mean of EC10 and MATC.	• Tested species were springtail (*Folsomia fimetario*), earthworm (*Eisenia andrei*, *Lumbricus rubellus*, *Aporrectodea caliginosa*, *Allolobophora chlorotica*), and nematode. Closely related species likely present in the Terrestrial Study Area. • High/very high bioavailability conditions (scores = 2). • Reproduction, population, and growth endpoints.	EPA, 2007d

Table 4-6. Reliability and Relevance Review for Soil Benchmarks for Terrestrial Plants and Soil Invertebrates

Benchmark Type	COPC	Qualities that Inform Reliability	Qualities that Inform Relevance	Location of Additional Discussion and/or Documentation
Terrestrial Invertebrates LOE 1 (continued)				
Eco-SSL or SSL	Iron	• Developed by EPA in accordance with EPA Eco-SSL guidance (EPA, 2005a). • Alternative approach recommended by EPA of concurrent site-specific field measurement of pH and Eh to approximate valence state and associated bioavailability and toxicity.	• Based on plant toxicity data.	EPA, 2003c
	Manganese	• Developed by EPA in accordance with EPA Eco-SSL guidance (EPA, 2005a). • Three studies. • Geometric mean of EC20.	• Tested species were potworm (*Enchytraeus crypticus*), springtail (*Folsomia candida*), and earthworm (*Eisenia fetida*). Closely related species likely present in the Terrestrial Study Area. • High/very high bioavailability conditions (scores = 2). • Reproduction endpoint.	EPA, 2007e
	Molybdenum	• Developed by TAI using methodology similar to Eco-SSL guidance (EPA, 2005a). Toxicity data extracted from ARCHE threshold calculator (v.2; 2018). • Eight studies. • Geometric mean of EC20.	• Tested species were oligochaetes (*Eisenia andrei* and *Enchytraeus cryticus*). Closely related species likely present in the Terrestrial Study Area. • High/very high bioavailability conditions (scores = 2). • Chemical form was sodium molybdate. • Reproduction endpoint.	Appendix D
	Silver	• Developed by TAI using methodology similar to Eco-SSL guidance (EPA, 2005a). Toxicity data identified from Eco-SSL documents and via literature search; studies reviewed and scored as per Eco-SSL acceptance criteria; only studies with a score of 10 or greater were used to derive the SSL (Eco-SSL requires a score of 11 or greater). • Four studies. • Geometric mean of EC20 and EC10.	• Tested species were springtail (*Folsomia candida*) and oligochaete (*Eisenia andrei*). Closely related species likely present in the Terrestrial Study Area. • High/very high bioavailability conditions (scores = 2). • Chemical form was silver nitrate. • Reproduction endpoint.	Appendix D
	Thallium	• Developed by TAI using methodology similar to Eco-SSL guidance (EPA, 2005a). Toxicity data identified from Eco-SSL documents and via literature search; studies reviewed and scored as per Eco-SSL acceptance criteria; only studies with a score of 10 or greater were used to derive the SSL (Eco-SSL requires a score of 11 or greater). • Five studies. • Geometric mean of MATC.	• Tested species were earthworm (*Eisenia fetida*) and land snail (*Arianta arbustorum*). Closely related species likely present in the Terrestrial Study Area. • Medium bioavailability conditions (score = 1). • Chemical form was thallium carbonate. • Reproduction, growth, and mortality endpoints.	Appendix D
	Vanadium	• Developed by TAI using methodology similar to Eco-SSL guidance (EPA, 2005a). Toxicity data identified from Eco-SSL documents and via literature search; studies reviewed and scored as per Eco-SSL acceptance criteria; only studies with a score of 10 or greater were used to derive the SSL (Eco-SSL requires a score of 11 or greater); and SSL derived using a minimum of 1 data point (Eco-SSL requires a minimum of 3). • One study. • MATC. • Study data (unpublished and not available for review) was used by Environment Canada to derive their soil quality guideline for vanadium.	• Tested species was earthworm (*Eisenia fetida*). Closely related species likely present in the Terrestrial Study Area. • Medium bioavailability conditions (score = 1). • Chemical form was vanadium pentoxide. • Mortality endpoint.	Appendix D
	Zinc	• Developed by EPA in accordance with EPA Eco-SSL guidance (EPA, 2005a). • Six studies. • Geometric mean of EC10 and MATC.	• Tested species were springtail (*Folsomia candida*) and nematode. Closely related species likely present in the Terrestrial Study Area. • High/very high bioavailability conditions (scores = 2). • Reproduction and population endpoints.	EPA, 2007h
Bioavailability-adjusted Benchmark	Cobalt	• Developed by ARCHE Consulting using soil data sets developed for the European REACH dossiers, and is analogous to EPA's approach to calculating hardness-based ambient water quality criteria. • Four studies, using a total of four species of oligochaete worms and springtails. • Fifth percentile of the species sensitivity distribution of EC20s. • Reliability and relevance criteria for selection of terrestrial ecotoxicity data are clearly defined.	• Three species of oligochaetes and one species of springtail were used in the development of the bioavailability-adjusted benchmark; closely related species likely present in the Terrestrial Study Area. • Chemical form was cobalt sulfate and cobalt (II) chloride hexahydrate. • Bioavailability adjustments (such as pH, percent OC, percent clay, and eCEC) were included in the bioavailability-adjusted benchmark. • All four studies used reproduction endpoints.	ARCHE, 2020; Appendix D

Table 4-6. Reliability and Relevance Review for Soil Benchmarks for Terrestrial Plants and Soil Invertebrates

Benchmark Type	COPC	Qualities that Inform Reliability	Qualities that Inform Relevance	Location of Additional Discussion and/or Documentation
Terrestrial Invertebrates LOE 1 (continued)				
Bioavailability-adjusted Benchmark	Copper	• Developed by ARCHE Consulting using soil data sets developed for the European REACH dossiers, and is analogous to EPA's approach to calculating hardness-based ambient water quality criteria. • Twenty one studies, using a total of 14 species of oligochaete worms, springtails, mites, and nematodes. • Fifth percentile of the species sensitivity distribution of EC20s. • Reliability and relevance criteria for selection of terrestrial ecotoxicity data are clearly defined.	• Oligochaetes, springtails, mites, and nematodes were used in the development of the bioavailability-adjusted benchmark, closely related species likely present in the Terrestrial Study Area. • Chemical forms were copper chloride, copper chloride hydrate, copper sulfate, or copper nitrate trihydrate. • Bioavailability adjustments (such as pH, percent OC, percent clay, and eCEC) were included in the bioavailability-adjusted benchmark. • Endpoints included growth, reproduction, mortality, and litter breakdown.	ARCHE, 2020; Appendix D
	Molybdenum	• Developed by ARCHE Consulting using soil data sets developed for the European REACH dossiers, and is analogous to EPA's approach to calculating hardness-based ambient water quality criteria. • One study, using a total of three species of oligochaete worms and springtail. • Fifth percentile of the species sensitivity distribution of EC20s. • Reliability and relevance criteria for selection of terrestrial ecotoxicity data are clearly defined.	• Two species of oligochaetes and one species of springtail were used in the development of the bioavailability-adjusted benchmark. Closely related species likely present in the Terrestrial Study Area. • Chemical form was sodium molybdate. • Bioavailability adjustments (such as pH, percent OC, percent clay, and eCEC) were included in the bioavailability-adjusted benchmark. • Reproduction endpoint used in study.	ARCHE, 2020; Appendix D
	Zinc	• Developed by ARCHE consulting using soil data sets developed for the European REACH dossiers, and is analogous to EPA's approach to calculating hardness-based ambient water quality criteria. • Seventeen studies, using a total of nine species of oligochaete worms and springtails. • Fifth percentile of the species sensitivity distribution of EC20s. • Reliability and relevance criteria for selection of terrestrial ecotoxicity data are clearly defined.	• Oligochaetes and springtails were used in the development of the bioavailability-adjusted benchmark. Closely related species likely present in the Terrestrial Study Area. • Chemical forms were zinc chloride, zinc sulfate, zinc nitrate, or zinc nitrate hexahydrate. • Bioavailability adjustments (such as pH, percent OC, percent clay, and eCEC) were included in the bioavailability-adjusted benchmark. • Endpoints included growth and reproduction.	ARCHE, 2020; Appendix D

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Notes:

Red italics - SSL not used to make risk conclusions because a BAB benchmark is available for this COPC.

< = less than

BAB = bioavailability-adjusted benchmark

COPC = chemical of potential concern

EC10 = concentration that causes a 10 percent effect

EC20 = concentration that causes a 20 percent effect

eCEC = effective cation exchange capacity

Eco-SSL = ecological soil screening level

LOE = line of evidence

MATC = maximum acceptable toxicant concentration

OC = organic carbon

REACH = Registration, Evaluation, Authorisation and Restriction of Chemicals; Regulation EC No 1907/2006

SSL = soil screening level

TAI = Teck American Incorporated

UCR = Upper Columbia River

Table 4-7. Dietary TRVs for Wildlife

Receptor	Analyte	COPC/COI	Growth TRV (mg/kg bw/day)	Growth TRV Type	Growth Species	Growth Citation	Reproduction TRV (mg/kg bw/day)	Reproduction TRV Type	Reproduction Species	Reproduction Citation	Survival TRV (mg/kg bw/day)	Survival TRV Type	Survival Species	Survival Citation	Notes/Documentation
Bird TRVs															
Birds (general)	Aluminum	COI	**150**	ED20	Chicken	Capdevielle and Scanes, 1995a	None	NA	NA	NA	560	LOAEL ≥ 20	Chicken	Capdevielle and Scanes, 1995a	No toxicity data for reproduction (Appendix E2, Table E2-2)
	Antimony	COI	None	NA	NA	NA	None	NA	NA	NA	None	NA	NA	NA	No toxicity data for any endpoint
	Barium	COI	**480**	ED20	Chicken	Johnson et al., 1960	None	NA	NA	NA	890	LOAEL ≥ 20	44	Johnson et al., 1960	No toxicity data for reproduction (Appendix E2, Table E2-4
	Beryllium	COI	None	NA	NA	NA	None	NA	NA	NA	None	NA	NA	NA	No toxicity data for any endpoint
	Cadmium	COPC	**2.0**	ED20	Chicken	Bokort et al., 1995b	2.3	ED20	Chicken	Leach et al., 1979	7.4	ED20	Japanese quail	Bokort et al., 1995a; Olgun, 2015	Appendix E1, Table 4-1
	Chromium (III)	COPC	**510**	LOAEL ≥ 20	Chicken	Chung et al., 1985	None	NA	NA	NA	None	NA	NA	NA	Appendix E2, Table E2-5
	Copper	COPC	62	ED20	Chicken	Poupoulis and Jensen, 1976; Wang et al., 1987	**28**	ED20	Chicken	Various	67	ED20	Chicken	Mehring et al., 1960	Appendix E1, Table 4-2
	Iron	COI	**160**	LOAEL ≥ 20	Chicken	McGhee et al., 1965	None	NA	NA	NA	1100	ED20	Chicken	Pescatore and Harter-Dennis, 1989; Wallner-Pendleton et al., 1986	Appendix E2, Table E2-6
	Lead	COPC	29	LOAEL ≥ 20	Chicken	Abduljaleel and Shuhaimi-Othman, 2013	**4.7**	Geometric mean	Japanese quail	Edens and Garlich, 1983; Stone and Soares, 1976	11	ED20	Pigeon	Anders et al., 1982; Barthlamus et al., 1977	Appendix E1, Table 4-3
	Methylmercury	COI	0.97	ED20	Chicken	Scott et al., 1975	**0.012**	ED20	Zebra finch	Varian-Ramos et al., 2014	0.051	LOAEL ≥ 20	Zebra finch	Varian-Ramos et al., 2014	Appendix E2, Table E2-7
	Molybdenum	COI	100	ED20	Chicken	Davies et al., 1960	**36**	ED20	Chicken	Lepore and Miller, 1965	610	ED20	Chicken	Davies et al., 1960	Appendix E2, Table E2-8
	Selenium	COPC	**0.29**	Eco-SSL			0.55	ED20	Chicken	Ort and Latshaw, 1978	0.59	LOAEL ≥ 20	Chicken	Arnold et al., 1973	Appendix E2, Table E2-9
	Thallium	COI	None	NA	NA	NA	None	NA	NA	NA	None	NA	NA	NA	Lacking in toxicity data (Appendix E)
	Vanadium	COPC	**1.2**	ED20	Chicken	Berg and Lawrence, 1971	2.1	LOAEL ≥ 20	Chicken	Toussant and Latshaw, 1994	2.4	ED20	Chicken	Blalock and Hill, 1987	Appendix E2, Table E2-11
	Zinc	COPC	**66**	Eco-SSL			77	ED20	Chicken	Gibson et al., 1986	250	LOAEL ≥ 20	Chicken	Roberson Schaible, 1960	Appendix E1, Table 4-5
Kestrel-specific	Methylmercury	COI	None	NA			**0.25**	ED20	Kestrel	Albers et al., 2007	None	NA	NA	NA	Appendix E2, Table E2-7
Mammal TRVs															
Mammals (general)	Aluminum	COI	400	LOAEL ≥ 20	Mouse	Belles et al., 1999	**27**	ED20	Rat	Paternain et al., 1999	400	LOAEL ≥ 20	Mouse	Belles et al., 1999	Appendix E2, E2-2
	Antimony	COPC	None	NA	NA	NA	None	NA	NA	NA	None	NA	NA	NA	Appendix E2, Table E2-3
	Cadmium	COPC	4.2	ED20	Rat	Wilson et al., 1941	2.7	ED20	Rat	Sutou et al., 1980	**1.5**	ED20	Vole	Swiergosz et al., 1998	Appendix E1, Table 4-1
	Chromium (III)	COPC	110	LOAEL ≥ 20	Rat	Bataineh et al., 1997	**91**	LOAEL ≥ 20	Mouse	Elbetieha and Al-Hamood, 1997	None	NA	NA	NA	Appendix E2, Table E2-5
	Copper	COPC	12	ED20	Pig	Allcroft et al., 1961	27	LOAEL ≥ 20	Mink	Aulerich et al., 1982	**8.7**	Geometric mean	Pig	Allcroft et al., 1961; Richie et al., 1963	Appendix E1, Table 4-2
	Iron	COI	**140**	Geometric mean	Rat	Banis et al., 1969; Storey and Greger, 1987	None	NA	NA	NA	870	ED20	Rat	Whittaker et al., 1996	Appendix E2, Table E2-6
	Lead	COPC	20	LOAEL ≥ 20	Rabbit	Lorenzo et al., 1978	**4.7**	Eco-SSL	NA	NA	7.6	ED20	Rabbit	Lorenzo et al., 1978	Appendix E1, Table 4-3
	Methylmercury	COI	0.65	LOAEL ≥ 20	Rat	Mitsumori et al., 1983	**0.23**	LOAEL ≥ 20	Rat	Verschuuren et al., 1976a	0.24	ED20	Rat	Mitsumori et al., 1983; Verschuuren et al., 1976b	Appendix E2, E2-7
	Molybdenum	COI	28	LOAEL ≥ 20	Rat	Brinkman and Miller, 1961	4.5	ED20	Rat	Fungwe et al., 1990	None	NA	NA	NA	Appendix E2, Table E2-8
	Selenium	COPC	0.33	ED20	Pug	Mahan and Moxon, 1984	5	LOAEL ≥ 20	Mouse	Seidenberg et al., 1986	0.61	LOAEL ≥ 20	Rat	McAdam and Levander, 1987	Appendix E2, Table E2-9
	Thallium	COI	2.6	ED20			None	NA			2.1	ED20			Appendix E
	Zinc	COPC	**75**	Eco-SSL			75	Eco-SSL			190	Geometric mean			TAI, 2019d
Wolf-specific	Cadmium	COPC	100	LOAEL ≥ 20			None	NA			None	NA			Appendix E

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Table 4-8. Dose-Response Models for Wildlife

COPC/COI	Receptor Group	Endpoint	Final Selected TRV (mg/kg bw/day)	Final TRV Basis	Dose-Response Model	Dose-Response Model Parameters [a]			Dose-Response Effect Values [a]		
						X50	s	y0	ED20 (mg/kg bw/day)	ED50 (mg/kg bw/day)	ED80 (mg/kg bw/day)
Aluminum	Bird	Growth	150	ED20	Threshold-sigmoid	2.752	0.64881	610	150	560	2100
Aluminum	Mammal	Reproduction	27	ED20	Threshold-sigmoid	2.0311	0.61703	3.2678	27	110	420
Barium	Bird	Growth	480	ED20	Threshold-sigmoid	2.9533	1.36	433	480	900	1700
Cadmium	Bird	Growth	2	ED20	Threshold-sigmoid	0.96588	0.551	1.48	2.0	9.2	43
Cadmium	Bird	Reproduction	2.3	ED20	Threshold-sigmoid	1.0222	0.564	66.6	2.3	11	47
Cadmium	Bird	Survival	7.4	ED20	Threshold-sigmoid	1.3431	0.777	102	7.4	22	65
Cadmium	Mammal	Growth	4.2	ED20	Threshold-sigmoid	1.25	0.585	0.199	4.2	18	76
Cadmium	Mammal	Reproduction	2.7	ED20	Threshold-sigmoid	1.0215	0.623	14	2.7	11	41
Cadmium	Mammal	Survival	1.5	ED20	Gaussian-log	1.032	1.01	0.87155	1.5	11	76
Copper	Bird	Growth	62	ED20	Threshold-sigmoid	2.0187	1.61	100	62	100	180
Copper	Bird	Reproduction	28	ED20	Threshold-sigmoid	1.624	2.09	102.09	28	42	63
Copper	Bird	Survival	67	ED20	gaussian-log	2.0245	0.239	0.96229	67	110	170
Copper	Mammal	Growth	12	ED20	Threshold-sigmoid	1.1682	3.45	1.24	12	15	19
Iron	Bird	Survival	1100	ED20	Threshold-sigmoid	3.2886	1.49	99.5	1100	1900	3400
Iron	Mammal	Survival	870	ED20	Gaussian-log	3.9108	1.1537	0.9999	870	8100	76000
Lead	Bird	Survival	11	ED20	Threshold-sigmoid	1.4101	1.0403	99.58	11	26	58
Lead	Mammal	Survival	7.6	ED20	Gaussian-log	1.0683	0.22	0.82602	7.6	12	18
Methylmercury	Bird	Growth	0.97	ED20	Threshold-sigmoid	0.3518	1.002	1.664	0.97	2.2	5.2
Methylmercury	Bird	Reproduction	0.012	ED20	Threshold-sigmoid	-0.53774	0.26716	13.025	0.012	0.29	6.9
Methylmercury	Kestrel	Reproduction	0.25	ED20	Threshold-sigmoid	-0.46109	2.4701	1.9651	0.25	0.35	0.49
Methylmercury	Mammal	Survival	0.24	ED20	Threshold-sigmoid	-0.34567	1.3454	94.426	0.24	0.45	0.85
Molybdenum	Bird	Growth	100	ED20	Threshold-sigmoid	2.4528	0.818	98.8	100	280	800
Molybdenum	Bird	Reproduction	36	ED20	Threshold-sigmoid	1.8122	1.42	15.6	36	65	120
Molybdenum	Bird	Survival	610	ED20	Gaussian-log	2.9093	0.15	0.97147	610	810	1100
Molybdenum	Mammal	Reproduction	4.5	ED20	Threshold-sigmoid	1.8206	0.31401	50.852	4.5	66	980
Selenium[b]	Bird	Growth	0.29	Eco-SSL	Threshold-sigmoid	0.14871	0.52361	101.04	0.28	1.4	7.1
Selenium	Bird	Reproduction	0.55	ED20	Threshold-sigmoid	0.010778	1.3706	92.077	0.55	1	1.9
Selenium	Mammal	Growth	0.33	ED20	Threshold-sigmoid	-0.080362	0.92942	19.152	0.33	0.83	2.1
Thallium	Mammal	Growth	2.6	ED20	Threshold-sigmoid	0.61471	1.89	94.9	2.6	4.1	6.4
Thallium	Mammal	Survival	2.1	ED20	Threshold-sigmoid	0.44655	2.7753	104	2.1	2.8	3.8
Vanadium	Bird	Growth	1.2	ED20	Threshold-sigmoid	0.40122	1.14	126	1.2	2.5	5.3
Vanadium	Bird	Survival	2.4	ED20	Gaussian-log	0.5004	0.14567	0.97473	2.4	3.2	4.2
Zinc	Bird	Reproduction	77	ED20	Threshold-sigmoid	2.0517	2.23	6.418	77	110	160

[a] Calculated ED20, ED50, and ED80 values are rounded to two significant digits, consistent with the toxicity reference values (TRVs) and the level of precision in the underlying toxicity data. Dose-response model parameters are not rounded, allowing for increased accuracy in the calculation of the sample-specific EDx values (which are then rounded to two significant digits after calculation).

[b] Dose-response data were evaluated for selenium but the ecological soil screening level (Eco-SSL) was selected for the final TRV because the Eco-SSL is higher than the ED20 (0.28 mg/kg bw/day).

Equations:

gausian-log: $Y = Y_0\,(1 - F_s \int_{-\infty}^{z^x} f(z_x)dz_x)\ where\ z_x = \frac{x - x_p}{\sigma} + z_p$

threshold-sigmoid:

$$Y = Y_0 \quad X < X_0$$
$$Y = Y_0\,(1 - \tfrac{1}{2}(\sqrt{2p} + s(X - X_p))^2) \quad X_0 < X < X_{50}$$
$$Y = Y_0\,(\tfrac{1}{2}(\sqrt{2(1-p} - S(X - X_p))^2) \quad X_{50} < X < X_{100}$$
$$Y = 0 \quad X > X_{100}$$

Dose-Response Model Parameters from EPA's TRAP version 1.30a:

X50 - is X level which gives a response half way between 0 and y0

s - slope at inflection point

y0 - higher asymptote

Notes

COPC = chemical of potential concern

COI = chemical of interest

EDx = effective dose with an x percent reduction in the response relative to the control (modeled)

ED20 = effective dose with 20 percent reduction in the response relative to the control

ED50 = effective dose with 50 percent reduction in the response relative to the control

ED80 = effective dose with 80 percent reduction in the response relative to the control

EPA = U.S. Environmental Protection Agency

mg/kg bw/day = milligrams of metal per kilogram of body weight per day

Table 4-9. Reliability and Relevance Review for Bird Dietary TRVs

COPC	Endpoint	Qualities that Inform Reliability	Qualities that Inform Relevance	Location of Additional Discussion and/or Documentation
Birds (General)				
Aluminum	Survival	•Represents a chicken LOAEL ≥ 20 based on a single data set (25 percent reduction in response relative to the control) (Capdevielle and Scanes, 1995a). •One data set (Tier 1) was available for one species. • BW and FIR estimated from other sources.	• Study species (chicken) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was aluminum sulfate, a soluble form of aluminum. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	Appendix E
	Growth	• Represents a chicken ED20 from a single data set (Capdevielle and Scanes (1995a) •. Four data sets (Tier 1) were available for two species. • BW and FIR estimated from other sources.	• Studies species (chicken and mallard) are not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was aluminum sulfate, a soluble form of aluminum. • TRV studies were conducted during a critical life stage. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	
Barium	Survival	• Represents a chicken LOAEL ≥ 20 (56 and 68 percent reduction in response relative to the control) (Johnson et al., 1960). •Two data sets (Tier 1) were available for one species (chicken). • BW and FIR estimated from other sources.	• Studies species (chicken) not present in the Terrestrial Study Area; closely related species likely are. • Chemical forms were barium hydroxide and barium acetate. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	Appendix E
	Growth	• Two data sets (Tier 1) were available for one species. • Represents an ED20 calculated from a single data set. • BW and FIR estimated from other sources.	• Studies species (chicken) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was barium acetate. • Exposure route were dietary, and dose was calculated based on estimated FIRs and BWs.	
Cadmium (Appendix E1, Table 4-1)	Survival	• Represents a Japanese quail ED20 calculated from two pooled data sets . •.Five data sets (Tier 1) were available for three species • BW measured in one study and estimated from secondary source for the other study. FIR estimated from secondary source for both studies.	• Studies species (chicken, Japanese quail, and Pekin duck) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was cadmium sulfate, a soluble form of cadmium. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	TAI, 2019d
	Growth	•Represents a chicken ED20 based on a single data set (30 percent reduction in response relative to control). • Eleven data sets (10 Tier 1 and one Tier 2) were available for three species. • BW measured in study, FIR estimated from secondary source.	• Studies species (chicken, mallard, and Japanese quail) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was cadmium sulfate, a soluble form of cadmium. • TRV studies conducted during a critical life stage. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	
	Reproduction	• Represents a chicken ED20 calculated from a single data set (25 percent reduction in response relative to control). • Five data sets (Tier 1) were available for three species. • BW and FIR estimated from secondary source. • Effect is based on egg production endpoint.	• Studies species (chicken, mallard, and Japanese quail) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was cadmium sulfate, a soluble form of cadmium. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	
Chromium (III)	Growth	• Represents a chicken LOAEL ≥ 20 calculated from a single data set (43 percent reduction in response relative to the control). • One data set (Tier 1) was available for one species. • BW and FIR estimated from secondary source.	• Study species (chicken) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was chromium (III) sulfate, a soluble form of chromium. • TRV study conducted during critical life stage. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	Appendix E
Copper	Survival	• Represents a chicken ED20 calculated from a single data set. • Seven data sets (Tier 1) were available for three species. • BW measured in study and FIR obtained from secondary source.	• Studies species (chicken, Pekin duck, and turkey) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was copper oxide, which is less soluble than the other form of copper tested (copper sulfate). • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	TAI, 2019d
	Growth	• Represents a chicken ED20 generated from three pooled Tier I data sets all with LOAEL ≥ 20. • Twelve data sets (Tier 1) with LOAEL ≥20 were available for one species (chicken). • BW and FIR estimated from secondary source.	• Studies species (chicken and turkey) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was copper sulfate in the pooled data set representing the ED20, a soluble form of copper. • TRV studies conducted during critical life stage. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	
	Reproduction	• Represents a chicken ED20 generated from five pooled Tier I data sets all with LOAEL ≥ 20. • Thirteen data sets (Tier 1) were available for one species. • BW and FIR derived from studies and estimated from secondary sources. • Effect is based on egg production endpoint.	• Studies species (chicken) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was copper sulfate, a soluble form of copper. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	

Table 4-9. Reliability and Relevance Review for Bird Dietary TRVs

COPC	Endpoint	Qualities that Inform Reliability	Qualities that Inform Relevance	Location of Additional Discussion and/or Documentation
Birds (General) (continued)				
Iron	Survival	• Represents a chicken ED20 generated from two pooled Tier 1 data sets both with LOAEL ≥ 20. • Two data sets (Tier 1) were available for one species. • BW and FIR derived from studies and estimated from secondary sources. • Effect is based on survival	• Studies species (chicken) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was iron sulfate, a soluble form of iron. • Exposure route was gavage, and dose was calculated based on estimated FIRs and BWs.	Appendix E
	Growth	• Represents a chicken LOAEL ≥ 20 calculated from a single data set (24 percent reduction in response relative to the control). • One single dose data set (Tier 1) was available for one species (chicken). • BW estimated from study and secondary source and FIR estimated from secondary source.	• Study species (chicken) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was iron sulfate, a soluble form of iron. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	
Lead	Survival	• Represents a pigeon ED20 generated from the geomean of two pooled Tier 1 data sets . • Two data sets (Tier 1) were available for two species. • Doses reported in paper rather than calculated from BW and FIR.	• Studies species (chicken and pigeon) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was lead acetate, a soluble form of lead. • Exposure route in TRV studies was gavage.	TAI, 2019d
	Growth	•Represents a chicken LOAEL ≥ 20 (20% reduction in chicken growth relative to the control) (21 percent reduction in response relative to control) • Twelve data sets (Tier 1) were available for two species • BW and FIR estimated from secondary source. • Effect is based on body weight	• Studies species (chicken and Japanese quail) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was lead nitrate, a soluble form of lead. • TRV studies conducted during critical lifestage. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	
	Reproduction	• Represents the geometric mean of LOAELs from three pooled data sets (two studies) all with LOAEL ≥ 20 (21-59 percent reduction in response relative to the control). • High variability in the three data sets. • Eight data sets (Tier 1) were available for two species (chicken and Japanese quail). • BW and FIR estimated from secondary source. • Effect is based on egg production endpoint, which has high variability and uncertainty in Japanese quail (Sample et al., 2019).	• Studies species (chicken and Japanese quail) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was lead acetate, a soluble form of lead. • Exposure route was dietary and dose was calculated based on estimated FIRs and BWs. • Effect level is a LOAEL	
Methylmercury	Survival	• Represents a finch LOAEL ≥ 20 (23 and 24 percent reduction in response relative to the control. • Nine data sets (Tier 1) were available for four species (Kestrel, quail, chicken and finch). • BW and FIR estimated from secondary source. • Effect level based on survival in F0 and F1 generation hatchlings to adults exposed from < 1 week to 1 year.	• Two study species (chicken, zebra finch and Japanese quail) not present in the Terrestrial Study Area; closely related species likely are (i.e. California quail); the other studies species (American kestrel) is a receptor for the Terrestrial Study Area. • Chemical form was methylmercury cysteine, the most toxic form. However, methylmercury is not directly relevant to the total mercury measured in the abiotic and biotic chemistry data sets used to calculate EPCs. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	Appendix E
	Growth	• Represents a chicken ED20 calculated from a single Tier 2 data set. • Only one data set (Tier 2) was available for one species. • BW and FIR estimated from secondary source. •Effect is based on body weight	• Study species (chicken) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was methylmercury chloride, the most toxic form. However, methylmercury is not directly relevant to the total mercury measured in the abiotic and biotic chemistry data sets used to calculate EPCs. • TRV study conducted during non-critical lifestage, <10 percent of lifespan. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	
	Reproduction	• Represents a finch ED20 calculated from one Tier 1 data sets. • Twenty one data sets (Tier 1) were available for five species. • BW and FIR estimated from secondary source. • Effect measure F1 number of offspring, although exposure duration unclear.	• Four study species (chicken, mallard, zebra finch, and Japanese quail) not present in the Terrestrial Study Area; closely related species likely are; the other eight study species (American kestrel) is a receptor for the Terrestrial Study Area. • Chemical form was methylmercury cysteine, the most toxic form. However, methylmercury is not directly relevant to the total mercury measured in the abiotic and biotic chemistry data sets used to calculate EPCs. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	
Molybdenum	Survival	• Represents an chicken ED20 calculated from a single Tier 1 data set. • Only one data set (Tier 1) was available for one species (chicken). • BW and FIR estimated from secondary source.	• Study species (chicken) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was sodium molybdate, a soluble form of molybdenum. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	Appendix E
	Growth	• Represents a chicken ED20 based on two pooled Tier I data sets LOAELs ≥ 20. • Three data sets (Tier 1) were available for two species (chicken and bobwhite quail). • BW and FIR estimated from secondary source.	• Two study species (chicken and bobwhite quail) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was sodium molybdate, a soluble form of molybdenum. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	
	Reproduction	• Represents a chicken ED20 calculated from a single Tier I data set. • Only one data set (Tier 1) was available for one species. • BW and FIR estimated from secondary source.	• Study species (chicken) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was sodium molybdate, a soluble form of molybdenum. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	

Table 4-9. Reliability and Relevance Review for Bird Dietary TRVs

COPC	Endpoint	Qualities that Inform Reliability	Qualities that Inform Relevance	Location of Additional Discussion and/or Documentation
Birds (General) (continued)				
Selenium	Survival	• Represents a chicken LOAEL ≥ 20 calculated from a single Tier I data set (35 percent reduction in response relative to the control). •Seven data sets (Tier 1) were available for three species. • BW measured in study and FIR estimated from secondary source.	• Studies species (chicken, mallard, and Japanese quail) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was sodium selenite, a soluble form of selenium. • Study conducted on a critical lifestage. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	Appendix E and EPA, 2007b
	Growth	• Selected TRV is the avian Eco-SSL TRV, which is the highest bounded NOAEL. The Eco-SSL used data from 135 data sets. • EPA estimated BW and FIR from other sources if not available in the studies used for the Eco-SSL. • Dose-response relationships were comparable among the studies.	• Six study species (chicken, mallard, Japanese quail, black-crowned night-heron, duck, and Eastern screech owl) not present in the Terrestrial Study Area; closely related species likely are; one species (American kestrel) is a receptor for the Terrestrial Study Area. • Chemical form was sodium selenite, a soluble form of selenium. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	
	Reproduction	• Represents a chicken ED20 calculated from a single data set. • Ten data sets (Tier 1) were available for three species. • BW and FIR estimated from secondary source. • Effect measurement was hatchability.	• Studies species (chicken, mallard, and eastern screech owl) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was sodium selenite, a soluble form of selenium. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	
Vanadium	Survival	• Represents a chicken ED20 calculated from a single Tier I data set. • Eight data sets (Tier 1) were available for one species. • BW and FIR estimated from secondary source.	• Studies species (chicken) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was vanadyl chloride, a soluble form of vanadium. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	Appendix E
	Growth	• Represents an chicken ED20 calculated from a single Tier I data set. • Twelve data sets (Tier 1) were available for one species. • BW and FIR estimated from secondary source.	• Studies species (chicken) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was vanadyl sulfate, a soluble form of vanadium. • TRV studies conducted during critical lifestage. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	
	Reproduction	• Represents a chicken LOAEL ≥ 20 calculated from a single data set (49 percent reduction in response relative to the control). • Four data sets (Tier 1) were available for one species. • BW and FIR estimated from secondary source. • Effect is based on egg production endpoint.	• Studies species (chicken) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was ammonium metavanadate, a soluble form of vanadium. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	
Zinc	Survival	•Represents Chicken LOAEL ≥ 20 calculated from one dataset (21 percent reduction in response relative to the control). • Seven data sets (Tier 1) were available for three species all were LOAEL ≥ 20. • BW and FIR estimated from secondary source.	• Studies species (chicken, mallard, and Japanese quail) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was zinc carbonate, an insoluble form of zinc. Other studies were conducted with zinc oxide (insoluble) and zinc acetate (soluble); these studies resulted in higher effect levels than the selected TRV. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	TAI, 2019d; EPA, 2007b
	Growth	• Selected TRV is the avian Eco-SSL TRV, which is the geometric mean of 34 NOAELs for growth and 9 NOAELs for reproduction. The Eco-SSL used data from 68 data sets. • The Eco-SSL (66 mg/kg bw/day) is greater than the ED20 (43 mg/kg bw/day). The EPA estimated BW and FIR from other sources if not available in the studies used for the Eco-SSL.	• Studies species (chicken, turkey, mallard duck, and Japanese quail) are not present in the Terrestrial Study Area; closely related species likely are. • Chemical forms in the studies used to derive the TRV were zinc carbonate (insoluble), zinc oxide (insoluble), and zinc acetate (soluble). • Exposure route was dietary and gavage, and dose was calculated based on estimated FIRs and BWs.	
	Reproduction	• Represents a chicken ED20 calculated from a single data set. • Eight data sets (Tier 1) were available for one species all of these data sets report LOAELs ≥ 20. • BW and FIR measured study. • Effect is based on egg production endpoint.	• Studies species (chicken) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form was zinc acetate dihrdrate, a soluble form of zinc. • Exposure route was dietary, and dose was calculated based on measured FIRs and BWs.	
Kestrel-specific				
Methylmercury	Reproduction	• Represents a Kestrel ED20 from a single data set. • Four data sets all with kestrel as the test species (Tier 1). • BW and FIR obtained from secondary sources. • Effect measure was number of eggs hatched	• American kestrel is a receptor species for the Terrestrial Study Area. • Chemical form was methylmercury chloride, the most toxic form with greatest relevance for dietary uptake and bioaccumulation. • Exposure route was dietary, and dose was calculated based on estimated FIRs and BWs.	Appendix E

Sources:

Capdevielle MC, Scanes CG. 1995a. Effect of dietary acid or aluminum on growth and growth-related hormones in young chickens. Toxicol Appl Pharmacol 133:164-171.

Johnson D, Jr, Mehring AL, Jr, Titus HW. 1960. Tolerance of chickens for barium. Proc Soc Exper Biol Med 104:436-438.

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Teck American Incorporated (TAI). 2019d. *Final Wildlife Toxicity Reference Values for the Baseline Ecological Risk Assessment: Methods and Results for Five Metals* . Prepared for TAI by Windward Environmental LLC, Seattle, WA.

U.S. Environmental Protection Agency (EPA). 2007b. *Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs): Attachment 4-1, Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs* . OSWER Directive 9285.7-55. Office of Solid Waste and Emergency Response.

Notes:

Tier 1 - Tier 1 studies meet the following criteria: dietary or gavage exposure, and growth endpoint exposure period during a critical life stage or for at least 10 percent of the species' lifespan.

Tier 2 - Tier 2 studies meet the following criteria: drinking water exposure, growth endpoint exposure period during a noncritical life stage or for less than 10 percent of the species' lifespan.

< = less than

BW = body weight

COPC = chemical of potential concern

Eco-SSL = ecological soil screening level

ED20 = effective dose with a 20% reduction in the response relative to the control

EPA = U.S. Environmental Protection Agency

EPC = exposure point concentration

FIR = food ingestion rate

LOAEL = lowest observed adverse effect level

LOAEL ≥ 20 = lowest observed adverse effect level that is also more than 20 percent different from controls

mg/kg bw/day = milligrams of metal per kilogram of body weight per day

NOAEL = no observed adverse effect level

TRV = toxicity reference value

Table 4-10. Reliability and Relevance Review for Mammal Dietary TRVs

COPC	Endpoint	Qualities that Inform Reliability	Qualities that Inform Relevance	Location of Additional Discussion and/or Documentation
Mammals (General)				
Aluminum	Survival	• One data set (Tier 1) available for one species. • LOAEL ≥ 20 selected from a single data set (56 percent reduction in response relative to the control). • Doses reported in study rather than calculated from BW and FIR.	• Study species (mice) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was aluminum nitrate nonahydrate, a soluble form of aluminum. • Chemical administration in TRV study was gavage.	Appendix E
	Growth	• Three data sets (one Tier 1 and two Tier 2) available for two species. • LOAEL ≥ 20 selected from a single data set (86 percent reduction in response relative to the control). • Doses reported in study rather than calculated from BW and FIR.	• Study species (mice and rats) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was aluminum nitrate nonahydrate, a soluble form of aluminum. • TRV study was conducted during a noncritical life stage for less than 10 percent of the species lifespan. • Chemical administration in TRV study was gavage.	
	Reproduction	• Six data sets (Tier 1) available for two species. • ED20 calculated from a single data set. • Doses reported in study rather than calculated from BW and FIR.	• Study species (mice and rats) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was aluminum nitrate nonahydrate, a soluble form of aluminum. • Chemical administration in TRV study was gavage.	
Cadmium	Survival	• Six data sets (three Tier 1 and three Tier 2) available for three species. • ED20 calculated from a single data set. • BW measured in study; FIR obtained from secondary source.	• One study species (vole) present in the Terrestrial Study Area; other study species (mice and rats) not present in the Terrestrial Study Area; closely related species likely are. • TRV study conducted on males only. • Chemical form in the TRV study was cadmium chloride, a soluble form of cadmium. • Chemical administration in the TRV study was dietary, and dose was calculated based on estimated FIRs and BWs.	TAI, 2019d
	Growth	• Nine data sets (Tier 1) available for five species. • ED20 calculated from a single data set. • Study conducted during critical lifestage. • BW measured in TRV studies; FIR obtained from secondary source.	• Two study species (shrew, dogs [wolf]) present in the Terrestrial Study Area; other study species (rats, pigs, and mice) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was cadmium chloride, a soluble form of cadmium. • Chemical administration in the TRV study was dietary, and dose was calculated based on estimated FIRs and BWs.	
	Reproduction	• Eight data sets (Tier 1) available for two species. • ED20 calculated from a single data set. • Doses reported in study rather than calculated from BW and FIR.	• Study species (mice and rats) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was cadmium chloride, a soluble form of cadmium. • Dose administration in the TRV study was gavage.	
Chromium (III)	Growth	• One data set (Tier 2) available for one species. • LOAEL ≥ 20 selected from a single data set (24 percent reduction in response relative to the control). • BW measured in TRV studies; FIR obtained from secondary source.	• Study species (rats) not present in the Terrestrial Study Area; closely related species likely are. • TRV study conducted on males only • Chemical form in the TRV study was chromium(III) chloride, a soluble form of chromium. • TRV study was conducted for more than 10 percent of species lifespan. • Chemical administration in the TRV study was drinking water.	Appendix E
	Reproduction	• Two data sets (Tier 2) available for one species. • LOAEL ≥ 20 selected from a single data set (37 percent reduction in response relative to the control). • BW measured in TRV studies; water consumption rate estimated from secondary source.	• Study species (mice) not present in the Terrestrial Study Area; closely related species likely are. • TRV study conducted on females only. • Chemical form in the TRV study was chromium(III) chloride, a soluble form of chromium. • Chemical administration in the TRV study was drinking water, and dose was calculated based on estimated FIRs and BWs.	
Copper	Survival	• Seven data sets (five Tier 1 and two Tier 2) available for four species. • Geometric mean of two pooled data sets using LOAEL ≥ 20 (25-100 percent reduction in response relative to the control). • BW measured in one of the pooled studies; FIR estimated from secondary source for both studies.	• One study species (mink) present in the Terrestrial Study Area; other study species (pigs, rats, and mice) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was copper sulfate, a soluble form of copper. • Chemical administration in the TRV study was dietary, and dose was calculated based on estimated FIRs and BWs. • TRV study was conducted with pigs without additional zinc supplementation, which has been found to ameliorate copper toxicity in pigs.	TAI, 2019d
	Growth	• Five data sets (Tier 1) available for five species. • ED20 calculated from a single data set. • BW and FIR obtained from secondary sources.	• One study species (mink) present in the Terrestrial Study Area; other study species (mice, rabbits, rats, and pigs) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was copper sulfate, a soluble form of copper. • TRV study conducted during a critical lifestage. • Chemical administration in the TRV study was dietary, and dose was calculated based on estimated FIRs and BWs. • TRV study was conducted with pigs without additional zinc supplementation, which has been found to ameliorate copper toxicity in pigs.	
	Reproduction	• Four data sets (Tier 1) available for three species. • LOAEL ≥ 20 selected from a single data set (30 percent reduction in response relative to the control). • BW measured in TRV studies; FIR obtained from secondary source.	• One study species (mink) present the in the Terrestrial Study Area; other study species (pigs, mice) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was copper sulfate, a soluble form of copper. • Chemical administration in the TRV study was dietary, and dose was calculated based on estimated FIRs and BWs.	

Table 4-10. Reliability and Relevance Review for Mammal Dietary TRVs

COPC	Endpoint	Qualities that Inform Reliability	Qualities that Inform Relevance	Location of Additional Discussion and/or Documentation
Mammals (General) (continued)				
Iron	Survival	• Two data sets (Tier 1) available for one species. • ED20 calculated from a single data set. • BW and FIR obtained from secondary sources.	• Study species (rats) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was carbonyl iron, an insoluble form of iron. Another study was conducted with iron sulfate (soluble); this study resulted in higher effect level than the selected TRV. • Chemical administration in the TRV study was dietary.	Appendix E
	Growth	• Four data sets (Tier 1) were available for one species. • Represents the geometric mean of LOAELs ≥ 20 from two pooled data sets (two studies; 21 and 23 percent reduction in response relative to control). • BW from study and secondary source and FIR estimated from secondary source. • Effect is based on BW.	• Study species (rats) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was iron sulfate, a soluble form of iron. • Chemical administration in the TRV study was dietary.	
Lead	Survival	• Five data sets (Tier 1) available for four species. • ED20 calculated from a single data set. • BW and FIR measured in the TRV studies.	• One study species (shrew) present the in the Terrestrial Study Area; other study species (mice, rabbits, and rats) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was lead nitrate, a soluble form of lead. • Chemical administration in the TRV study was dietary, and dose was calculated based on measured FIRs and BWs.	TAI, 2019d; EPA, 2005h~~7b~~
	Growth	• Four data sets (Tier 1) available for two species. • LOAEL ≥ 20 selected from a single data set (41 percent reduction in response relative to the control). • FIR and BW reported in TRV studies.	• Study species (mice, rabbits, rats, and pigs) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was lead nitrate, a soluble form of lead. • TRV study conducted during a critical lifestage. • Chemical administration in the TRV study was dietary, and dose was calculated based on measured FIRs and BWs.	
	Reproduction	• Selected TRV is the mammalian Eco-SSL TRV, which is the highest bounded NOAEL. The Eco-SSL utilized 223 available data sets. • The EPA estimated BW and FIR from other sources if not available in the studies used for the Eco-SSL.	• Study species (rat, sheep, guinea pig, hamster, mouse, horse, cattle, dog, shrew, rabbit) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was lead acetate, a soluble form of lead. • Chemical administration in the TRV study was through drinking water.	
Methylmercury	Survival	• Four data sets (Tier 1) available for one species. • ED20 calculated from four pooled data sets. • BW and FIR measured in TRV studies.	• Study species (rats) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was methylmercury chloride. Methylmercury is the most toxic form. However, methylmercury is not directly relevant to the total mercury measured in the abiotic and biotic chemistry data sets used to calculate EPCs. • Chemical administration in the TRV study was dietary, and dose was calculated based on measured FIRs and BWs.	Appendix E
	Growth	• One data set (Tier 1) available for one species. • LOAEL ≥ 20 selected from a single data set (36 percent reduction in response relative to the control). • BW and FIR measured in TRV studies.	• Study species (rats) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was methylmercury chloride. Methylmercury is the most toxic form. However, methylmercury is not directly relevant to the total mercury measured in the abiotic and biotic chemistry data sets used to calculate EPCs. • TRV study conducted during critical lifestage. • Chemical administration in the TRV study was dietary, and dose was calculated based on measured FIRs and BWs.	
	Reproduction	• Three data sets (Tier 1) available for one species. • LOAEL ≥ 20 selected from a single data set (58 percent reduction in response relative to the control). • BW measured in TRV studies; FIR obtained from secondary source.	• Study species (rats) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was methylmercury chloride. Methylmercury is the most toxic form. However, methylmercury is not directly relevant to the total mercury measured in the abiotic and biotic chemistry data sets used to calculate EPCs. • Chemical administration in the TRV study was dietary, and dose was calculated based on estimated FIRs and BWs.	
Molybdenum	Growth	• Four data sets (three Tier 1 and one Tier 2) available for one species. • LOAEL ≥ 20 selected from a single data set (54 percent reduction in response relative to the control). • BW and FIR obtained from secondary sources.	• Study species (rats) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was sodium molybdate, a soluble form of molybdenum. • TRV study conducted during a critical lifestage, on males only. • Chemical administration in the TRV study was dietary, and dose was calculated based on estimated FIRs and BWs.	Appendix E
	Reproduction	• One data set (Tier 2) available for one species. • ED20 calculated from the single data set. • BW obtained from secondary source; water ingestion rate measured in TRV studies.	• Study species (rats) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was sodium molybdate, a soluble form of molybdenum. • Chemical administration in the TRV study was drinking water, and dose was calculated based on measured FIRs and BWs.	
Selenium	Survival	• Nine data sets (Tier 1) available for four species. • LOAEL ≥ 20 selected from a single data set (62 percent reduction in response relative to the control). • BW and FIR obtained from secondary sources.	• Study species (rats, hamsters, pigs, and mice) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was D-selenomethionine, a soluble form of selenium and the most relevant to selenium food chain transfer. • Chemical administration in the TRV study was dietary, and dose was calculated based on estimated FIRs and BWs.	Appendix E
	Growth	• Eight data sets (five Tier 1 and three Tier 2) available for four species. • ED20 calculated from a single data set. • BW and FIR measured in the study.	• Study species (rats, hamsters, pigs, and mice) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was sodium selenite, a soluble form of selenium. • TRV study conducted during a critical lifestage. • Chemical administration in the TRV study was dietary, and dose was calculated based on measured FIRs and BWs.	
	Reproduction	• Two data sets (Tier 1) available for one species. • LOAEL ≥ 20 selected from a single data set (54 percent reduction in response relative to the control). • Doses reported in study rather than calculated from BW and FIR.	• Study species (mice) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was sodium selenate, a soluble form of selenium. • Chemical administration in the TRV study was gavage.	

Table 4-10. Reliability and Relevance Review for Mammal Dietary TRVs

COPC	Endpoint	Qualities that Inform Reliability	Qualities that Inform Relevance	Location of Additional Discussion and/or Documentation
Mammals (General) (continued)				
Thallium	Survival	• Two data sets (Tier 1) available for one species. • ED20 calculated from a pooled data set. • BW measured in the study and FIR obtained from secondary source.	• Study species (rats) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was thallic oxide, an insoluble form of thallium. • Chemical administration in the TRV study was dietary.	Appendix E
	Growth	• Two data sets (Tier 1) available for one species. • ED20 calculated from a pooled data set. • BW measured in the study and FIR obtained from secondary source.	• Study species (rats) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was thallic oxide, an insoluble form of thallium. • Chemical administration in the TRV study was dietary.	
Zinc	Survival	• Four data sets (Tier 1) available for two species. • Geometric mean of LOAEL ≥ 20 values sourced from three pooled data sets (25-37.5 percent reduction in response relative to the control). • BW and FIR were measured in study.	• Study species (ferret and pig) not present in the Terrestrial Study Area; closely related species likely are. • Chemical form in the TRV study was zinc carbonate, an insoluble form of zinc. • Chemical administration in the TRV study was dietary, and dose was calculated based on measured FIRs and BWs.	TAI, 2019d; EPA, 2007h
	Growth	• The Eco-SSL utilized 86 available data sets and for the selected mammalian Eco-SSL TRV, utlized the geometric mean of 25 NOAELs for reproduction and 44 NOAELs for growth. • The EPA estimated BW and FIR from other sources if not available in the studies used for the Eco-SSL.	• Study species (pigs, mice, rats, cattle, hamsters, sheep, water buffalo) not present in the Terrestrial Study Area; closely related species likely are. • Chemical forms in the TRV study was zinc oxide (insoluble), zinc chloride (soluble), zinc acetate (soluble), zinc carbonate (insoluble), zinc sulfate (soluble), zinc sulfate heptahydrate (soluble), zinc (insoluble), zinc methionine (soluble). • Chemical administration in the TRV studies was dietary.	
	Reproduction	• The Eco-SSL utilized 86 available data sets and for the selected mammalian Eco-SSL TRV, utlized the geometric mean of 25 NOAELs for reproduction and 44 NOAELs for growth. • The EPA estimated BW and FIR from other sources if not available in the studies used for the Eco-SSL.	• Study species (pigs, mice, rats, cattle, hamsters, sheep, water buffalo) not present in the Terrestrial Study Area; closely related species likely are. • Chemical forms in the TRV study was zinc oxide (insoluble), zinc chloride (soluble), zinc acetate (soluble), zinc carbonate (insoluble), zinc sulfate (soluble), zinc sulfate heptahydrate (soluble), zinc (insoluble), zinc methionine (soluble). • Chemical administration in the TRV studies was dietary.	
Wolf-specific				
Cadmium	Growth	• One data set (Tier 1) available for wolf-specific TRV. • LOAEL ≥ 20 (30 percent reduction in response relative to the control). • Doses reported in study rather than calculated from BW and FIR.	• Receptor-specific TRV (wolf) for the Terrestrial Study Area. • Chemical form in the TRV study was cadmium chloride, a soluble form of cadmium. • TRV study conducted during a critical lifestage. • Chemical administration in the TRV study was dietary, and dose was calculated by the study authors.	TAI, 2019d

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Notes:

Tier 1 - Studies meet the following criteria: dietary or gavage exposure, and growth endpoint exposure period during a critical life stage or for at least 10 percent of the species' lifespan

Tier 2 - Studies meet the following criteria: drinking water exposure, growth endpoint exposure period during a noncritical life stage or for less than 10 percent of the species' lifespan

BERA = baseline ecological risk assessment
BW = body weight
COPC = chemical of potential concern
Eco-SSL = ecological soil screening level
ED20 = effective dose with a 20% reduction in the response relative to the control
EPA = U.S. Environmental Protection Agency
EPC = exposure point concentration
FIR = food ingestion rate
LOAEL ≥ 20 = lowest-observed-adverse-effect level that is also more than 20 percent different from controls
mg/kg bw/day = milligrams of metal per kilogram of body weight per day
mg/kg/d = milligram(s) per kilogram per day
NOAEL = no-observed-adverse-effect level
TRV = toxicity reference value

Table 6-1. Summary of HQs and PAFs for Plants for Each Study

Analyte	Study	Number of Sample Locations	Eco-SSL/SSL				Bioavailability-Adjusted Benchmark					
			Count of HQs ≥ 1	Percent of HQs ≥ 1 or pH < benchmark	Count of HQs > 5	Percent of HQs > 5	Count of HQs ≥ 1	Percent of HQs ≥ 1	Count of HQs > 5	Percent of HQs > 5	Median PAF	Maximum PAF
Aluminum	2012 Ecology Upland Soil Study	106	17[a]	16	NA	NA	NA	NA	NA	NA	NA	NA
Aluminum	2014 UCR Upland Soil Study	141	19[a]	13	NA	NA	NA	NA	NA	NA	NA	NA
Aluminum	2015 Bossburg Study	6	1[a]	17	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	2012 Ecology Upland Soil Study	106	0	0.0	0	0	NA	NA	NA	NA	NA	NA
Antimony	2014 UCR Upland Soil Study	141	0	0.0	0	0	NA	NA	NA	NA	NA	NA
Antimony	2015 Bossburg Study	6	0	0.0	0	0	NA	NA	NA	NA	NA	NA
Arsenic	2012 Ecology Upland Soil Study	106	34	32	0	0	NA	NA	NA	NA	NA	NA
Arsenic	2014 UCR Upland Soil Study	141	42	30	0	0	NA	NA	NA	NA	NA	NA
Arsenic	2015 Bossburg Study	6	0	0.0	0	0	NA	NA	NA	NA	NA	NA
Barium	2012 Ecology Upland Soil Study	106	1	0.9	0	0	NA	NA	NA	NA	NA	NA
Barium	2014 UCR Upland Soil Study	141	2	1.4	0	0	NA	NA	NA	NA	NA	NA
Barium	2015 Bossburg Study	6	0	0.0	0	0	NA	NA	NA	NA	NA	NA
Chromium	2012 Ecology Upland Soil Study	106	1	0.9	0	0	NA	NA	NA	NA	NA	NA
Chromium	2014 UCR Upland Soil Study	141	0	0.0	0	0	NA	NA	NA	NA	NA	NA
Chromium	2015 Bossburg Study	6	0	0.0	0	0	NA	NA	NA	NA	NA	NA
Cobalt	2012 Ecology Upland Soil Study	106	8	7.5	0	0	1	0.9	0	0	<1	5.2
Cobalt	2014 UCR Upland Soil Study	141	5	3.5	0	0	0	0	0	0	<1	<1
Cobalt	2015 Bossburg Study	6	0	0.0	0	0	0	0	0	0	<1	<1
Copper	2012 Ecology Upland Soil Study	106	0	0.0	0	0	0	0	0	0	<1	<1
Copper	2014 UCR Upland Soil Study	141	0	0.0	0	0	0	0	0	0	<1	<1
Copper	2015 Bossburg Study	6	0	0.0	0	0	0	0	0	0	<1	<1
Iron	2012 Ecology Upland Soil Study	106	1[a]	0.9	NA	NA	NA	NA	NA	NA	NA	NA
Iron	2014 UCR Upland Soil Study	141	5[a]	3.5	NA	NA	NA	NA	NA	NA	NA	NA
Iron	2015 Bossburg Study	6	0[a]	0.0	NA	NA	NA	NA	NA	NA	NA	NA
Lead	2012 Ecology Upland Soil Study	106	80	75	17	16	42	40	0	0	<1	60
Lead	2014 UCR Upland Soil Study	141	104	74	1	0.7	18	13	0	0	<1	18
Lead	2015 Bossburg Study	6	4	67	1	17	3	50	1	17	5.9	93
Manganese	2012 Ecology Upland Soil Study	106	103	97	50	47	NA	NA	NA	NA	NA	NA
Manganese	2014 UCR Upland Soil Study	141	141	100	48	34	NA	NA	NA	NA	NA	NA
Manganese	2015 Bossburg Study	6	6	100	0	0	NA	NA	NA	NA	NA	NA
Molybdenum	2014 UCR Upland Soil Study	141	0	0.0	0	0	0	0	0	0	<1	2.0
Nickel	2012 Ecology Upland Soil Study	106	11	10	0	0	3	2.8	0	0	<1	39
Nickel	2014 UCR Upland Soil Study	141	11	7.8	0	0	0	0	0	0	<1	3.3
Nickel	2015 Bossburg Study	6	0	0.0	0	0	0	0	0	0	<1	1.1
Selenium	2012 Ecology Upland Soil Study	106	13	12	1	0.94	NA	NA	NA	NA	NA	NA
Selenium	2014 UCR Upland Soil Study	141	21	15	1	0.71	NA	NA	NA	NA	NA	NA
Selenium	2015 Bossburg Study	6	1	17	0	0.0	NA	NA	NA	NA	NA	NA
Thallium	2012 Ecology Upland Soil Study	106	0	0.0	0	0.0	NA	NA	NA	NA	NA	NA
Thallium	2014 UCR Upland Soil Study	141	0	0.0	0	0.0	NA	NA	NA	NA	NA	NA
Thallium	2015 Bossburg Study	6	0	0.0	0	0.0	NA	NA	NA	NA	NA	NA
Zinc	2012 Ecology Upland Soil Study	106	90	85	7	6.6	73	69	9	8.5	15	94
Zinc	2014 UCR Upland Soil Study	141	126	89	1	0.7	117	83	0	0	12	52
Zinc	2015 Bossburg Study	6	1	17	0	0	4	67	0	0	14	42

Notes:

[a] Screening levels for aluminum and iron are based on pH rather than chemical concentration.

HQs and PAFs for each sample are presented in Appendix F

> = greater than

≥ = greater than or equal to

< = less than

Eco-SSL = ecological soil screening level

HQ = hazard quotient

NA = not applicable, no bioavailability-based benchmark available

PAF = potentially affected fraction (as percent)

SSL = soil screening level

UCR = Upper Columbia River

Table 6-2. Hazard Quotients for Plants for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, and Potentially Affected Fraction at Each Sampling Location for Each Study

					Anionic metals																	
						Arsenic			Selenium			Chromium			Molybdenum						Aluminum	
Study	Location ID	COPCs with SSL HQ ≥ 1 COPCs with BABs Not included	COPCs with BAB HQ ≥ 1	COPCs with concentration > BTV	Anionic metal bioavailability score	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	BAB HQ	SSL HQ	>BTV	Detect	Cationic metal bioavailability score	pH ≥ 5.5	>BTV	
2012 Ecology Upland Soil Study	SA10-2C	As,Mn,Se	Pb,Zn	Sb,As,Ba,Co,Cu,Fe,Pb,Mn,Ni,Se,Tl,Zn	OR	3.1	Yes	Yes	2.5	Yes	Yes	0.11	No	Yes	NA	NA	NA	NA	OR	TRUE	No	
2012 Ecology Upland Soil Study	SA10-7C	As,Mn	Zn	As,Ba,Pb,Mn,Ni,Se,Zn	OR	2.2	Yes	Yes	0.96	Yes	No	0.11	No	Yes	NA	NA	NA	NA	OR	TRUE	No	
2012 Ecology Upland Soil Study	SA10-3C	As,Mn	Zn	Sb,As,Ba,Cu,Pb,Mn,Ni,Se,Zn	OR	1.7	Yes	Yes	0.96	Yes	Yes	0.079	No	Yes	NA	NA	NA	NA	OR	TRUE	No	
2012 Ecology Upland Soil Study	SA10-8C	As,Mn	Zn	Pb,Mn,Se,Zn	1	1.2	No	Yes	0.96	Yes	No	0.11	No	Yes	NA	NA	NA	NA	1	TRUE	No	
2012 Ecology Upland Soil Study	SA11-9C	As,Mn,Se	Pb,Zn	Sb,As,Ba,Cr,Cu,Pb,Mn,Ni,Se,Tl,Zn	OR	1.9	Yes	Yes	1.2	Yes	Yes	0.16	Yes	Yes	NA	NA	NA	NA	OR	TRUE	No	
2012 Ecology Upland Soil Study	SA12-9C	Mn	NA	Ba,Pb,Mn,Ni,Se,Zn	2	0.77	No	Yes	0.96	Yes	No	0.12	No	Yes	NA	NA	NA	NA	2	TRUE	No	
2012 Ecology Upland Soil Study	SA1-1C	Mn,Se	NA	Ba,Cr,Pb,Mn,Se,Zn	OR	0.59	No	Yes	1.2	Yes	No	0.25	Yes	Yes	NA	NA	NA	NA	OR	TRUE	No	
2012 Ecology Upland Soil Study	SA1-2C	Mn	Zn	Ba,Cr,Fe,Pb,Mn,Se,Zn	0	0.77	No	Yes	0.96	Yes	No	0.16	Yes	Yes	NA	NA	NA	NA	2	TRUE	No	
2012 Ecology Upland Soil Study	SA12-7C	Mn	Zn	Ba,Pb,Mn,Se,Zn	2	0.97	No	Yes	0.96	Yes	No	0.12	No	Yes	NA	NA	NA	NA	2	TRUE	No	
2012 Ecology Upland Soil Study	SA2-1C	Mn	Zn	Ba,Pb,Mn,Se,Zn	OR	0.90	No	Yes	0.96	Yes	No	0.086	No	Yes	NA	NA	NA	NA	OR	TRUE	No	
2012 Ecology Upland Soil Study	SA3-6C	Mn	Pb,Ni,Zn	Ba,Cr,Co,Cu,Fe,Pb,Mn,Ni,Se,Tl,Zn	OR	0.98	No	Yes	0.96	Yes	No	0.58	Yes	Yes	NA	NA	NA	NA	OR	TRUE	No	
2014 UCR Upland Soil Study	ADA-061	Mn	NA	Sb,Ba,Cr,Pb,Mn,Ni,Se,Zn	OR	0.83	No	Yes	0.40	Yes	Yes	0.41	Yes	Yes	0.027	0.030	No	Yes	OR	TRUE	No	
2012 Ecology Upland Soil Study	SA10-6C	Mn	NA	Ba,Pb,Mn,Se,Zn	OR	0.91	No	Yes	0.96	Yes	No	0.11	No	Yes	NA	NA	NA	NA	OR	TRUE	No	
2012 Ecology Upland Soil Study	SA13-6C	As,Mn	NA	Pb,Mn,Se,Zn	1	1.2	No	Yes	0.96	Yes	No	0.095	No	Yes	NA	NA	NA	NA	3	TRUE	No	
2014 UCR Upland Soil Study	ADA-064	Al,Mn	Zn	Sb,Ba,Cr,Pb,Mn,Se,Zn	OR	0.92	No	Yes	0.73	Yes	Yes	0.19	Yes	Yes	0.023	0.050	No	Yes	OR	FALSE	No	
2014 UCR Upland Soil Study	ADA-107	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Mo,Ni,Se,Zn	OR	0.90	No	Yes	0.63	Yes	Yes	0.26	Yes	Yes	0.077	0.086	Yes	Yes	OR	TRUE	No	
2014 UCR Upland Soil Study	ADA-103	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Ni,Se,Zn	1	0.88	No	Yes	0.65	Yes	Yes	0.17	Yes	Yes	0.038	0.044	No	Yes	1	TRUE	No	
2014 UCR Upland Soil Study	ADA-056	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Se,Zn	0	0.64	No	Yes	0.40	Yes	Yes	0.17	Yes	Yes	0.0083	0.035	No	Yes	2	TRUE	No	
2012 Ecology Upland Soil Study	SA6-1C	Mn	Pb,Zn	Pb,Mn,Se,Zn	OR	0.86	No	Yes	0.96	Yes	No	0.11	No	Yes	NA	NA	NA	NA	OR	TRUE	No	
2012 Ecology Upland Soil Study	SA9-8C	As,Mn	Pb,Zn	Sb,As,Ba,Cr,Pb,Mn,Se,Tl,Zn	OR	1.5	Yes	Yes	0.96	Yes	No	0.18	Yes	Yes	NA	NA	NA	NA	OR	TRUE	No	
2014 UCR Upland Soil Study	ADA-058	Mn	NA	Sb,Ba,Pb,Mn,Mo,Se,Zn	OR	0.44	No	Yes	0.35	Yes	Yes	0.11	No	Yes	0.018	0.058	Yes	Yes	OR	TRUE	No	
2014 UCR Upland Soil Study	ADA-053	Mn	NA	Sb,Ba,Cr,Pb,Mn,Se,Zn	OR	0.62	No	Yes	0.65	Yes	Yes	0.18	Yes	Yes	0.0088	0.033	No	Yes	OR	TRUE	No	
2014 UCR Upland Soil Study	ADA-093	As,Mn	Zn	Sb,Ba,Pb,Mn,Se,Zn	OR	1.1	No	Yes	0.63	Yes	Yes	0.097	No	Yes	0.0053	0.030	No	Yes	OR	TRUE	No	
2014 UCR Upland Soil Study	ADA-059	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Mo,Se,Zn	OR	0.66	No	Yes	0.56	Yes	Yes	0.16	Yes	Yes	0.027	0.060	Yes	Yes	OR	TRUE	No	
2012 Ecology Upland Soil Study	SA9-1C	As,Mn	Pb,Zn	As,Ba,Cr,Pb,Mn,Se,Tl,Zn	1	1.6	Yes	Yes	0.96	Yes	No	0.23	Yes	Yes	NA	NA	NA	NA	1	TRUE	No	
2012 Ecology Upland Soil Study	SA9-5C	As,Mn	Pb,Zn	Sb,As,Ba,Pb,Mn,Se,Zn	1	1.6	Yes	Yes	0.96	Yes	No	0.095	No	Yes	NA	NA	NA	NA	1	TRUE	No	
2012 Ecology Upland Soil Study	SA1-6C	As,Mn	NA	Pb,Mn,Se,Zn	0	1.2	No	Yes	0.96	Yes	No	0.12	No	Yes	NA	NA	NA	NA	2	TRUE	No	
2014 UCR Upland Soil Study	ADA-055	As,Ba,Mn,Se	Zn	Sb,As,Ba,Cu,Pb,Mn,Mo,Ni,Se,Zn	OR	1.4	Yes	Yes	1.6	Yes	Yes	0.078	No	Yes	0.23	0.23	Yes	Yes	OR	TRUE	No	
2012 Ecology Upland Soil Study	SA11-5C	Al,As,Mn	Zn	Sb,Ba,Pb,Mn,Se,Zn	0	1.2	No	Yes	0.96	Yes	No	0.078	No	Yes	NA	NA	NA	NA	2	FALSE	No	
2014 UCR Upland Soil Study	ADA-122	Mn	NA	Sb,Ba,Pb,Mn,Se,Zn	OR	0.58	No	Yes	0.69	Yes	Yes	0.10	No	Yes	0.022	0.040	No	Yes	OR	TRUE	No	
2012 Ecology Upland Soil Study	SA12-1C	As,Mn	Zn	As,Cr,Cu,Fe,Pb,Mn,Ni,Se,Zn	2	1.4	Yes	Yes	0.96	Yes	No	0.18	Yes	Yes	NA	NA	NA	NA	2	TRUE	No	
2014 UCR Upland Soil Study	ADA-084	Mn	NA	Sb,Pb,Mn,Se,Zn	OR	0.69	No	Yes	0.60	Yes	Yes	0.12	No	Yes	0.041	0.027	No	Yes	OR	TRUE	No	
2014 UCR Upland Soil Study	ADA-099	As,Mn	Zn	Sb,Cr,Pb,Mn,Se,Zn	OR	1.2	No	Yes	0.56	Yes	Yes	0.14	Yes	Yes	0.025	0.028	No	Yes	OR	TRUE	No	
2014 UCR Upland Soil Study	ADA-106	Al,Mn,Se	Zn	Sb,Ba,Pb,Mn,Mo,Se,Zn	OR	0.65	No	Yes	1.5	Yes	Yes	0.10	No	Yes	0.045	0.094	Yes	Yes	OR	FALSE	No	
2012 Ecology Upland Soil Study	SA11-8C	Al,As,Mn	Pb,Zn	Sb,As,Ba,Cr,Cu,Pb,Mn,Se,Tl,Zn	1	2.1	Yes	Yes	0.96	Yes	No	0.14	Yes	Yes	NA	NA	NA	NA	3	FALSE	No	
2014 UCR Upland Soil Study	ADA-063	Mn	Zn	Sb,Ba,Pb,Mn,Mo,Se,Zn	OR	0.80	No	Yes	0.73	Yes	Yes	0.088	No	Yes	0.057	0.066	Yes	Yes	OR	TRUE	No	
2014 UCR Upland Soil Study	ADA-089	As,Mn	Zn	Sb,As,Ba,Cr,Pb,Mn,Se,Zn	OR	1.3	Yes	Yes	0.63	Yes	Yes	0.13	Yes	Yes	0.028	0.029	No	Yes	OR	TRUE	No	
2014 UCR Upland Soil Study	ADA-092	As,Mn,Se	Zn	Sb,As,Ba,Cr,Pb,Mn,Mo,Se,Zn	OR	1.3	Yes	Yes	1.1	Yes	Yes	0.13	Yes	Yes	0.055	0.078	Yes	Yes	OR	TRUE	No	
2014 UCR Upland Soil Study	ADA-112	Mn	NA	Sb,Ba,Pb,Mn,Se,Zn	OR	0.64	No	Yes	0.58	Yes	Yes	0.11	No	Yes	0.0051	0.022	No	Yes	OR	TRUE	No	
2014 UCR Upland Soil Study	ADA-025	As,Mn,Se	Zn	Sb,Ba,Pb,Mn,Mo,Se,Zn	1	1.2	No	Yes	1.1	Yes	Yes	0.042	No	Yes	0.46	0.23	Yes	Yes	1	TRUE	No	
2014 UCR Upland Soil Study	ADA-113	Mn	NA	Sb,Ba,Cr,Pb,Mn,Se,Zn	OR	0.72	No	Yes	0.50	Yes	Yes	0.14	Yes	Yes	0.016	0.023	No	Yes	OR	TRUE	No	
2014 UCR Upland Soil Study	ADA-114	Al,Fe,Mn	Zn	Sb,Ba,Pb,Mn,Se,Zn	OR	0.93	No	Yes	0.40	Yes	Yes	0.11	No	Yes	0.0029	0.033	No	Yes	OR	FALSE	No	
2012 Ecology Upland Soil Study	SA12-2C	Al,Mn	Zn	Pb,Mn,Se,Zn	0	0.91	No	Yes	0.96	Yes	No	0.11	No	Yes	NA	NA	NA	NA	2	FALSE	No	
2012 Ecology Upland Soil Study	SA13-3C	Mn	NA	Pb,Mn,Se,Zn	1	0.71	No	Yes	0.96	Yes	No	0.098	No	Yes	NA	NA	NA	NA	3	TRUE	No	
2012 Ecology Upland Soil Study	SA13-5C	As,Mn	Pb,Zn	Sb,Ba,Cr,Cu,Pb,Mn,Se,Zn	OR	1.0	No	Yes	0.96	Yes	No	0.15	Yes	Yes	NA	NA	NA	NA	OR	TRUE	No	
2014 UCR Upland Soil Study	ADA-049	Mn	Zn	Sb,Ba,Pb,Mn,Mo,Se,Zn	1	0.67	No	Yes	0.92	Yes	Yes	0.069	No	Yes	0.14	0.15	Yes	Yes	1	TRUE	No	
2012 Ecology Upland Soil Study	SA11-7C	Al,As,Mn,Se	Pb,Zn	Sb,As,Ba,Cu,Pb,Mn,Se,Tl,Zn	OR	1.6	Yes	Yes	3.8	Yes	No	0.045	No	Yes	NA	NA	NA	NA	OR	FALSE	No	
2012 Ecology Upland Soil Study	SA3-3C	Mn	Zn	Ba,Cr,Pb,Mn,Ni,Se,Zn	2	0.84	No	Yes	0.96	Yes	No	0.33	Yes	Yes	NA	NA	NA	NA	2	TRUE	No	
2014 UCR Upland Soil Study	ADA-118	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Se,Zn	1	0.73	No	Yes	0.42	Yes	Yes	0.23	Yes	Yes	0.081	0.025	No	Yes	1	TRUE	No	
2014 UCR Upland Soil Study	ADA-174	Al,Mn	Zn	Sb,Ba,Pb,Mn,Mo,Se,Zn	OR	0.62	No	Yes	0.65	Yes	Yes	0.072	No	Yes	0.0094	0.082	Yes	Yes	OR	FALSE	No	
2012 Ecology Upland Soil Study	SA6-7C	Al,As,Mn	Pb,Zn	Sb,As,Cr,Pb,Mn,Se,Zn	OR	2.0	Yes	Yes	0.96	Yes	No	0.15	Yes	Yes	NA	NA	NA	NA	OR	FALSE	No	
2014 UCR Upland Soil Study	ADA-010	As,Mn	Zn	Sb,As,Pb,Mn,Se,Zn	OR	1.4	Yes	Yes	0.75	Yes	Yes	0.096	No	Yes	0.020	0.028	No	Yes	OR	TRUE	No	
2012 Ecology Upland Soil Study	SA12-8C	Mn	Zn	Pb,Mn,Se,Zn	1	0.88	No	Yes	0.96	Yes	No	0.093	No	Yes	NA	NA	NA	NA	3	TRUE	No	
2014 UCR Upland Soil Study	ADA-067	Mn	Zn	Sb,Ba,Cr,Cu,Pb,Mn,Mo,Se,Zn	1	0.62	No	Yes	0.73	Yes	Yes	0.13	Yes	Yes	0.089	0.10	Yes	Yes	1	TRUE	No	
2012 Ecology Upland Soil Study	SA9-9C	As,Mn	Zn	As,Cr,Pb,Mn,Ni,Se,Zn	1	1.8	Yes	Yes	0.96	Yes	No	0.16	Yes	Yes	NA	NA	NA	NA	3	TRUE	No	
2012 Ecology Upland Soil Study	SA1-8C	Mn	NA	Ba,Pb,Mn,Se,Zn	OR	0.58	No	Yes	0.96	Yes	No	0.077	No	Yes	NA	NA	NA	NA	OR	TRUE	No	
2012 Ecology Upland Soil Study	SA11-4C	As,Mn	Pb,Zn	Sb,Ba,Pb,Mn,Se,Tl,Zn	OR	1.2	No	Yes	0.96	Yes	No	0.11	No	Yes	NA	NA	NA	NA	OR	TRUE	No	
2014 UCR Upland Soil Study	ADA-173	Al,Mn	Zn	Sb,Pb,Mn,Mo,Se,Zn	OR	0.69	No	Yes	0.60	Yes	Yes	0.083	No	Yes	0.023	0.079	Yes	Yes	OR	FALSE	No	
2012 Ecology Upland Soil Study	SA3-2C	Mn	NA	Ba,Pb,Mn,Se,Zn	1	0.33	No	Yes	0.96	Yes	No	0.062	No	Yes	NA	NA	NA	NA	3	TRUE	No	
2014 UCR Upland Soil Study	ADA-088	As,Mn	Zn	Sb,Cr,Pb,Mn,Se,Zn	OR	1.1	No	Yes	0.79	Yes	Yes	0.17	Yes	Yes	0.055	0.036	No	Yes	OR	TRUE	No	
2014 UCR Upland Soil Study	ADA-090	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Se,Zn	OR	0.72	No	Yes	0.58	Yes	Yes	0.14	Yes	Yes	0.0088	0.025	No	Yes	OR	TRUE	No	
2012 Ecology Upland Soil Study	SA2-4C	Al,Mn	Zn	Pb,Mn,Se,Zn	1	0.93	No	Yes	0.96	Yes	No	0.091	No	Yes	NA	NA	NA	NA	3	FALSE	No	
2012 Ecology Upland Soil Study	SA6-3C	Al,As,Mn	Pb,Zn	As,Cr,Pb,Mn,Se,Zn	OR	1.4	Yes	Yes	0.96	Yes	No	0.21	Yes	Yes	NA	NA	NA	NA	OR	FALSE	No	
2014 UCR Upland Soil Study	ADA-117	Mn	Zn	Sb,Pb,Mn,Se,Zn	0	0.86	No	Yes	0.31	Yes	Yes	0.097	No	Yes	0.020	0.025	No	Yes	2	TRUE	No	
2012 Ecology Upland Soil Study	SA12-6C	Mn	Zn	Cu,Pb,Mn,Se,Zn	1	0.74	No	Yes	0.96	Yes	No	0.079	No	Yes	NA	NA	NA	NA	1	TRUE	No	
2012 Ecology Upland Soil Study	SA13-2C	Mn,Se	NA	Pb,Mn,Se,Zn	OR	0.33	No	Yes	3.3	Yes	Yes	0.11	No	Yes	NA	NA	NA	NA	OR	TRUE	No	
2012 Ecology Upland Soil Study	SA9-3C	Mn	Zn	Ba,Cr,Fe,Pb,Mn,Ni,Se,Zn	0	0.76	No	Yes	0.96	Yes	No	0.47	Yes	Yes	NA	NA	NA	NA	2	TRUE	No	
2012 Ecology Upland Soil Study	SA9-7C	As,Mn	Pb,Zn	Sb,As,Cr,Pb,Mn,Se,Tl,Zn	1	2.0	Yes	Yes	0.96	Yes	No	0.13	Yes	Yes	NA	NA	NA	NA	3	TRUE	No	
2014 UCR Upland Soil Study	ADA-035	Mn	Zn	Sb,Pb,Mn,Se,Zn	1	0.86	No	Yes	0.38	Yes	Yes	0.065	No	Yes	0.026	0.028	No	Yes	1	TRUE	No	
2014 UCR Upland Soil Study	ADA-096	Mn	Zn	Sb,Ba,Pb,Mn,Se,Zn	OR	0.82	No	Yes	0.73	Yes	Yes	0.076	No	Yes	0.025	0.027	No	Yes	OR	TRUE	No	
2014 UCR Upland Soil Study	ADA-078	As,Mn	Zn	Sb,Ba,Cr,Pb,Se,Zn	0	1.2	No	Yes	0.62	Yes	Yes	0.13	Yes	Yes	0.013	0.029	No	Yes	2	TRUE	No	
2014 UCR Upland Soil Study	ADA-095	Mn	NA	Sb,Cr,Pb,Se,Zn	OR	0.94	No	Yes	0.56	Yes	Yes	0.16	Yes	Yes	0.023	0.026	No	Yes	OR	TRUE	No	
2012 Ecology Upland Soil Study	SA11-2C	Mn	NA	Ba,Pb,Se,Zn	2	0.59	No	Yes	0.96	Yes	No	0.10	No	Yes	NA	NA	NA	NA	2	TRUE	No	
2012 Ecology Upland Soil Study	SA13-8C	Al,Mn	NA	Pb,Se,Zn	0	0.91	No	Yes	0.96	Yes	No	0.11	No	Yes	NA	NA	NA	NA	2	FALSE	No	
2012 Ecology Upland Soil Study	SA4-7C	Mn	Zn	Cr,Pb,Ni,Se,Zn	0	0.83	No	Yes	0.96	Yes	No	0.28	Yes	Yes	NA	NA	NA	NA	2	TRUE	No	
2014 UCR Upland Soil Study	ADA-097	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	OR	1.1	No	Yes	0.90	Yes	Yes	0.15	Yes	Yes	0.13	0.044	No	Yes	OR	TRUE	No	

Table 6-2. Hazard Quotients for Plants for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, and Potentially Affected Fraction at Each Sampling Location for Each Study

					Anionic metals																
						Arsenic			Selenium			Chromium			Molybdenum					Aluminum	
Study	Location ID	COPCs with SSL HQ ≥ 1 COPCs with BABs Not included	COPCs with BAB HQ ≥ 1	COPCs with concentration > BTV	Anionic metal bioavailability score	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	BAB HQ	SSL HQ	>BTV	Detect	Cationic metal bioavailability score	pH ≥ 5.5	>BTV
2014 UCR Upland Soil Study	ADA-104	Mn	Zn	Sb,Ba,Pb,Mo,Se,Zn	OR	0.61	No	Yes	0.90	Yes	Yes	0.067	No	Yes	0.032	0.10	Yes	Yes	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-115	Mn	NA	Sb,Pb,Se,Zn	OR	0.78	No	Yes	0.35	Yes	Yes	0.092	No	Yes	0.012	0.020	No	Yes	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-121	Mn	Zn	Sb,Cr,Pb,Se,Zn	OR	0.97	No	Yes	0.60	Yes	Yes	0.13	Yes	Yes	0.026	0.034	No	Yes	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-179	Mn	Zn	Sb,Pb,Mo,Se,Zn	OR	0.49	No	Yes	0.58	Yes	Yes	0.065	No	Yes	0.025	0.073	Yes	Yes	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-181	Mn,Se	Zn	Sb,Ba,Pb,Mo,Se,Zn	OR	0.56	No	Yes	1.2	Yes	Yes	0.073	No	Yes	0.023	0.12	Yes	Yes	OR	TRUE	No
2012 Ecology Upland Soil Study	SA2-8C	Mn	Zn	Cr,Pb,Se,Zn	2	0.90	No	Yes	0.96	Yes	No	0.16	Yes	Yes	NA	NA	NA	NA	2	TRUE	No
2014 UCR Upland Soil Study	ADA-033	Mn	Zn	Sb,Ba,Pb,Mo,Ni,Se,Zn	2	0.76	No	Yes	0.73	Yes	Yes	0.056	No	Yes	0.30	0.15	Yes	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-184	Mn,Se	Zn	Sb,Ba,Pb,Mo,Se,Zn	OR	0.53	No	Yes	1.2	Yes	Yes	0.057	No	Yes	0.069	0.15	Yes	Yes	OR	TRUE	No
2012 Ecology Upland Soil Study	SA1-5C	Mn	NA	Pb,Se,Zn	OR	0.94	No	Yes	0.96	Yes	No	0.12	No	Yes	NA	NA	NA	NA	OR	TRUE	No
2012 Ecology Upland Soil Study	SA6-2C	Mn	Pb,Zn	Pb,Se,Zn	1	0.87	No	Yes	0.96	Yes	No	0.11	No	Yes	NA	NA	NA	NA	2	TRUE	No
2012 Ecology Upland Soil Study	SA9-6C	Mn	Pb,Zn	Sb,Cr,Pb,Se,Tl,Zn	OR	0.78	No	Yes	0.96	Yes	No	0.13	Yes	Yes	NA	NA	NA	NA	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-177	Al,Fe,Mn	NA	Sb,Pb,Se	OR	0.50	No	Yes	0.35	Yes	Yes	0.10	No	Yes	0.0043	0.021	No	Yes	OR	FALSE	No
2012 Ecology Upland Soil Study	SA1-7C	Mn	NA	Pb,Se,Zn	0	0.70	No	Yes	0.96	Yes	No	0.10	No	Yes	NA	NA	NA	NA	2	TRUE	No
2012 Ecology Upland Soil Study	SA2-7C	Mn	Zn	Cr,Pb,Ni,Se,Zn	OR	0.98	No	Yes	0.96	Yes	No	0.15	Yes	Yes	NA	NA	NA	NA	OR	TRUE	No
2012 Ecology Upland Soil Study	SA2-2C	Mn	Zn	Cr,Pb,Se,Zn	1	0.68	No	Yes	0.96	Yes	No	0.17	Yes	Yes	NA	NA	NA	NA	3	TRUE	No
2012 Ecology Upland Soil Study	SA3-7C	Mn	Pb,Zn	Sb,Pb,Se,Zn	OR	0.79	No	Yes	0.96	Yes	No	0.11	No	Yes	NA	NA	NA	NA	OR	TRUE	No
2012 Ecology Upland Soil Study	SA5-3C	Mn	Zn	Pb,Se,Zn	1	0.94	No	Yes	0.96	Yes	No	0.12	No	Yes	NA	NA	NA	NA	1	TRUE	No
2014 UCR Upland Soil Study	ADA-045	As,Mn	Pb,Zn	Sb,As,Pb,Se,Zn	OR	1.5	Yes	Yes	0.75	Yes	Yes	0.079	No	Yes	0.016	0.022	No	Yes	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-085	Mn	Zn	Sb,Pb,Se,Zn	OR	0.59	No	Yes	0.92	Yes	Yes	0.096	No	Yes	0.052	0.053	No	Yes	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-101	Mn	NA	Sb,Pb,Se,Zn	OR	0.96	No	Yes	0.77	Yes	Yes	0.11	No	Yes	0.45	0.037	No	Yes	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-116	Mn	Zn	Sb,Pb,Se,Zn	0	0.84	No	Yes	0.38	Yes	Yes	0.10	No	Yes	0.0080	0.022	No	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-172	Al,Mn	NA	Sb,Pb,Se	OR	0.35	No	Yes	0.50	Yes	Yes	0.056	No	Yes	0.0015	0.020	No	Yes	OR	FALSE	No
2012 Ecology Upland Soil Study	SA10-1C	Mn	Zn	Ba,Cr,Pb,Se,Zn	OR	0.66	No	Yes	0.96	Yes	No	0.18	Yes	Yes	NA	NA	NA	NA	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-039	Mn	Zn	Sb,Ba,Pb,Mo,Se,Zn	2	0.46	No	Yes	0.63	Yes	Yes	0.074	No	Yes	0.061	0.12	Yes	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-111	Mn	Zn	Sb,Cr,Pb,Se,Zn	1	0.63	No	Yes	0.38	Yes	Yes	0.17	Yes	Yes	0.018	0.018	No	Yes	1	TRUE	No
2014 UCR Upland Soil Study	ADA-175	Al,Mn	NA	Sb,Pb,Se,Zn	OR	0.33	No	Yes	0.33	Yes	Yes	0.086	No	Yes	0.0028	0.021	No	Yes	OR	FALSE	No
2012 Ecology Upland Soil Study	SA7-1C	Mn	Pb,Zn	Sb,Pb,Se,Zn	OR	0.92	No	Yes	0.96	Yes	No	0.085	No	Yes	NA	NA	NA	NA	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-076	Al,As,Mn,Se	Zn	Sb,As,Ba,Pb,Mo,Se,Zn	OR	1.4	Yes	Yes	1.3	Yes	Yes	0.11	No	Yes	0.011	0.061	Yes	Yes	OR	FALSE	No
2014 UCR Upland Soil Study	ADA-105	Mn	Zn	Sb,Ba,Pb,Se,Zn	OR	0.89	No	Yes	0.54	Yes	Yes	0.12	No	Yes	0.032	0.020	No	Yes	OR	TRUE	No
2012 Ecology Upland Soil Study	SA1-3C	Mn	NA	Ba,Cr,Pb,Se,Zn	OR	0.68	No	Yes	0.96	Yes	No	0.14	Yes	Yes	NA	NA	NA	NA	OR	TRUE	No
2012 Ecology Upland Soil Study	SA4-6C	Mn	Pb,Zn	Cr,Pb,Se,Zn	OR	0.99	No	Yes	0.96	Yes	No	0.16	Yes	Yes	NA	NA	NA	NA	OR	TRUE	No
2012 Ecology Upland Soil Study	SA7-8C	As,Mn	Co,Pb,Ni,Zn	As,Ba,Cr,Co,Cu,Fe,Pb,Ni,Se,Tl,Zn	1	2.2	Yes	Yes	0.96	Yes	No	0.84	Yes	Yes	NA	NA	NA	NA	3	TRUE	No
2014 UCR Upland Soil Study	ADA-048	Ba,Mn,Se	NA	Sb,Ba,Pb,Mo,Se,Zn	OR	0.60	No	Yes	1.5	Yes	Yes	0.081	No	Yes	0.068	0.10	Yes	Yes	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-079	Al,Mn	Zn	Sb,Ba,Pb,Mo,Se,Zn	OR	0.82	No	Yes	0.87	Yes	Yes	0.11	No	Yes	0.047	0.12	Yes	Yes	OR	FALSE	No
2014 UCR Upland Soil Study	ADA-152	As,Mn	Zn	Sb,As,Cr,Pb,Se,Zn	0	1.5	Yes	Yes	0.62	Yes	Yes	0.15	Yes	Yes	0.018	0.023	No	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-018	Mn	Pb,Zn	Sb,Pb,Se,Zn	0	0.88	No	Yes	0.67	Yes	Yes	0.11	No	Yes	0.0047	0.045	No	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-091	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	OR	1.1	No	Yes	0.63	Yes	Yes	0.19	Yes	Yes	0.020	0.026	No	Yes	OR	TRUE	No
2012 Ecology Upland Soil Study	SA3-4C	Mn	NA	Pb,Se,Zn	1	0.71	No	Yes	0.96	Yes	No	0.065	No	Yes	NA	NA	NA	NA	3	TRUE	No
2014 UCR Upland Soil Study	ADA-102	Mn	Zn	Sb,Ba,Pb,Se,Zn	1	0.75	No	Yes	0.52	Yes	Yes	0.11	No	Yes	0.012	0.025	No	Yes	1	TRUE	No
2014 UCR Upland Soil Study	ADA-156	As,Mn	Pb,Zn	Sb,Pb,Se,Zn	OR	1.1	No	Yes	0.71	Yes	Yes	0.11	No	Yes	0.013	0.041	No	Yes	OR	TRUE	No
2012 Ecology Upland Soil Study	SA12-4C	Mn	NA	Ba,Pb,Se,Zn	1	0.56	No	Yes	0.96	Yes	No	0.084	No	Yes	NA	NA	NA	NA	1	TRUE	No
2012 Ecology Upland Soil Study	SA5-2C	Mn	Zn	Ba,Cr,Fe,Pb,Ni,Se,Zn	OR	0.67	No	Yes	0.96	Yes	No	0.96	Yes	Yes	NA	NA	NA	NA	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-043	Mn,Se	NA	Sb,Ba,Pb,Mo,Ni,Se,Zn	OR	0.71	No	Yes	1.2	Yes	Yes	0.12	No	Yes	0.038	0.11	Yes	Yes	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-070	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	OR	1.1	No	Yes	0.79	Yes	Yes	0.14	Yes	Yes	0.016	0.029	No	Yes	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-071	Mn	Zn	Sb,Pb,Se,Zn	0	0.88	No	Yes	0.52	Yes	Yes	0.11	No	Yes	0.027	0.038	No	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-131	Al,As,Mn,Se	Pb,Zn	Sb,As,Ba,Pb,Se,Zn	OR	1.6	Yes	Yes	1.1	Yes	Yes	0.092	No	Yes	0.045	0.038	No	Yes	OR	FALSE	No
2014 UCR Upland Soil Study	ADA-169	Mn	NA	Sb,Pb,Se	OR	0.66	No	Yes	0.31	Yes	Yes	0.078	No	Yes	0.0087	0.022	No	Yes	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-044	Mn,Se	Zn	Sb,Ba,Cr,Pb,Mo,Ni,Se,Zn	OR	0.81	No	Yes	1.3	Yes	Yes	0.20	Yes	Yes	0.13	0.12	Yes	Yes	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-119	Mn	NA	Sb,Cr,Pb,Se,Zn	OR	0.74	No	Yes	0.37	Yes	Yes	0.13	Yes	Yes	0.019	0.020	No	Yes	OR	TRUE	No
2012 Ecology Upland Soil Study	SA1-4C	Mn	NA	Ba,Pb,Se,Zn	1	0.52	No	Yes	0.96	Yes	No	0.11	No	Yes	NA	NA	NA	NA	3	TRUE	No
2012 Ecology Upland Soil Study	SA7-7C	Al,As,Mn,Se	Pb,Zn	Sb,As,Pb,Se,Tl,Zn	0	1.3	Yes	Yes	1.2	Yes	Yes	0.097	No	Yes	NA	NA	NA	NA	2	FALSE	No
2012 Ecology Upland Soil Study	SA8-8C	As,Mn,Se	Pb,Zn	Sb,As,Ba,Cu,Pb,Se,Tl,Zn	0	2.5	Yes	Yes	1.3	Yes	Yes	0.063	No	Yes	NA	NA	NA	NA	2	TRUE	No
2014 UCR Upland Soil Study	ADA-034	Mn	Zn	Sb,Pb,Mo,Se,Zn	2	0.53	No	Yes	0.60	Yes	Yes	0.074	No	Yes	0.11	0.098	Yes	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-057	Mn	NA	Sb,Cr,Pb,Se,Zn	1	0.81	No	Yes	0.46	Yes	Yes	0.19	Yes	Yes	0.025	0.032	No	Yes	1	TRUE	No
2014 UCR Upland Soil Study	ADA-094	Mn	NA	Sb,Pb,Se,Zn	0	0.70	No	Yes	0.35	Yes	Yes	0.12	No	Yes	0.010	0.026	No	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-170	Al,Mn	Zn	Sb,Pb,Mo,Se,Zn	OR	0.71	No	Yes	0.60	Yes	Yes	0.077	No	Yes	0.0083	0.057	Yes	Yes	OR	FALSE	No
2012 Ecology Upland Soil Study	SA3-8C	Mn	Zn	Pb,Se,Zn	0	0.44	No	Yes	0.96	Yes	No	0.077	No	Yes	NA	NA	NA	NA	2	TRUE	No
2014 UCR Upland Soil Study	ADA-028	As,Mn	Zn	Sb,Pb,Se,Zn	1	1.1	No	Yes	0.38	Yes	Yes	0.073	No	Yes	0.025	0.026	No	Yes	1	TRUE	No
2014 UCR Upland Soil Study	ADA-042	Mn	Zn	Sb,Ba,Pb,Mo,Se,Zn	1	0.65	No	Yes	0.56	Yes	Yes	0.089	No	Yes	0.020	0.098	Yes	Yes	3	TRUE	No
2014 UCR Upland Soil Study	ADA-180	Mn,Se	Zn	Sb,Ba,Pb,Mo,Se,Zn	OR	0.48	No	Yes	1.0	Yes	Yes	0.069	No	Yes	0.037	0.12	Yes	Yes	OR	TRUE	No
2012 Ecology Upland Soil Study	SA11-1C	Mn	NA	Cr,Pb,Se,Zn	2	0.68	No	Yes	0.96	Yes	No	0.17	Yes	Yes	NA	NA	NA	NA	2	TRUE	No
2012 Ecology Upland Soil Study	SA4-1C	Mn	Zn	Cr,Pb,Se,Zn	OR	0.79	No	Yes	0.96	Yes	No	0.14	Yes	Yes	NA	NA	NA	NA	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-052	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	OR	1.1	No	Yes	0.75	Yes	Yes	0.15	Yes	Yes	0.038	0.032	No	Yes	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-159	As,Mn	Pb,Zn	Sb,Cr,Pb,Se,Zn	OR	1.0	No	Yes	0.63	Yes	Yes	0.13	Yes	Yes	0.040	0.025	No	Yes	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-178	Mn	NA	Sb,Pb,Se,Zn	OR	0.52	No	Yes	0.33	Yes	Yes	0.093	No	Yes	0.0048	0.035	No	Yes	OR	TRUE	No
2012 Ecology Upland Soil Study	SA13-1C	Mn	NA	Pb,Se,Zn	OR	0.43	No	Yes	0.96	Yes	No	0.11	No	Yes	NA	NA	NA	NA	OR	TRUE	No
2012 Ecology Upland Soil Study	SA3-1C	Mn	NA	Pb,Se	1	0.36	No	Yes	0.96	Yes	No	0.11	No	Yes	NA	NA	NA	NA	3	TRUE	No
2012 Ecology Upland Soil Study	SA5-1C	Mn,Se	Pb,Zn	Sb,Pb,Se,Zn	OR	0.61	No	Yes	1.2	Yes	No	0.087	No	Yes	NA	NA	NA	NA	OR	TRUE	No
2012 Ecology Upland Soil Study	SA8-6C	Mn	Pb,Zn	Pb,Se,Zn	1	0.96	No	Yes	0.96	Yes	No	0.076	No	Yes	NA	NA	NA	NA	3	TRUE	No
2014 UCR Upland Soil Study	ADA-047	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	1	1.1	No	Yes	0.71	Yes	Yes	0.14	Yes	Yes	0.056	0.030	No	Yes	1	TRUE	No
2014 UCR Upland Soil Study	ADA-154	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	OR	1.1	No	Yes	0.62	Yes	Yes	0.23	Yes	Yes	0.031	0.027	No	Yes	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-176	Mn	NA	Sb,Cr,Pb,Ni,Se	OR	0.31	No	Yes	0.31	Yes	Yes	0.13	Yes	Yes	0.0037	0.016	No	Yes	OR	TRUE	No
2012 Ecology Upland Soil Study	SA10-5C	Mn	NA	Cr,Pb,Se,Zn	OR	0.64	No	Yes	0.96	Yes	No	0.14	Yes	Yes	NA	NA	NA	NA	OR	TRUE	No
2012 Ecology Upland Soil Study	SA13-7C	As,Mn	NA	Sb,Pb,Se,Zn	1	1.2	No	Yes	0.96	Yes	No	0.12	No	Yes	NA	NA	NA	NA	3	TRUE	No
2012 Ecology Upland Soil Study	SA4-4C	Al,Mn	Zn	Cr,Pb,Se,Zn	OR	0.66	No	Yes	0.96	Yes	No	0.15	Yes	Yes	NA	NA	NA	NA	OR	FALSE	No
2012 Ecology Upland Soil Study	SA4-5C	Mn	NA	Pb,Se,Zn	0	0.66	No	Yes	0.96	Yes	No	0.11	No	Yes	NA	NA	NA	NA	2	TRUE	No

Table 6-2. Hazard Quotients for Plants for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, and Potentially Affected Fraction at Each Sampling Location for Each Study

					Anionic metals																
						Arsenic			Selenium			Chromium			Molybdenum					Aluminum	
Study	Location ID	COPCs with SSL HQ ≥ 1 COPCs with BABs Not included	COPCs with BAB HQ ≥ 1	COPCs with concentration > BTV	Anionic metal bioavailability score	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	BAB HQ	SSL HQ	>BTV	Detect	Cationic metal bioavailability score	pH ≥ 5.5	>BTV
2012 Ecology Upland Soil Study	SA9-2C	Ba,Cr,Mn	Ni,Zn	Ba,Cr,Co,Cu,Fe,Pb,Ni,Se,Tl,Zn	1	0.57	No	Yes	0.96	Yes	No	2.5	Yes	Yes	NA	NA	NA	NA	1	TRUE	No
2014 UCR Upland Soil Study	ADA-004	Mn	Zn	Sb,Ba,Pb,Mo,Se,Zn	0	0.87	No	Yes	0.98	Yes	Yes	0.073	No	Yes	0.081	0.17	Yes	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-073	Al,As,Mn	Zn	Sb,Pb,Se,Zn	OR	1.1	No	Yes	0.60	Yes	Yes	0.11	No	Yes	0.0087	0.038	No	Yes	OR	FALSE	No
2012 Ecology Upland Soil Study	SA2-3C	Mn	Zn	Pb,Se,Zn	2	0.46	No	Yes	0.96	Yes	No	0.081	No	Yes	NA	NA	NA	NA	2	TRUE	No
2014 UCR Upland Soil Study	ADA-024	As,Mn	Pb,Zn	Sb,As,Cu,Pb,Se,Zn	OR	1.5	Yes	Yes	0.71	Yes	Yes	0.076	No	Yes	0.030	0.030	No	Yes	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-108	Mn	Zn	Sb,Cr,Pb,Se,Zn	OR	0.73	No	Yes	0.40	Yes	Yes	0.27	Yes	Yes	0.041	0.020	No	Yes	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-139	As,Mn	Zn	Sb,Pb,Se,Zn	0	1.0	No	Yes	0.71	Yes	Yes	0.12	No	Yes	0.020	0.036	No	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-171	Mn	Zn	Sb,Pb,Mo,Se,Zn	OR	0.61	No	Yes	0.58	Yes	Yes	0.071	No	Yes	0.017	0.077	Yes	Yes	OR	TRUE	No
2012 Ecology Upland Soil Study	SA8-7C	As,Mn	Pb,Zn	Sb,As,Pb,Se,Tl,Zn	OR	2.1	Yes	Yes	0.96	Yes	No	0.083	No	Yes	NA	NA	NA	NA	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-051	Mn,Se	Zn	Sb,Ba,Cu,Pb,Mo,Ni,Se,Zn	1	0.55	No	Yes	1.7	Yes	Yes	0.064	No	Yes	0.085	0.11	Yes	Yes	1	TRUE	No
2014 UCR Upland Soil Study	ADA-081	Mn	Zn	Sb,Cr,Pb,Se,Zn	0	0.82	No	Yes	0.44	Yes	Yes	0.16	Yes	Yes	0.011	0.030	No	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-145	Mn	Zn	Sb,Pb,Se,Zn	1	0.92	No	Yes	0.56	Yes	Yes	0.087	No	Yes	0.022	0.025	No	Yes	1	TRUE	No
2014 UCR Upland Soil Study	ADA-060	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	OR	1.2	No	Yes	0.62	Yes	Yes	0.16	Yes	Yes	0.076	0.032	No	Yes	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-126	As,Mn	Pb,Zn	Sb,Cu,Pb,Se,Zn	1	1.2	No	Yes	0.63	Yes	Yes	0.064	No	Yes	0.023	0.030	No	Yes	1	TRUE	No
2014 UCR Upland Soil Study	ADA-127	As,Mn	Zn	Sb,Ba,Pb,Se,Zn	1	1.1	No	Yes	0.73	Yes	Yes	0.092	No	Yes	0.085	0.038	No	Yes	1	TRUE	No
2014 UCR Upland Soil Study	ADA-161	Al,Fe,Mn	Pb,Zn	Sb,Pb,Se,Zn	0	0.92	No	Yes	0.50	Yes	Yes	0.098	No	Yes	0.0022	0.025	No	Yes	2	FALSE	No
2014 UCR Upland Soil Study	ADA-164	As,Mn,Se	Pb,Zn	Sb,Pb,Se,Zn	OR	1.1	No	Yes	1.5	Yes	Yes	0.076	No	Yes	0.096	0.026	No	Yes	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-008	As,Mn	Pb,Zn	Sb,Cr,Pb,Se,Zn	0	1.1	No	Yes	0.77	Yes	Yes	0.13	Yes	Yes	0.017	0.027	No	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-062	Mn	Zn	Sb,Pb,Se,Zn	OR	0.87	No	Yes	0.46	Yes	Yes	0.10	No	Yes	0.027	0.027	No	Yes	OR	TRUE	No
2012 Ecology Upland Soil Study	SA2-6C	As,Mn	Pb,Zn	Cr,Pb,Se,Zn	0	1.3	No	Yes	0.96	Yes	No	0.26	Yes	Yes	NA	NA	NA	NA	2	TRUE	No
2012 Ecology Upland Soil Study	SA8-1C	As,Mn	Pb,Zn	Sb,Pb,Se,Zn	0	1.1	No	Yes	0.96	Yes	No	0.064	No	Yes	NA	NA	NA	NA	2	TRUE	No
2014 UCR Upland Soil Study	ADA-026	Mn,Se	Zn	Sb,Ba,Pb,Mo,Ni,Se,Zn	OR	0.63	No	Yes	1.1	Yes	Yes	0.051	No	Yes	0.17	0.21	Yes	Yes	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-066	Mn	Zn	Sb,Pb,Se,Zn	0	0.66	No	Yes	0.40	Yes	Yes	0.10	No	Yes	0.036	0.035	No	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-109	Mn	Zn	Sb,Pb,Se,Zn	OR	0.84	No	Yes	0.88	Yes	Yes	0.11	No	Yes	0.077	0.028	No	Yes	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-133	Mn	Zn	Sb,Pb,Se,Zn	0	0.86	No	Yes	0.50	Yes	Yes	0.082	No	Yes	0.031	0.038	No	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-153	As,Mn	Zn	Sb,Pb,Se,Zn	OR	1.2	No	Yes	0.60	Yes	Yes	0.085	No	Yes	0.015	0.023	No	Yes	OR	TRUE	No
2012 Ecology Upland Soil Study	SA11-6C	As,Mn	Pb,Zn	Cr,Pb,Se,Zn	OR	1.2	No	Yes	0.96	Yes	No	0.17	Yes	Yes	NA	NA	NA	NA	OR	TRUE	No
2012 Ecology Upland Soil Study	SA6-6C	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	OR	0.53	No	Yes	0.96	Yes	No	0.040	No	Yes	NA	NA	NA	NA	OR	FALSE	No
2014 UCR Upland Soil Study	ADA-082	Mn	NA	Sb,Cr,Pb,Se,Zn	OR	0.72	No	Yes	0.69	Yes	Yes	0.13	Yes	Yes	0.013	0.029	No	Yes	OR	TRUE	No
2012 Ecology Upland Soil Study	SA12-3C	Mn,Se	NA	Pb,Se,Zn	OR	0.61	No	Yes	1.2	Yes	Yes	0.085	No	Yes	NA	NA	NA	NA	OR	TRUE	No
2012 Ecology Upland Soil Study	SA4-3C	Al,As,Fe,Mn	Zn	Cr,Pb,Se,Zn	OR	1.1	No	Yes	0.96	Yes	No	0.15	Yes	Yes	NA	NA	NA	NA	OR	FALSE	No
2012 Ecology Upland Soil Study	SA9-10C	As,Mn	Pb,Zn	As,Cr,Pb,Se,Zn	OR	1.7	Yes	Yes	0.96	Yes	No	0.14	Yes	Yes	NA	NA	NA	NA	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-017	As,Mn	Zn	Sb,Pb,Se,Zn	1	1.0	No	Yes	0.44	Yes	Yes	0.075	No	Yes	0.012	0.028	No	Yes	3	TRUE	No
2014 UCR Upland Soil Study	ADA-021	As,Mn	NA	Sb,Cu,Pb,Mo,Ni,Se,Zn	OR	1.3	No	Yes	0.73	Yes	Yes	0.12	No	Yes	0.25	0.058	Yes	Yes	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-054	As,Mn	Zn	Sb,As,Pb,Se,Zn	OR	1.3	Yes	Yes	0.79	Yes	Yes	0.087	No	Yes	0.046	0.038	No	Yes	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-124	Al,Fe,Mn	Zn	Sb,Pb,Se,Zn	1	0.68	No	Yes	0.48	Yes	Yes	0.059	No	Yes	0.019	0.034	No	Yes	3	FALSE	No
2014 UCR Upland Soil Study	ADA-141	Mn	Zn	Sb,Pb,Se,Zn	0	0.67	No	Yes	0.37	Yes	Yes	0.088	No	Yes	0.0099	0.026	No	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-155	Al,Mn	Zn	Sb,Pb,Se,Zn	0	0.95	No	Yes	0.48	Yes	Yes	0.051	No	Yes	0.0059	0.024	No	Yes	2	FALSE	No
2014 UCR Upland Soil Study	ADA-001	Mn	Zn	Sb,Pb,Se,Zn	0	0.89	No	Yes	0.52	Yes	Yes	0.099	No	Yes	0.012	0.023	No	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-046	Mn	Zn	Sb,Pb,Se,Zn	0	0.78	No	Yes	0.48	Yes	Yes	0.069	No	Yes	0.0096	0.022	No	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-165	As,Mn	Pb,Zn	Sb,Pb,Se,Zn	0	1.2	No	Yes	0.73	Yes	Yes	0.092	No	Yes	0.020	0.024	No	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-168	As,Mn	Pb,Zn	Sb,As,Pb,Se,Zn	2	1.4	Yes	Yes	0.56	Yes	Yes	0.086	No	Yes	0.054	0.024	No	Yes	2	TRUE	No
2012 Ecology Upland Soil Study	SA3-5C	Mn	NA	Pb,Se,Zn	2	0.48	No	Yes	0.96	Yes	No	0.11	No	Yes	NA	NA	NA	NA	2	TRUE	No
2012 Ecology Upland Soil Study	SA4-8C	Mn	NA	Pb,Se,Zn	0	0.69	No	Yes	0.96	Yes	No	0.071	No	Yes	NA	NA	NA	NA	2	TRUE	No
2012 Ecology Upland Soil Study	SA8-5C	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	OR	0.94	No	Yes	0.96	Yes	No	0.062	No	Yes	NA	NA	NA	NA	OR	FALSE	No
2012 Ecology Upland Soil Study	SA8-4C	Mn	Pb,Zn	Pb,Se,Zn	OR	0.65	No	Yes	0.96	Yes	No	0.056	No	Yes	NA	NA	NA	NA	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-146	Mn	Zn	Sb,Pb,Se,Zn	0	0.93	No	Yes	0.48	Yes	Yes	0.069	No	Yes	0.016	0.023	No	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-182	Mn,Se	Zn	Sb,Pb,Mo,Se,Zn	OR	0.45	No	Yes	1.2	Yes	Yes	0.079	No	Yes	0.026	0.11	Yes	Yes	OR	TRUE	No
2012 Ecology Upland Soil Study	SA4-2C	Mn	NA	Pb,Se,Zn	OR	0.51	No	Yes	0.96	Yes	No	0.12	No	Yes	NA	NA	NA	NA	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-005	As,Mn,Se	Zn	Sb,Pb,Mo,Ni,Se,Zn	2	1.1	No	Yes	1.7	Yes	Yes	0.11	No	Yes	0.082	0.23	Yes	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-050	As,Mn,Se	Zn	Sb,Cr,Cu,Pb,Se,Zn	OR	1.2	No	Yes	1.3	Yes	Yes	0.17	Yes	Yes	0.065	0.049	No	Yes	OR	TRUE	No
2012 Ecology Upland Soil Study	SA5-8C	As,Mn	Pb,Zn	As,Cr,Pb,Se,Zn	1	1.5	Yes	Yes	0.96	Yes	No	0.18	Yes	Yes	NA	NA	NA	NA	1	TRUE	No
2012 Ecology Upland Soil Study	SA7-5C	Al,As,Mn	Pb,Zn	Sb,As,Cu,Pb,Se,Tl,Zn	OR	2.0	Yes	Yes	0.96	Yes	No	0.079	No	Yes	NA	NA	NA	NA	OR	FALSE	No
2012 Ecology Upland Soil Study	SA7-6C	Mn	Pb,Zn	Sb,Pb,Se,Zn	0	0.87	No	Yes	0.96	Yes	No	0.066	No	Yes	NA	NA	NA	NA	2	TRUE	No
2012 Ecology Upland Soil Study	SA8-2C	Al,As,Mn	Pb,Zn	Sb,As,Pb,Se,Zn	OR	1.6	Yes	Yes	0.96	Yes	No	0.048	No	Yes	NA	NA	NA	NA	OR	FALSE	No
2014 UCR Upland Soil Study	ADA-015	Mn	Zn	Sb,Pb,Se,Zn	0	0.46	No	Yes	0.27	Yes	Yes	0.061	No	Yes	0.020	0.027	No	Yes	2	TRUE	No
2012 Ecology Upland Soil Study	SA5-4C	Mn	Pb,Zn	Sb,Pb,Se,Zn	1	0.58	No	Yes	0.96	Yes	No	0.10	No	Yes	NA	NA	NA	NA	1	TRUE	No
2014 UCR Upland Soil Study	ADA-019	Mn	NA	Sb,Cr,Pb,Se,Zn	1	0.77	No	Yes	0.42	Yes	Yes	0.16	Yes	Yes	0.037	0.025	No	Yes	1	TRUE	No
2014 UCR Upland Soil Study	ADA-158	As,Mn	Pb,Zn	Sb,As,Pb,Se,Zn	1	1.3	Yes	Yes	0.87	Yes	Yes	0.10	No	Yes	0.019	0.024	No	Yes	3	TRUE	No
2012 Ecology Upland Soil Study	SA11-3C	Mn,Se	NA	Pb,Se,Zn	1	0.50	No	Yes	1.3	Yes	Yes	0.12	No	Yes	NA	NA	NA	NA	1	TRUE	No
2014 UCR Upland Soil Study	ADA-002	Mn,Se	Zn	Sb,Pb,Mo,Ni,Se,Zn	2	0.78	No	Yes	1.4	Yes	Yes	0.12	No	Yes	0.11	0.17	Yes	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-110	Mn	Zn	Sb,Pb,Se,Zn	0	0.70	No	Yes	0.42	Yes	Yes	0.11	No	Yes	0.015	0.015	No	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-125	Mn	Zn	Sb,Pb,Se,Zn	1	0.73	No	Yes	0.37	Yes	Yes	0.051	No	Yes	0.021	0.031	No	Yes	3	TRUE	No
2014 UCR Upland Soil Study	ADA-136	Mn	Zn	Sb,Pb,Se,Zn	1	0.58	No	Yes	0.42	Yes	Yes	0.073	No	Yes	0.018	0.021	No	Yes	1	TRUE	No
2014 UCR Upland Soil Study	ADA-142	Mn	Zn	Sb,Pb,Se,Zn	1	0.61	No	Yes	0.38	Yes	Yes	0.064	No	Yes	0.024	0.019	No	Yes	1	TRUE	No
2014 UCR Upland Soil Study	ADA-183	Mn,Se	Zn	Sb,Ba,Pb,Mo,Ni,Se,Zn	OR	0.91	No	Yes	6.4	Yes	Yes	0.077	No	Yes	0.049	0.30	Yes	Yes	OR	TRUE	No
2012 Ecology Upland Soil Study	SA6-8C	Mn	Zn	Sb,Pb,Se,Zn	OR	0.72	No	Yes	0.96	Yes	No	0.048	No	Yes	NA	NA	NA	NA	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-020	Mn	Zn	Sb,Pb,Se,Zn	2	0.57	No	Yes	0.33	Yes	Yes	0.10	No	Yes	0.038	0.029	No	Yes	3	TRUE	No
2014 UCR Upland Soil Study	ADA-065	Mn	Zn	Sb,Pb,Se,Zn	2	0.59	No	Yes	0.33	Yes	Yes	0.057	No	Yes	0.025	0.020	No	Yes	2	TRUE	No
2012 Ecology Upland Soil Study	SA5-5C	Mn	Zn	Pb,Se,Zn	OR	0.47	No	Yes	0.96	Yes	No	0.11	No	Yes	NA	NA	NA	NA	OR	TRUE	No
2014 UCR Upland Soil Study	ADA-006	Mn	Zn	Sb,Pb,Se,Zn	1	0.68	No	Yes	0.38	Yes	Yes	0.079	No	Yes	0.017	0.02	No	Yes	3	TRUE	No
2014 UCR Upland Soil Study	ADA-148	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	1	0.92	No	Yes	0.46	Yes	Yes	0.067	No	Yes	0.0049	0.017	No	Yes	3	FALSE	No
2014 UCR Upland Soil Study	ADA-162	As,Mn	Pb,Zn	Sb,Pb,Se,Zn	0	1.1	No	Yes	0.81	Yes	Yes	0.055	No	Yes	0.033	0.017	No	Yes	2	TRUE	No
2012 Ecology Upland Soil Study	SA5-7C	Mn	Pb,Zn	Pb,Se,Zn	1	0.56	No	Yes	0.96	Yes	No	0.082	No	Yes	NA	NA	NA	NA	1	TRUE	No
2012 Ecology Upland Soil Study	SA2-5C	Mn	NA	Pb,Se	0	0.41	No	Yes	0.96	Yes	No	0.11	No	Yes	NA	NA	NA	NA	2	TRUE	No
2014 UCR Upland Soil Study	ADA-016	Mn	Zn	Sb,Pb,Se,Zn	1	0.46	No	Yes	0.27	Yes	Yes	0.067	No	Yes	0.73	0.022	No	Yes	3	TRUE	No

Table 6-2. Hazard Quotients for Plants for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, and Potentially Affected Fraction at Each Sampling Location for Each Study

					Anionic metals																
						Arsenic			Selenium			Chromium			Molybdenum					Aluminum	
Study	Location ID	COPCs with SSL HQ ≥ 1 COPCs with BABs Not included	COPCs with BAB HQ ≥ 1	COPCs with concentration > BTV	Anionic metal bioavailability score	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	BAB HQ	SSL HQ	>BTV	Detect	Cationic metal bioavailability score	pH ≥ 5.5	>BTV
2014 UCR Upland Soil Study	ADA-023	As,Mn,Se	Zn	Sb,Cr,Pb,Mo,Se,Zn	2	1.0	No	Yes	1.6	Yes	Yes	0.14	Yes	Yes	0.11	0.14	Yes	Yes	2	TRUE	No
2015 Bossburg Study	UDU-05-ICS	Mn	NA	Sb,Cr,Pb,Se,Zn	2	0.35	No	Yes	0.31	Yes	Yes	0.13	Yes	Yes	NA	NA	NA	NA	2	TRUE	No
2012 Ecology Upland Soil Study	SA7-3C	Al,As,Mn	Pb,Zn	Sb,As,Pb,Se,Zn	OR	1.6	Yes	Yes	0.96	Yes	No	0.054	No	Yes	NA	NA	NA	NA	OR	FALSE	No
2012 Ecology Upland Soil Study	SA8-3C	Mn	Zn	Pb,Se,Zn	1	0.66	No	Yes	0.96	Yes	No	0.090	No	Yes	NA	NA	NA	NA	3	TRUE	No
2012 Ecology Upland Soil Study	SA7-2C	Mn	Pb,Zn	Pb,Se,Zn	2	0.49	No	Yes	0.96	Yes	No	0.095	No	Yes	NA	NA	NA	NA	2	TRUE	No
2014 UCR Upland Soil Study	ADA-135	Mn	Zn	Sb,Pb,Se,Zn	2	0.49	No	Yes	0.48	Yes	Yes	0.11	No	Yes	0.053	0.020	No	Yes	3	TRUE	No
2015 Bossburg Study	UDU-06-ICS	Mn,Se	NA	Sb,Pb,Se	2	0.59	No	Yes	1.3	Yes	Yes	0.12	No	Yes	NA	NA	NA	NA	0	TRUE	No
2012 Ecology Upland Soil Study	SA9-4C	Mn,Se	Pb,Zn	Sb,Pb,Se,Zn	2	0.99	No	Yes	1.9	Yes	Yes	0.10	No	Yes	NA	NA	NA	NA	2	TRUE	No
2014 UCR Upland Soil Study	ADA-132	Al,Fe,Mn	Zn	Sb,Pb,Se,Zn	0	0.66	No	Yes	0.42	Yes	Yes	0.085	No	Yes	0.0015	0.028	No	Yes	2	FALSE	No
2014 UCR Upland Soil Study	ADA-143	Mn	Zn	Sb,Pb,Se,Zn	1	0.55	No	Yes	0.40	Yes	Yes	0.065	No	Yes	0.013	0.019	No	Yes	3	TRUE	No
2014 UCR Upland Soil Study	ADA-144	As,Mn	Zn	Sb,Pb,Se,Zn	0	1.1	No	Yes	0.50	Yes	Yes	0.039	No	Yes	0.014	0.017	No	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-150	Mn	Pb,Zn	Sb,Pb,Se,Zn	1	0.98	No	Yes	0.48	Yes	Yes	0.054	No	Yes	0.012	0.015	No	Yes	3	TRUE	No
2014 UCR Upland Soil Study	ADA-160	Mn	Zn	Sb,Pb,Se,Zn	1	0.77	No	Yes	0.35	Yes	Yes	0.052	No	Yes	0.0091	0.017	No	Yes	3	TRUE	No
2015 Bossburg Study	UDU-01-ICS	Mn	Zn	Sb,Pb,Se	2	0.35	No	Yes	0.25	Yes	Yes	0.062	No	Yes	NA	NA	NA	NA	2	TRUE	No
2015 Bossburg Study	UDU-02-ICS	Mn	Pb,Zn	Sb,Pb,Se,Zn	2	0.33	No	Yes	0.23	Yes	Yes	0.071	No	Yes	NA	NA	NA	NA	2	TRUE	No
2015 Bossburg Study	UDU-04-ICS	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	1	0.45	No	Yes	0.37	Yes	Yes	0.065	No	Yes	NA	NA	NA	NA	3	FALSE	No
2012 Ecology Upland Soil Study	SA13-4C	Mn,Se	NA	Pb,Se,Zn	0	0.29	No	Yes	3.8	Yes	No	0.12	No	Yes	NA	NA	NA	NA	2	TRUE	No
2014 UCR Upland Soil Study	ADA-128	Mn	Zn	Sb,Pb,Se,Zn	2	0.59	No	Yes	0.35	Yes	Yes	0.045	No	Yes	0.037	0.015	No	Yes	2	TRUE	No
2014 UCR Upland Soil Study	ADA-147	Mn	Pb,Zn	Sb,Pb,Se,Zn	0	0.94	No	Yes	0.56	Yes	Yes	0.039	No	Yes	0.019	0.015	No	Yes	2	TRUE	No
2015 Bossburg Study	UDU-03-ICS	Mn	Pb,Zn	Sb,Cu,Pb,Se,Zn	3	0.36	No	Yes	0.21	Yes	Yes	0.068	No	Yes	NA	NA	NA	NA	3	TRUE	No
2012 Ecology Upland Soil Study	SA7-4C	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	OR	0.56	No	Yes	0.96	Yes	No	0.037	No	Yes	NA	NA	NA	NA	OR	FALSE	No
2014 UCR Upland Soil Study	ADA-151	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	1	0.76	No	Yes	0.52	Yes	Yes	0.067	No	Yes	0.0077	0.012	No	Yes	3	FALSE	No
2012 Ecology Upland Soil Study	SA6-5C	NA	NA	Pb,Se	1	0.38	No	Yes	0.96	Yes	No	0.044	No	Yes	NA	NA	NA	NA	3	TRUE	No
2012 Ecology Upland Soil Study	SA6-4C	NA	NA	Pb,Se	0	0.32	No	Yes	0.96	Yes	No	0.047	No	Yes	NA	NA	NA	NA	2	TRUE	No
2012 Ecology Upland Soil Study	SA10-4C	Se	NA	Sb,Pb,Se,Zn	OR	0.31	No	Yes	10	Yes	Yes	0.059	No	Yes	NA	NA	NA	NA	OR	TRUE	No

Source: U.S. Environmental Protection Agency (EPA). 2005. *Guidance for Developing Ecological Soil Screening Levels* . OSWER Directive 9285.7-55. Office of Solid Waste and Emergency Response. https://www.epa.gov/sites/default/files/2015-09/documents/ecossl_guidance_chapters.pdf.

Notes:

HQs, PAFs, and BTV comparisons for each sample are presented in Appendix F

Qualitative bioavailability score: OR - Out of range due to high organic matter; 0 = very low; 1 = low; 2 = medium; 3 = high; Based on EPA (2005b).

> = greater than

≥ = greater than or equal to

Al = aluminum

As = arsenic

Ba = barium

BAB = bioavailability-adjusted benchmark

BTV = background threshold value

Co = cobalt

COPC = chemical of potential concern

Cr = chromium

Cu = copper

Fe = iron

HQ = hazard quotient

ID = identification

Mn = manganese

Mo = molybdenum

NA = not applicable

Ni = nickel

PAF = potentially affected fraction

Pb = lead

Sb = antimony

Se = selenium

SSL = soil screening level

Tl = thallium

UCR = Upper Columbia River

Zn = zinc

Table 6-2. Hazard Quotients for Plants for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, and Potentially Affected Fraction at Each

					Cationic metals																	
						Antimony			Barium			Cobalt					Copper				Iron	
Study	Location ID	COPCs with SSL HQ ≥ 1 COPCs with BABs Not included	COPCs with BAB HQ ≥ 1	COPCs with concentration > BTV	Detect	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	PAF (%)	BAB HQ	SSL HQ	>BTV	Detect	BAB HQ	SSL HQ	>BTV	Detect	pH exceeds SSL	>BTV
2012 Ecology Upland Soil Study	SA10-2C	As,Mn,Se	Pb,Zn	Sb,As,Ba,Co,Cu,Fe,Pb,Mn,Ni,Se,Tl,Zn	Yes	<0.001	Yes	Yes	0.35	Yes	Yes	0.0014	0.21	1.7	Yes	Yes	0.19	0.90	Yes	Yes	TRUE	Yes
2012 Ecology Upland Soil Study	SA10-7C	As,Mn	Zn	As,Ba,Pb,Mn,Ni,Se,Zn	Yes	<0.001	No	Yes	0.36	Yes	Yes	<0.001	0.12	0.95	No	Yes	0.12	0.55	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA10-3C	As,Mn	Zn	Sb,As,Ba,Cu,Pb,Mn,Ni,Se,Zn	Yes	<0.001	Yes	Yes	0.36	Yes	Yes	<0.001	0.12	0.93	No	Yes	0.12	0.60	Yes	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA10-8C	As,Mn	Zn	Pb,Mn,Se,Zn	Yes	<0.001	No	Yes	0.26	No	Yes	<0.001	0.090	0.69	No	Yes	0.080	0.39	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA11-9C	As,Mn,Se	Pb,Zn	Sb,As,Ba,Cr,Cu,Pb,Mn,Ni,Se,Tl,Zn	Yes	<0.001	Yes	Yes	0.30	Yes	Yes	0.0013	0.21	0.94	No	Yes	0.17	0.62	Yes	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA12-9C	Mn	NA	Ba,Pb,Mn,Ni,Se,Zn	Yes	<0.001	No	No	0.29	Yes	Yes	<0.001	0.16	0.79	No	Yes	0.074	0.28	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA1-1C	Mn,Se	NA	Ba,Cr,Pb,Mn,Se,Zn	Yes	<0.001	No	No	0.47	Yes	Yes	<0.001	0.16	0.84	No	Yes	0.093	0.36	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA1-2C	Mn	Zn	Ba,Cr,Fe,Pb,Mn,Se,Zn	Yes	<0.001	No	No	0.79	Yes	Yes	<0.001	0.19	0.95	No	Yes	0.067	0.26	No	Yes	TRUE	Yes
2012 Ecology Upland Soil Study	SA12-7C	Mn	Zn	Ba,Pb,Mn,Se,Zn	Yes	<0.001	No	No	0.42	Yes	Yes	<0.001	0.13	0.66	No	Yes	0.10	0.37	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA2-1C	Mn	Zn	Ba,Pb,Mn,Se,Zn	Yes	<0.001	No	Yes	0.53	Yes	Yes	0.0032	0.23	0.49	No	Yes	0.12	0.29	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA3-6C	Mn	Pb,Ni,Zn	Ba,Cr,Co,Cu,Fe,Pb,Mn,Ni,Se,Tl,Zn	Yes	<0.001	No	No	0.66	Yes	Yes	0.0563	0.38	1.8	Yes	Yes	0.18	0.67	Yes	Yes	TRUE	Yes
2014 UCR Upland Soil Study	ADA-061	Mn	NA	Sb,Ba,Cr,Pb,Mn,Ni,Se,Zn	Yes	<0.001	Yes	Yes	0.44	Yes	Yes	<0.001	0.16	1.0	No	Yes	0.064	0.28	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA10-6C	Mn	NA	Ba,Pb,Mn,Se,Zn	Yes	<0.001	No	No	0.30	Yes	Yes	<0.001	0.11	0.82	No	Yes	0.079	0.38	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA13-6C	As,Mn	NA	Pb,Mn,Se,Zn	Yes	<0.001	No	Yes	0.21	No	Yes	<0.001	0.066	0.54	No	Yes	0.049	0.24	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-064	Al,Mn	Zn	Sb,Ba,Cr,Pb,Mn,Se,Zn	Yes	<0.001	Yes	Yes	0.37	Yes	Yes	0.0011	0.20	0.84	No	Yes	0.083	0.29	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-107	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Mo,Ni,Se,Zn	Yes	<0.001	Yes	Yes	0.41	Yes	Yes	0.0103	0.28	1.1	No	Yes	0.14	0.48	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-103	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Ni,Se,Zn	Yes	0.001	Yes	Yes	0.37	Yes	Yes	0.0031	0.24	1.2	No	Yes	0.096	0.37	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-056	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Se,Zn	Yes	<0.001	Yes	Yes	0.39	Yes	Yes	<0.001	0.20	0.78	No	Yes	0.074	0.25	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA6-1C	Mn	Pb,Zn	Pb,Mn,Se,Zn	Yes	<0.001	No	Yes	0.25	No	Yes	0.0289	0.33	0.64	No	Yes	0.11	0.26	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA9-8C	As,Mn	Pb,Zn	Sb,As,Ba,Cr,Pb,Mn,Se,Tl,Zn	Yes	<0.001	Yes	Yes	0.38	Yes	Yes	<0.001	0.20	0.88	No	Yes	0.15	0.55	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-058	Mn	NA	Sb,Ba,Pb,Mn,Mo,Se,Zn	Yes	<0.001	Yes	Yes	0.30	Yes	Yes	<0.001	0.17	0.82	No	Yes	0.057	0.21	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-053	Mn	NA	Sb,Ba,Cr,Pb,Mn,Se,Zn	Yes	<0.001	Yes	Yes	0.40	Yes	Yes	<0.001	0.11	0.77	No	Yes	0.057	0.26	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-093	As,Mn	Zn	Sb,Ba,Pb,Mn,Se,Zn	Yes	0.0012	Yes	Yes	0.29	Yes	Yes	<0.001	0.13	0.63	No	Yes	0.060	0.22	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-059	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Mo,Se,Zn	Yes	0.0011	Yes	Yes	0.42	Yes	Yes	0.0011	0.20	0.86	No	Yes	0.094	0.33	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA9-1C	As,Mn	Pb,Zn	As,Ba,Cr,Pb,Mn,Se,Tl,Zn	Yes	<0.001	No	Yes	0.51	Yes	Yes	<0.001	0.17	0.77	No	Yes	0.13	0.46	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA9-5C	As,Mn	Pb,Zn	Sb,As,Ba,Pb,Mn,Se,Zn	Yes	<0.001	Yes	Yes	0.31	Yes	Yes	<0.001	0.13	0.60	No	Yes	0.12	0.44	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA1-6C	As,Mn	NA	Pb,Mn,Se,Zn	Yes	<0.001	No	No	0.18	No	Yes	<0.001	0.14	0.69	No	Yes	0.062	0.24	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-055	As,Ba,Mn,Se	Zn	Sb,As,Ba,Cu,Pb,Mn,Mo,Ni,Se,Zn	Yes	0.0018	Yes	Yes	1.0	Yes	Yes	<0.001	0.18	0.72	No	Yes	0.17	0.61	Yes	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA11-5C	Al,As,Mn	Zn	Sb,Ba,Pb,Mn,Se,Zn	Yes	<0.001	Yes	Yes	0.29	Yes	Yes	<0.001	0.11	0.49	No	Yes	0.10	0.34	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-122	Mn	NA	Sb,Ba,Pb,Mn,Se,Zn	Yes	<0.001	Yes	Yes	0.30	Yes	Yes	<0.001	0.12	0.62	No	Yes	0.048	0.19	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA12-1C	As,Mn	Zn	As,Cr,Cu,Fe,Pb,Mn,Ni,Se,Zn	Yes	<0.001	No	Yes	0.19	No	Yes	0.0100	0.28	1.4	No	Yes	0.20	0.76	Yes	Yes	TRUE	Yes
2014 UCR Upland Soil Study	ADA-084	Mn	NA	Sb,Pb,Mn,Se,Zn	Yes	0.0014	Yes	Yes	0.23	No	Yes	<0.001	0.084	0.70	No	Yes	0.058	0.29	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-099	As,Mn	Zn	Sb,Cr,Pb,Mn,Se,Zn	Yes	0.0017	Yes	Yes	0.27	No	Yes	<0.001	0.12	0.72	No	Yes	0.076	0.32	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-106	Al,Mn,Se	Zn	Sb,Ba,Pb,Mn,Mo,Se,Zn	Yes	<0.001	Yes	Yes	0.63	Yes	Yes	0.0022	0.22	0.84	No	Yes	0.098	0.32	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA11-8C	Al,As,Mn	Pb,Zn	Sb,As,Ba,Cr,Cu,Pb,Mn,Se,Tl,Zn	Yes	<0.001	Yes	Yes	0.37	Yes	Yes	<0.001	0.14	0.62	No	Yes	0.17	0.60	Yes	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-063	Mn	Zn	Sb,Ba,Pb,Mn,Mo,Se,Zn	Yes	0.0013	Yes	Yes	0.97	Yes	Yes	<0.001	0.16	0.71	No	Yes	0.069	0.25	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-089	As,Mn	Zn	Sb,As,Ba,Cr,Pb,Mn,Se,Zn	Yes	0.0016	Yes	Yes	0.28	Yes	Yes	<0.001	0.19	0.84	No	Yes	0.098	0.35	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-092	As,Mn,Se	Zn	Sb,As,Ba,Cr,Pb,Mn,Mo,Se,Zn	Yes	0.0015	Yes	Yes	0.30	Yes	Yes	<0.001	0.085	0.66	No	Yes	0.071	0.34	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-112	Mn	NA	Sb,Ba,Pb,Mn,Se,Zn	Yes	<0.001	Yes	Yes	0.32	Yes	Yes	<0.001	0.091	0.64	No	Yes	0.062	0.28	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-025	As,Mn,Se	Zn	Sb,Ba,Pb,Mn,Mo,Se,Zn	Yes	0.0015	Yes	Yes	0.58	Yes	Yes	<0.001	0.14	0.54	No	Yes	0.10	0.35	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-113	Mn	NA	Sb,Ba,Cr,Pb,Mn,Se,Zn	Yes	<0.001	Yes	Yes	0.39	Yes	Yes	<0.001	0.12	0.66	No	Yes	0.064	0.26	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-114	Al,Fe,Mn	Zn	Sb,Ba,Pb,Mn,Se,Zn	Yes	<0.001	Yes	Yes	0.28	Yes	Yes	<0.001	0.11	0.55	No	Yes	0.061	0.24	No	Yes	FALSE	No
2012 Ecology Upland Soil Study	SA12-2C	Al,Mn	Zn	Pb,Mn,Se,Zn	Yes	<0.001	No	No	0.18	No	Yes	<0.001	0.13	0.68	No	Yes	0.068	0.26	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA13-3C	Mn	NA	Pb,Mn,Se,Zn	Yes	<0.001	No	Yes	0.27	No	Yes	<0.001	0.065	0.53	No	Yes	0.052	0.26	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA13-5C	As,Mn	Pb,Zn	Sb,Ba,Cr,Cu,Pb,Mn,Se,Zn	Yes	<0.001	Yes	Yes	0.32	Yes	Yes	<0.001	0.10	0.85	No	Yes	0.13	0.62	Yes	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-049	Mn	Zn	Sb,Ba,Pb,Mn,Mo,Se,Zn	Yes	<0.001	Yes	Yes	0.44	Yes	Yes	0.0049	0.25	0.63	No	Yes	0.12	0.31	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA11-7C	Al,As,Mn,Se	Pb,Zn	Sb,As,Ba,Cu,Pb,Mn,Se,Tl,Zn	Yes	0.0091	Yes	Yes	0.62	Yes	Yes	<0.001	0.07	0.32	No	Yes	0.21	0.74	Yes	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA3-3C	Mn	Zn	Ba,Cr,Pb,Mn,Ni,Se,Zn	Yes	<0.001	No	No	0.30	Yes	Yes	<0.001	0.18	0.85	No	Yes	0.084	0.31	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-118	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Se,Zn	Yes	<0.001	Yes	Yes	0.29	Yes	Yes	<0.001	0.17	0.68	No	Yes	0.076	0.26	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-174	Al,Mn	Zn	Sb,Ba,Pb,Mn,Mo,Se,Zn	Yes	0.001	Yes	Yes	0.29	Yes	Yes	<0.001	0.070	0.43	No	Yes	0.035	0.15	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA6-7C	Al,As,Mn	Pb,Zn	Sb,As,Cr,Pb,Mn,Se,Zn	Yes	<0.001	Yes	Yes	0.21	No	Yes	0.0545	0.37	0.72	No	Yes	0.21	0.47	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-010	As,Mn	Zn	Sb,As,Pb,Mn,Se,Zn	Yes	0.0024	Yes	Yes	0.14	No	Yes	<0.001	0.11	0.71	No	Yes	0.10	0.45	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA12-8C	Mn	Zn	Pb,Mn,Se,Zn	Yes	<0.001	No	No	0.26	No	Yes	<0.001	0.11	0.55	No	Yes	0.057	0.22	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-067	Mn	Zn	Sb,Ba,Cr,Cu,Pb,Mn,Mo,Se,Zn	Yes	<0.001	Yes	Yes	0.57	Yes	Yes	0.0111	0.28	0.86	No	Yes	0.22	0.66	Yes	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA9-9C	As,Mn	Zn	As,Cr,Pb,Mn,Ni,Se,Zn	Yes	<0.001	No	No	0.27	No	Yes	<0.001	0.17	0.78	No	Yes	0.13	0.47	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA1-8C	Mn	NA	Ba,Pb,Mn,Se,Zn	Yes	<0.001	No	No	0.28	Yes	Yes	<0.001	0.091	0.46	No	Yes	0.053	0.20	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA11-4C	As,Mn	Pb,Zn	Sb,Ba,Pb,Mn,Se,Tl,Zn	Yes	<0.001	Yes	Yes	0.34	Yes	Yes	<0.001	0.11	0.52	No	Yes	0.10	0.36	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-173	Al,Mn	Zn	Sb,Pb,Mn,Mo,Se,Zn	Yes	<0.001	Yes	Yes	0.24	No	Yes	<0.001	0.13	0.54	No	Yes	0.061	0.21	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA3-2C	Mn	NA	Ba,Pb,Mn,Se,Zn	Yes	<0.001	No	No	0.31	Yes	Yes	<0.001	0.076	0.35	No	Yes	0.038	0.14	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-088	As,Mn	Zn	Sb,Cr,Pb,Mn,Se,Zn	Yes	0.0017	Yes	Yes	0.27	No	Yes	<0.001	0.15	0.85	No	Yes	0.089	0.36	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-090	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Se,Zn	Yes	0.0017	Yes	Yes	0.34	Yes	Yes	<0.001	0.11	0.66	No	Yes	0.066	0.28	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA2-4C	Al,Mn	Zn	Pb,Mn,Se,Zn	Yes	<0.001	No	Yes	0.22	No	Yes	0.0051	0.25	0.53	No	Yes	0.093	0.23	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA6-3C	Al,As,Mn	Pb,Zn	As,Cr,Pb,Mn,Se,Zn	Yes	<0.001	No	Yes	0.24	No	Yes	0.1790	0.46	0.90	No	Yes	0.21	0.48	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-117	Mn	Zn	Sb,Pb,Mn,Se,Zn	Yes	0.0012	Yes	Yes	0.21	No	Yes	0.0064	0.26	0.55	No	Yes	0.093	0.22	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA12-6C	Mn	Zn	Cu,Pb,Mn,Se,Zn	Yes	<0.001	No	No	0.26	No	Yes	<0.001	0.10	0.50	No	Yes	0.16	0.61	Yes	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA13-2C	Mn,Se	NA	Pb,Mn,Se,Zn	Yes	<0.001	No	No	0.22	No	Yes	<0.001	0.067	0.55	No	Yes	0.11	0.56	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA9-3C	Mn	Zn	Ba,Cr,Fe,Pb,Mn,Ni,Se,Zn	Yes	<0.001	No	No	0.42	Yes	Yes	0.0043	0.25	1.1	No	Yes	0.15	0.54	No	Yes	TRUE	Yes
2012 Ecology Upland Soil Study	SA9-7C	As,Mn	Pb,Zn	Sb,As,Cr,Pb,Mn,Se,Tl,Zn	Yes	<0.001	Yes	Yes	0.25	No	Yes	<0.001	0.15	0.66	No	Yes	0.12	0.44	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-035	Mn	Zn	Sb,Pb,Mn,Se,Zn	Yes	0.0012	Yes	Yes	0.22	No	Yes	<0.001	0.087	0.39	No	Yes	0.044	0.16	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-096	Mn	Zn	Sb,Ba,Pb,Mn,Se,Zn	Yes	0.0018	Yes	Yes	0.33	Yes	Yes	<0.001	0.083	0.53	No	Yes	0.060	0.26	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-078	As,Mn	Zn	Sb,Ba,Cr,Pb,Se,Zn	Yes	0.0026	Yes	Yes	0.30	Yes	Yes	0.0019	0.22	0.60	No	Yes	0.083	0.23	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-095	Mn	NA	Sb,Cr,Pb,Se,Zn	Yes	0.0014	Yes	Yes	0.25	No	Yes	<0.001	0.089	0.78	No	Yes	0.051	0.26	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA11-2C	Mn	NA	Ba,Pb,Se,Zn	Yes	<0.001	No	No	0.31	Yes	Yes	<0.001	0.13	0.61	No	Yes	0.074	0.27	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA13-8C	Al,Mn	NA	Pb,Se,Zn	Yes	<0.001	No	Yes	0.19	No	Yes	<0.001	0.073	0.60	No	Yes	0.047	0.23	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA4-7C	Mn	Zn	Cr,Pb,Ni,Se,Zn	Yes	<0.001	No	No	0.27	No	Yes	<0.001	0.15	0.72	No	Yes	0.10	0.37	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-097	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	Yes	0.0029	Yes	Yes	0.24	No	Yes	<0.001	0.065	0.64	No	Yes	0.075	0.41	No	Yes	TRUE	No

Table 6-2. Hazard Quotients for Plants for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, and Potentially Affected Fraction at Each

					Cationic metals																		
						Antimony			Barium			Cobalt					Copper				Iron		
Study	Location ID	COPCs with SSL HQ ≥ 1 COPCs with BABs Not included	COPCs with BAB HQ ≥ 1	COPCs with concentration > BTV	Detect	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	PAF (%)	BAB HQ	SSL HQ	>BTV	Detect	BAB HQ	SSL HQ	>BTV	Detect	pH exceeds SSL	>BTV
2014 UCR Upland Soil Study	ADA-104	Mn	Zn	Sb,Ba,Pb,Mo,Se,Zn	Yes	<0.001	Yes	Yes	0.30	Yes	Yes	<0.001	0.11	0.53	No	Yes	0.053	0.20	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-115	Mn	NA	Sb,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.23	No	Yes	<0.001	0.093	0.46	No	Yes	0.047	0.18	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-121	Mn	Zn	Sb,Cr,Pb,Se,Zn	Yes	0.0016	Yes	Yes	0.28	No	Yes	<0.001	0.15	0.76	No	Yes	0.095	0.37	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-179	Mn	Zn	Sb,Pb,Mo,Se,Zn	Yes	<0.001	Yes	Yes	0.21	No	Yes	<0.001	0.10	0.46	No	Yes	0.047	0.17	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-181	Mn,Se	Zn	Sb,Ba,Pb,Mo,Se,Zn	Yes	0.001	Yes	Yes	0.30	Yes	Yes	<0.001	0.058	0.47	No	Yes	0.052	0.25	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA2-8C	Mn	Zn	Cr,Pb,Se,Zn	Yes	<0.001	No	No	0.28	No	Yes	0.0184	0.31	0.65	No	Yes	0.10	0.25	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-033	Mn	Zn	Sb,Ba,Pb,Mo,Ni,Se,Zn	Yes	<0.001	Yes	Yes	0.37	Yes	Yes	<0.001	0.19	0.47	No	Yes	0.088	0.23	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-184	Mn,Se	Zn	Sb,Ba,Pb,Mo,Se,Zn	Yes	<0.001	Yes	Yes	0.54	Yes	Yes	<0.001	0.085	0.58	No	Yes	0.070	0.31	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA1-5C	Mn	NA	Pb,Se,Zn	Yes	<0.001	No	No	0.19	No	Yes	<0.001	0.13	0.64	No	Yes	0.073	0.28	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA6-2C	Mn	Pb,Zn	Pb,Se,Zn	Yes	<0.001	No	Yes	0.23	No	Yes	0.0428	0.35	0.68	No	Yes	0.18	0.40	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA9-6C	Mn	Pb,Zn	Sb,Cr,Pb,Se,Tl,Zn	Yes	<0.001	Yes	Yes	0.26	No	Yes	<0.001	0.15	0.66	No	Yes	0.11	0.40	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-177	Al,Fe,Mn	NA	Sb,Pb,Se	Yes	<0.001	Yes	Yes	0.13	No	Yes	<0.001	0.11	0.76	No	Yes	0.040	0.19	No	Yes	FALSE	No
2012 Ecology Upland Soil Study	SA1-7C	Mn	NA	Pb,Se,Zn	Yes	<0.001	No	No	0.16	No	Yes	<0.001	0.11	0.55	No	Yes	0.059	0.23	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA2-7C	Mn	Zn	Cr,Pb,Ni,Se,Zn	Yes	<0.001	No	No	0.15	No	Yes	0.7410	0.63	1.4	No	Yes	0.20	0.49	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA2-2C	Mn	Zn	Cr,Pb,Se,Zn	Yes	<0.001	No	No	0.24	No	Yes	0.0184	0.31	0.65	No	Yes	0.10	0.25	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA3-7C	Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.21	No	Yes	<0.001	0.11	0.52	No	Yes	0.11	0.41	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA5-3C	Mn	Zn	Pb,Se,Zn	Yes	<0.001	No	Yes	0.21	No	Yes	0.0014	0.21	0.58	No	Yes	0.16	0.44	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-045	As,Mn	Pb,Zn	Sb,As,Pb,Se,Zn	Yes	0.0031	Yes	Yes	0.18	No	Yes	<0.001	0.088	0.54	No	Yes	0.093	0.39	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-085	Mn	Zn	Sb,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.21	No	Yes	<0.001	0.054	0.59	No	Yes	0.042	0.24	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-101	Mn	NA	Sb,Pb,Se,Zn	Yes	0.0021	Yes	Yes	0.17	No	Yes	<0.001	0.077	0.63	No	Yes	0.060	0.30	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-116	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.0011	Yes	Yes	0.19	No	Yes	0.0013	0.20	0.55	No	Yes	0.076	0.21	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-172	Al,Mn	NA	Sb,Pb,Se	Yes	<0.001	Yes	Yes	0.16	No	Yes	<0.001	0.036	0.41	No	Yes	0.020	0.12	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA10-1C	Mn	Zn	Ba,Cr,Pb,Se,Zn	Yes	<0.001	No	No	0.36	Yes	Yes	<0.001	0.090	0.69	No	Yes	0.12	0.56	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-039	Mn	Zn	Sb,Ba,Pb,Mo,Se,Zn	Yes	<0.001	Yes	Yes	0.45	Yes	Yes	0.0101	0.27	0.50	No	Yes	0.085	0.19	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-111	Mn	Zn	Sb,Cr,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.26	No	Yes	0.0020	0.22	0.78	No	Yes	0.099	0.31	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-175	Al,Mn	NA	Sb,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.20	No	Yes	<0.001	0.17	0.57	No	Yes	0.060	0.19	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA7-1C	Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.21	No	Yes	0.0092	0.27	0.42	No	Yes	0.13	0.27	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-076	Al,As,Mn,Se	Zn	Sb,As,Ba,Pb,Mo,Se,Zn	Yes	0.004	Yes	Yes	0.28	Yes	Yes	<0.001	0.11	0.60	No	Yes	0.073	0.30	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-105	Mn	Zn	Sb,Ba,Pb,Se,Zn	Yes	0.002	Yes	Yes	0.30	Yes	Yes	<0.001	0.15	0.70	No	Yes	0.10	0.36	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA1-3C	Mn	NA	Ba,Cr,Pb,Se,Zn	Yes	<0.001	No	No	0.30	Yes	Yes	<0.001	0.15	0.77	No	Yes	0.080	0.31	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA4-6C	Mn	Pb,Zn	Cr,Pb,Se,Zn	Yes	<0.001	No	Yes	0.15	No	Yes	<0.001	0.15	0.68	No	Yes	0.10	0.36	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA7-8C	As,Mn	Co,Pb,Ni,Zn	As,Ba,Cr,Co,Cu,Fe,Pb,Ni,Se,Tl,Zn	Yes	<0.001	No	Yes	0.36	Yes	Yes	5.2300	1.1	1.7	Yes	Yes	0.43	0.89	Yes	Yes	TRUE	Yes
2014 UCR Upland Soil Study	ADA-048	Ba,Mn,Se	NA	Sb,Ba,Pb,Mo,Se,Zn	Yes	0.0011	Yes	Yes	1.0	Yes	Yes	<0.001	0.073	0.73	No	Yes	0.072	0.39	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-079	Al,Mn	Zn	Sb,Ba,Pb,Mo,Se,Zn	Yes	0.0018	Yes	Yes	0.66	Yes	Yes	<0.001	0.054	0.50	No	Yes	0.051	0.27	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-152	As,Mn	Zn	Sb,As,Cr,Pb,Se,Zn	Yes	0.002	Yes	Yes	0.27	No	Yes	<0.001	0.19	0.72	No	Yes	0.10	0.34	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-018	Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	0.0037	Yes	Yes	0.19	No	Yes	<0.001	0.083	0.53	No	Yes	0.097	0.42	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-091	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	Yes	0.0016	Yes	Yes	0.22	No	Yes	<0.001	0.18	0.76	No	Yes	0.091	0.32	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA3-4C	Mn	NA	Pb,Se,Zn	Yes	<0.001	No	No	0.19	No	Yes	<0.001	0.081	0.38	No	Yes	0.040	0.15	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-102	Mn	Zn	Sb,Ba,Pb,Se,Zn	Yes	0.001	Yes	Yes	0.28	Yes	Yes	<0.001	0.19	0.69	No	Yes	0.086	0.27	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-156	As,Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	0.0036	Yes	Yes	0.23	No	Yes	<0.001	0.10	0.52	No	Yes	0.081	0.31	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA12-4C	Mn	NA	Ba,Pb,Se,Zn	Yes	<0.001	No	No	0.30	Yes	Yes	<0.001	0.10	0.52	No	Yes	0.055	0.21	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA5-2C	Mn	Zn	Ba,Cr,Fe,Pb,Ni,Se,Zn	Yes	<0.001	No	No	0.55	Yes	Yes	0.3720	0.55	1.5	No	Yes	0.12	0.33	No	Yes	TRUE	Yes
2014 UCR Upland Soil Study	ADA-043	Mn,Se	NA	Sb,Ba,Pb,Mo,Ni,Se,Zn	Yes	0.0012	Yes	Yes	0.83	Yes	Yes	<0.001	0.14	1.0	No	Yes	0.13	0.58	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-070	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	Yes	0.0028	Yes	Yes	0.25	No	Yes	<0.001	0.12	0.66	No	Yes	0.081	0.32	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-071	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.0021	Yes	Yes	0.20	No	Yes	<0.001	0.15	0.51	No	Yes	0.084	0.26	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-131	Al,As,Mn,Se	Pb,Zn	Sb,As,Ba,Pb,Se,Zn	Yes	0.0041	Yes	Yes	0.29	Yes	Yes	<0.001	0.18	0.56	No	Yes	0.10	0.33	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-169	Mn	NA	Sb,Pb,Se	Yes	<0.001	Yes	Yes	0.16	No	Yes	<0.001	0.11	0.71	No	Yes	0.037	0.18	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-044	Mn,Se	Zn	Sb,Ba,Cr,Pb,Mo,Ni,Se,Zn	Yes	<0.001	Yes	Yes	0.31	Yes	Yes	<0.001	0.15	0.87	No	Yes	0.098	0.40	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-119	Mn	NA	Sb,Cr,Pb,Se,Zn	Yes	0.001	Yes	Yes	0.19	No	Yes	<0.001	0.12	0.62	No	Yes	0.073	0.28	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA1-4C	Mn	NA	Ba,Pb,Se,Zn	Yes	<0.001	No	No	0.34	Yes	Yes	<0.001	0.12	0.62	No	Yes	0.056	0.21	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA7-7C	Al,As,Mn,Se	Pb,Zn	Sb,As,Pb,Se,Tl,Zn	Yes	<0.001	Yes	Yes	0.19	No	Yes	0.0225	0.31	0.49	No	Yes	0.26	0.53	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA8-8C	As,Mn,Se	Pb,Zn	Sb,As,Ba,Cu,Pb,Se,Tl,Zn	Yes	0.0014	Yes	Yes	0.30	Yes	Yes	<0.001	0.18	0.38	No	Yes	0.30	0.71	Yes	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-034	Mn	Zn	Sb,Pb,Mo,Se,Zn	Yes	<0.001	Yes	Yes	0.22	No	Yes	<0.001	0.20	0.52	No	Yes	0.083	0.23	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-057	Mn	NA	Sb,Cr,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.20	No	Yes	0.0041	0.24	0.88	No	Yes	0.12	0.38	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-094	Mn	NA	Sb,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.25	No	Yes	<0.001	0.19	0.61	No	Yes	0.077	0.23	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-170	Al,Mn	Zn	Sb,Pb,Mo,Se,Zn	Yes	<0.001	Yes	Yes	0.15	No	Yes	<0.001	0.087	0.57	No	Yes	0.048	0.21	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA3-8C	Mn	Zn	Pb,Se,Zn	Yes	<0.001	No	No	0.22	No	Yes	<0.001	0.082	0.38	No	Yes	0.054	0.20	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-028	As,Mn	Zn	Sb,Pb,Se,Zn	Yes	0.0016	Yes	Yes	0.16	No	Yes	<0.001	0.12	0.41	No	Yes	0.10	0.31	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-042	Mn	Zn	Sb,Ba,Pb,Mo,Se,Zn	Yes	0.001	Yes	Yes	0.32	Yes	Yes	0.0053	0.25	0.58	No	Yes	0.084	0.21	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-180	Mn,Se	Zn	Sb,Ba,Pb,Mo,Se,Zn	Yes	0.001	Yes	Yes	0.41	Yes	Yes	<0.001	0.075	0.47	No	Yes	0.054	0.23	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA11-1C	Mn	NA	Cr,Pb,Se,Zn	Yes	<0.001	No	No	0.16	No	Yes	<0.001	0.18	0.83	No	Yes	0.13	0.46	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA4-1C	Mn	Zn	Cr,Pb,Se,Zn	Yes	<0.001	No	Yes	0.21	No	Yes	<0.001	0.16	0.74	No	Yes	0.10	0.36	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-052	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	Yes	0.0025	Yes	Yes	0.24	No	Yes	<0.001	0.11	0.67	No	Yes	0.088	0.37	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-159	As,Mn	Pb,Zn	Sb,Cr,Pb,Se,Zn	Yes	0.0032	Yes	Yes	0.14	No	Yes	<0.001	0.16	0.66	No	Yes	0.11	0.33	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-178	Mn	NA	Sb,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.13	No	Yes	<0.001	0.14	0.80	No	Yes	0.047	0.19	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA13-1C	Mn	NA	Pb,Se,Zn	Yes	<0.001	No	No	0.19	No	Yes	<0.001	0.080	0.65	No	Yes	0.074	0.37	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA3-1C	Mn	NA	Pb,Se	Yes	<0.001	No	No	0.22	No	Yes	<0.001	0.11	0.49	No	Yes	0.068	0.25	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA5-1C	Mn,Se	Pb,Zn	Sb,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.14	No	Yes	<0.001	0.14	0.38	No	Yes	0.18	0.50	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA8-6C	Mn	Pb,Zn	Pb,Se,Zn	Yes	<0.001	No	Yes	0.14	No	Yes	<0.001	0.19	0.39	No	Yes	0.11	0.27	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-047	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	Yes	0.0021	Yes	Yes	0.16	No	Yes	<0.001	0.18	0.67	No	Yes	0.11	0.37	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-154	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	Yes	0.0022	Yes	Yes	0.22	No	Yes	<0.001	0.17	0.73	No	Yes	0.11	0.41	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-176	Mn	NA	Sb,Cr,Pb,Ni,Se	Yes	<0.001	Yes	Yes	0.26	No	Yes	0.0031	0.23	0.92	No	Yes	0.075	0.25	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA10-5C	Mn	NA	Cr,Pb,Se,Zn	Yes	<0.001	No	Yes	0.16	No	Yes	<0.001	0.086	0.66	No	Yes	0.062	0.30	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA13-7C	As,Mn	NA	Sb,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.21	No	Yes	<0.001	0.085	0.69	No	Yes	0.054	0.27	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA4-4C	Al,Mn	Zn	Cr,Pb,Se,Zn	Yes	<0.001	No	Yes	0.15	No	Yes	<0.001	0.14	0.64	No	Yes	0.11	0.39	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA4-5C	Mn	NA	Pb,Se,Zn	Yes	<0.001	No	No	0.12	No	Yes	<0.001	0.15	0.72	No	Yes	0.091	0.34	No	Yes	TRUE	No

Table 6-2. Hazard Quotients for Plants for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, and Potentially Affected Fraction at Each

					Cationic metals																	
						Antimony			Barium			Cobalt					Copper				Iron	
Study	Location ID	COPCs with SSL HQ ≥ 1 COPCs with BABs Not included	COPCs with BAB HQ ≥ 1	COPCs with concentration > BTV	Detect	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	PAF (%)	BAB HQ	SSL HQ	>BTV	Detect	BAB HQ	SSL HQ	>BTV	Detect	pH exceeds SSL	>BTV
2012 Ecology Upland Soil Study	SA9-2C	Ba,Cr,Mn	Ni,Zn	Ba,Cr,Co,Cu,Fe,Pb,Ni,Se,Tl,Zn	Yes	<0.001	No	No	1.8	Yes	Yes	0.0924	0.41	1.9	Yes	Yes	0.20	0.72	Yes	Yes	TRUE	Yes
2014 UCR Upland Soil Study	ADA-004	Mn	Zn	Sb,Ba,Pb,Mo,Se,Zn	Yes	0.0015	Yes	Yes	0.30	Yes	Yes	<0.001	0.19	0.48	No	Yes	0.12	0.32	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-073	Al,As,Mn	Zn	Sb,Pb,Se,Zn	Yes	0.003	Yes	Yes	0.20	No	Yes	<0.001	0.13	0.48	No	Yes	0.080	0.26	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA2-3C	Mn	Zn	Pb,Se,Zn	Yes	<0.001	No	No	0.23	No	Yes	<0.001	0.19	0.41	No	Yes	0.071	0.17	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-024	As,Mn	Pb,Zn	Sb,As,Cu,Pb,Se,Zn	Yes	0.0034	Yes	Yes	0.18	No	Yes	<0.001	0.085	0.40	No	Yes	0.17	0.61	Yes	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-108	Mn	Zn	Sb,Cr,Pb,Se,Zn	Yes	0.0011	Yes	Yes	0.19	No	Yes	<0.001	0.14	0.74	No	Yes	0.083	0.33	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-139	As,Mn	Zn	Sb,Pb,Se,Zn	Yes	0.0019	Yes	Yes	0.22	No	Yes	<0.001	0.18	0.61	No	Yes	0.088	0.27	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-171	Mn	Zn	Sb,Pb,Mo,Se,Zn	Yes	<0.001	Yes	Yes	0.16	No	Yes	<0.001	0.10	0.48	No	Yes	0.067	0.25	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA8-7C	As,Mn	Pb,Zn	Sb,As,Pb,Se,Tl,Zn	Yes	<0.001	Yes	Yes	0.19	No	Yes	0.0211	0.31	0.64	No	Yes	0.25	0.59	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-051	Mn,Se	Zn	Sb,Ba,Cu,Pb,Mo,Ni,Se,Zn	Yes	<0.001	Yes	Yes	0.57	Yes	Yes	<0.001	0.15	0.58	No	Yes	0.21	0.70	Yes	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-081	Mn	Zn	Sb,Cr,Pb,Se,Zn	Yes	0.0017	Yes	Yes	0.15	No	Yes	0.0011	0.20	0.58	No	Yes	0.086	0.25	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-145	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.002	Yes	Yes	0.17	No	Yes	<0.001	0.13	0.54	No	Yes	0.083	0.29	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-060	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	Yes	0.002	Yes	Yes	0.16	No	Yes	<0.001	0.17	0.75	No	Yes	0.13	0.45	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-126	As,Mn	Pb,Zn	Sb,Cu,Pb,Se,Zn	Yes	0.0021	Yes	Yes	0.20	No	Yes	<0.001	0.13	0.37	No	Yes	0.26	0.74	Yes	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-127	As,Mn	Zn	Sb,Ba,Pb,Se,Zn	Yes	0.0013	Yes	Yes	0.35	Yes	Yes	0.0024	0.23	0.80	No	Yes	0.13	0.42	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-161	Al,Fe,Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	0.0024	Yes	Yes	0.17	No	Yes	<0.001	0.17	0.46	No	Yes	0.10	0.28	No	Yes	FALSE	No
2014 UCR Upland Soil Study	ADA-164	As,Mn,Se	Pb,Zn	Sb,Pb,Se,Zn	Yes	0.0037	Yes	Yes	0.14	No	Yes	<0.001	0.088	0.40	No	Yes	0.088	0.32	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-008	As,Mn	Pb,Zn	Sb,Cr,Pb,Se,Zn	Yes	0.003	Yes	Yes	0.20	No	Yes	<0.001	0.12	0.50	No	Yes	0.085	0.29	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-062	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.0014	Yes	Yes	0.17	No	Yes	<0.001	0.092	0.54	No	Yes	0.068	0.28	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA2-6C	As,Mn	Pb,Zn	Cr,Pb,Se,Zn	Yes	<0.001	No	Yes	0.14	No	Yes	0.0329	0.34	0.72	No	Yes	0.18	0.43	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA8-1C	As,Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.14	No	Yes	<0.001	0.16	0.33	No	Yes	0.13	0.30	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-026	Mn,Se	Zn	Sb,Ba,Pb,Mo,Ni,Se,Zn	Yes	0.0013	Yes	Yes	0.45	Yes	Yes	<0.001	0.07	0.45	No	Yes	0.083	0.36	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-066	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.0011	Yes	Yes	0.15	No	Yes	<0.001	0.16	0.50	No	Yes	0.089	0.26	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-109	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.0026	Yes	Yes	0.15	No	Yes	<0.001	0.062	0.45	No	Yes	0.063	0.29	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-133	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.0017	Yes	Yes	0.15	No	Yes	<0.001	0.16	0.44	No	Yes	0.089	0.25	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-153	As,Mn	Zn	Sb,Pb,Se,Zn	Yes	0.0019	Yes	Yes	0.16	No	Yes	<0.001	0.10	0.55	No	Yes	0.084	0.34	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA11-6C	As,Mn	Pb,Zn	Cr,Pb,Se,Zn	Yes	<0.001	No	Yes	0.14	No	Yes	<0.001	0.15	0.67	No	Yes	0.13	0.46	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA6-6C	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.098	No	Yes	<0.001	0.10	0.20	No	Yes	0.13	0.29	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-082	Mn	NA	Sb,Cr,Pb,Se,Zn	Yes	0.0011	Yes	Yes	0.20	No	Yes	<0.001	0.10	0.59	No	Yes	0.083	0.34	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA12-3C	Mn,Se	NA	Pb,Se,Zn	Yes	<0.001	No	Yes	0.11	No	Yes	<0.001	0.10	0.50	No	Yes	0.078	0.30	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA4-3C	Al,As,Fe,Mn	Zn	Cr,Pb,Se,Zn	Yes	<0.001	No	Yes	0.095	No	Yes	<0.001	0.16	0.75	No	Yes	0.14	0.51	No	Yes	FALSE	No
2012 Ecology Upland Soil Study	SA9-10C	As,Mn	Pb,Zn	As,Cr,Pb,Se,Zn	Yes	<0.001	No	Yes	0.13	No	Yes	<0.001	0.14	0.63	No	Yes	0.10	0.35	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-017	As,Mn	Zn	Sb,Pb,Se,Zn	Yes	0.002	Yes	Yes	0.13	No	Yes	<0.001	0.15	0.38	No	Yes	0.11	0.28	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-021	As,Mn	NA	Sb,Cu,Pb,Mo,Ni,Se,Zn	Yes	<0.001	Yes	Yes	0.14	No	Yes	0.0013	0.21	1.1	No	Yes	0.18	0.71	Yes	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-054	As,Mn	Zn	Sb,As,Pb,Se,Zn	Yes	0.0031	Yes	Yes	0.16	No	Yes	<0.001	0.068	0.50	No	Yes	0.098	0.46	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-124	Al,Fe,Mn	Zn	Sb,Pb,Se,Zn	Yes	0.002	Yes	Yes	0.12	No	Yes	0.0016	0.20	0.31	No	Yes	0.079	0.17	No	Yes	FALSE	No
2014 UCR Upland Soil Study	ADA-141	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.001	Yes	Yes	0.14	No	Yes	<0.001	0.16	0.41	No	Yes	0.065	0.18	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-155	Al,Mn	Zn	Sb,Pb,Se,Zn	Yes	0.0026	Yes	Yes	0.13	No	Yes	<0.001	0.10	0.26	No	Yes	0.071	0.19	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-001	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.0015	Yes	Yes	0.14	No	Yes	<0.001	0.18	0.66	No	Yes	0.097	0.32	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-046	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.0017	Yes	Yes	0.16	No	Yes	<0.001	0.13	0.38	No	Yes	0.090	0.26	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-165	As,Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	0.0029	Yes	Yes	0.15	No	Yes	<0.001	0.16	0.44	No	Yes	0.14	0.38	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-168	As,Mn	Pb,Zn	Sb,As,Pb,Se,Zn	Yes	0.0026	Yes	Yes	0.13	No	Yes	0.0019	0.21	0.44	No	Yes	0.12	0.29	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA3-5C	Mn	NA	Pb,Se,Zn	Yes	<0.001	No	No	0.19	No	Yes	<0.001	0.092	0.43	No	Yes	0.057	0.21	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA4-8C	Mn	NA	Pb,Se,Zn	Yes	<0.001	No	No	0.13	No	Yes	<0.001	0.10	0.46	No	Yes	0.068	0.25	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA8-5C	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.084	No	Yes	<0.001	0.15	0.30	No	Yes	0.18	0.42	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA8-4C	Mn	Pb,Zn	Pb,Se,Zn	Yes	<0.001	No	Yes	0.11	No	Yes	<0.001	0.13	0.27	No	Yes	0.091	0.21	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-146	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.002	Yes	Yes	0.13	No	Yes	<0.001	0.14	0.36	No	Yes	0.099	0.26	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-182	Mn,Se	Zn	Sb,Pb,Mo,Se,Zn	Yes	<0.001	Yes	Yes	0.26	No	Yes	<0.001	0.12	0.52	No	Yes	0.079	0.28	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA4-2C	Mn	NA	Pb,Se,Zn	Yes	<0.001	No	No	0.12	No	Yes	<0.001	0.13	0.58	No	Yes	0.086	0.32	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-005	As,Mn,Se	Zn	Sb,Pb,Mo,Ni,Se,Zn	Yes	0.0014	Yes	Yes	0.18	No	Yes	0.0032	0.23	0.77	No	Yes	0.17	0.50	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-050	As,Mn,Se	Zn	Sb,Cr,Cu,Pb,Se,Zn	Yes	0.0022	Yes	Yes	0.15	No	Yes	<0.001	0.15	0.92	No	Yes	0.15	0.66	Yes	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA5-8C	As,Mn	Pb,Zn	As,Cr,Pb,Se,Zn	Yes	<0.001	No	Yes	0.12	No	Yes	0.0062	0.26	0.73	No	Yes	0.18	0.50	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA7-5C	Al,As,Mn	Pb,Zn	Sb,As,Cu,Pb,Se,Tl,Zn	Yes	0.0017	Yes	Yes	0.12	No	Yes	0.0127	0.28	0.45	No	Yes	0.30	0.62	Yes	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA7-6C	Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.12	No	Yes	0.0030	0.22	0.35	No	Yes	0.15	0.31	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA8-2C	Al,As,Mn	Pb,Zn	Sb,As,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.11	No	Yes	<0.001	0.14	0.28	No	Yes	0.15	0.35	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-015	Mn	Zn	Sb,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.12	No	Yes	<0.001	0.095	0.29	No	Yes	0.054	0.16	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA5-4C	Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.16	No	Yes	<0.001	0.15	0.43	No	Yes	0.10	0.29	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-019	Mn	NA	Sb,Cr,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.11	No	Yes	<0.001	0.16	0.69	No	Yes	0.092	0.32	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-158	As,Mn	Pb,Zn	Sb,As,Pb,Se,Zn	Yes	0.0041	Yes	Yes	0.088	No	Yes	0.0070	0.26	0.43	No	Yes	0.15	0.41	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA11-3C	Mn,Se	NA	Pb,Se,Zn	Yes	<0.001	No	No	0.18	No	Yes	<0.001	0.10	0.46	No	Yes	0.089	0.32	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-002	Mn,Se	Zn	Sb,Pb,Mo,Ni,Se,Zn	Yes	0.0011	Yes	Yes	0.19	No	Yes	0.0095	0.28	0.71	No	Yes	0.17	0.45	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-110	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.0017	Yes	Yes	0.13	No	Yes	<0.001	0.15	0.46	No	Yes	0.090	0.27	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-125	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.0012	Yes	Yes	0.10	No	Yes	<0.001	0.18	0.27	No	Yes	0.083	0.17	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-136	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.0016	Yes	Yes	0.096	No	Yes	<0.001	0.15	0.36	No	Yes	0.087	0.22	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-142	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.002	Yes	Yes	0.088	No	Yes	<0.001	0.11	0.26	No	Yes	0.070	0.18	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-183	Mn,Se	Zn	Sb,Ba,Pb,Mo,Ni,Se,Zn	Yes	0.0021	Yes	Yes	0.31	Yes	Yes	<0.001	0.051	0.47	No	Yes	0.087	0.46	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA6-8C	Mn	Zn	Sb,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.084	No	Yes	<0.001	0.12	0.22	No	Yes	0.072	0.16	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-020	Mn	Zn	Sb,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.13	No	Yes	0.0763	0.39	0.57	No	Yes	0.12	0.24	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-065	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.0011	Yes	Yes	0.072	No	Yes	<0.001	0.18	0.32	No	Yes	0.086	0.19	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA5-5C	Mn	Zn	Pb,Se,Zn	Yes	<0.001	No	No	0.11	No	Yes	<0.001	0.18	0.51	No	Yes	0.11	0.32	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-006	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.0015	Yes	Yes	0.089	No	Yes	<0.001	0.18	0.37	No	Yes	0.092	0.22	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-148	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	0.002	Yes	Yes	0.063	No	Yes	0.0051	0.24	0.32	No	Yes	0.14	0.27	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-162	As,Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	0.0053	Yes	Yes	0.083	No	Yes	<0.001	0.070	0.23	No	Yes	0.14	0.42	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA5-7C	Mn	Pb,Zn	Pb,Se,Zn	Yes	<0.001	No	Yes	0.092	No	Yes	<0.001	0.13	0.37	No	Yes	0.11	0.31	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA2-5C	Mn	NA	Pb,Se	Yes	<0.001	No	No	0.064	No	Yes	0.0047	0.24	0.52	No	Yes	0.12	0.28	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-016	Mn	Zn	Sb,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.068	No	Yes	<0.001	0.14	0.27	No	Yes	0.063	0.14	No	Yes	TRUE	No

Table 6-2. Hazard Quotients for Plants for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, and Potentially Affected Fraction at Each

					Cationic metals																	
						Antimony			Barium			Cobalt					Copper				Iron	
Study	Location ID	COPCs with SSL HQ ≥ 1 COPCs with BABs Not included	COPCs with BAB HQ ≥ 1	COPCs with concentration > BTV	Detect	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	PAF (%)	BAB HQ	SSL HQ	>BTV	Detect	BAB HQ	SSL HQ	>BTV	Detect	pH exceeds SSL	>BTV
2014 UCR Upland Soil Study	ADA-023	As,Mn,Se	Zn	Sb,Cr,Pb,Mo,Se,Zn	Yes	0.0012	Yes	Yes	0.14	No	Yes	0.0050	0.25	0.65	No	Yes	0.16	0.47	No	Yes	TRUE	No
2015 Bossburg Study	UDU-05-ICS	Mn	NA	Sb,Cr,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.093	No	Yes	0.0021	0.22	0.57	No	Yes	0.12	0.33	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA7-3C	Al,As,Mn	Pb,Zn	Sb,As,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.085	No	Yes	<0.001	0.17	0.26	No	Yes	0.21	0.43	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA8-3C	Mn	Zn	Pb,Se,Zn	Yes	<0.001	No	No	0.059	No	Yes	0.0043	0.24	0.49	No	Yes	0.11	0.25	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA7-2C	Mn	Pb,Zn	Pb,Se,Zn	Yes	<0.001	No	Yes	0.070	No	Yes	0.0103	0.27	0.43	No	Yes	0.13	0.27	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-135	Mn	Zn	Sb,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.073	No	Yes	0.0928	0.40	0.46	No	Yes	0.15	0.27	No	Yes	TRUE	No
2015 Bossburg Study	UDU-06-ICS	Mn,Se	NA	Sb,Pb,Se	Yes	<0.001	Yes	Yes	0.14	No	Yes	<0.001	0.12	0.53	No	Yes	0.084	0.30	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA9-4C	Mn,Se	Pb,Zn	Sb,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.085	No	Yes	<0.001	0.11	0.48	No	Yes	0.10	0.37	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-132	Al,Fe,Mn	Zn	Sb,Pb,Se,Zn	Yes	0.0013	Yes	Yes	0.12	No	Yes	<0.001	0.15	0.38	No	Yes	0.074	0.20	No	Yes	FALSE	No
2014 UCR Upland Soil Study	ADA-143	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.0013	Yes	Yes	0.077	No	Yes	0.0020	0.21	0.31	No	Yes	0.11	0.21	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-144	As,Mn	Zn	Sb,Pb,Se,Zn	Yes	0.003	Yes	Yes	0.063	No	Yes	<0.001	0.08	0.22	No	Yes	0.094	0.26	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-150	Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	0.0024	Yes	Yes	0.059	No	Yes	0.0053	0.24	0.32	No	Yes	0.15	0.28	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-160	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.0018	Yes	Yes	0.074	No	Yes	<0.001	0.12	0.24	No	Yes	0.078	0.18	No	Yes	TRUE	No
2015 Bossburg Study	UDU-01-ICS	Mn	Zn	Sb,Pb,Se	Yes	<0.001	Yes	Yes	0.076	No	Yes	0.0940	0.39	0.32	No	Yes	0.13	0.19	No	Yes	TRUE	No
2015 Bossburg Study	UDU-02-ICS	Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.12	No	Yes	0.0748	0.38	0.32	No	Yes	0.17	0.25	No	Yes	TRUE	No
2015 Bossburg Study	UDU-04-ICS	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	0.0014	Yes	Yes	0.11	No	Yes	0.2160	0.46	0.32	No	Yes	0.19	0.24	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA13-4C	Mn,Se	NA	Pb,Se,Zn	Yes	<0.001	No	No	0.11	No	Yes	<0.001	0.085	0.69	No	Yes	0.062	0.31	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-128	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.0018	Yes	Yes	0.060	No	Yes	<0.001	0.13	0.22	No	Yes	0.11	0.24	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-147	Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	0.0037	Yes	Yes	0.062	No	Yes	<0.001	0.066	0.17	No	Yes	0.089	0.24	No	Yes	TRUE	No
2015 Bossburg Study	UDU-03-ICS	Mn	Pb,Zn	Sb,Cu,Pb,Se,Zn	Yes	0.024	Yes	Yes	0.075	No	Yes	0.3050	0.50	0.31	No	Yes	0.64	0.79	Yes	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA7-4C	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.039	No	Yes	<0.001	0.10	0.16	No	Yes	0.088	0.18	No	Yes	TRUE	No
2014 UCR Upland Soil Study	ADA-151	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	0.0029	Yes	Yes	0.040	No	Yes	0.0019	0.21	0.29	No	Yes	0.13	0.24	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA6-5C	NA	NA	Pb,Se	Yes	<0.001	No	Yes	0.025	No	Yes	<0.001	0.087	0.17	No	Yes	0.040	0.091	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA6-4C	NA	NA	Pb,Se	Yes	<0.001	No	No	0.031	No	Yes	<0.001	0.10	0.19	No	Yes	0.047	0.11	No	Yes	TRUE	No
2012 Ecology Upland Soil Study	SA10-4C	Se	NA	Sb,Pb,Se,Zn	Yes	<0.001	Yes	Yes	0.093	No	Yes	<0.001	0.029	0.22	No	Yes	0.092	0.44	No	Yes	TRUE	No

Source: U.S. Environmental Protection Agency (EPA). 2005. *Guidance for Developing Ecological Soil Screening Levels* . OSWER Directive 9285.7-55. Office of Solid Waste and Eı

Notes:

HQs, PAFs, and BTV comparisons for each sample are presented in Appendix F

Qualitative bioavailability score: OR - Out of range due to high organic matter; 0 = very low; 1 = low; 2 = medium; 3 = high; Based on EPA (2005b).

> = greater than

≥ = greater than or equal to

Al = aluminum

As = arsenic

Ba = barium

BAB = bioavailability-adjusted benchmark

BTV = background threshold value

Co = cobalt

COPC = chemical of potential concern

Cr = chromium

Cu = copper

Fe = iron

HQ = hazard quotient

ID = identification

Mn = manganese

Mo = molybdenum

NA = not applicable

Ni = nickel

PAF = potentially affected fraction

Pb = lead

Sb = antimony

Se = selenium

SSL = soil screening level

Tl = thallium

UCR = Upper Columbia River

Zn = zinc

Table 6-2. Hazard Quotients for Plants for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, and Potentially Affected Fraction at Each

					Lead					Manganese			Nickel					Thallium				
Study	Location ID	COPCs with SSL HQ ≥ 1 COPCs with BABs Not included	COPCs with BAB HQ ≥ 1	COPCs with concentration > BTV	Detect	PAF (%)	BAB HQ	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	PAF (%)	BAB HQ	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	PAF (%)
2012 Ecology Upland Soil Study	SA10-2C	As,Mn,Se	Pb,Zn	Sb,As,Ba,Co,Cu,Fe,Pb,Mn,Ni,Se,Tl,Zn	Yes	27	2.4	10	Yes	Yes	25	Yes	Yes	0.11	0.40	1.4	Yes	Yes	0.38	Yes	Yes	58
2012 Ecology Upland Soil Study	SA10-7C	As,Mn	Zn	As,Ba,Pb,Mn,Ni,Se,Zn	Yes	0.49	0.48	2.0	Yes	Yes	17	Yes	Yes	0.03	0.31	1.1	Yes	Yes	0.12	No	Yes	15
2012 Ecology Upland Soil Study	SA10-3C	As,Mn	Zn	Sb,As,Ba,Cu,Pb,Mn,Ni,Se,Zn	Yes	2.3	0.78	3.3	Yes	Yes	13	Yes	Yes	0.16	0.44	1.5	Yes	Yes	0.12	No	Yes	33
2012 Ecology Upland Soil Study	SA10-8C	As,Mn	Zn	Pb,Mn,Se,Zn	Yes	1.1	0.61	2.6	Yes	Yes	13	Yes	Yes	0.00	0.23	0.78	No	Yes	0.16	No	Yes	8.7
2012 Ecology Upland Soil Study	SA11-9C	As,Mn,Se	Pb,Zn	Sb,As,Ba,Cr,Cu,Pb,Mn,Ni,Se,Tl,Zn	Yes	16	1.8	6.0	Yes	Yes	13	Yes	Yes	0.23	0.47	1.0	Yes	Yes	0.22	Yes	Yes	49
2012 Ecology Upland Soil Study	SA12-9C	Mn	NA	Ba,Pb,Mn,Ni,Se,Zn	Yes	0.0038	0.16	0.55	Yes	Yes	12	Yes	Yes	0.09	0.39	0.93	Yes	Yes	0.062	No	No	1.4
2012 Ecology Upland Soil Study	SA1-1C	Mn,Se	NA	Ba,Cr,Pb,Mn,Se,Zn	Yes	0.18	0.37	1.3	Yes	Yes	11	Yes	Yes	0.07	0.37	0.88	No	Yes	0.094	No	Yes	2.3
2012 Ecology Upland Soil Study	SA1-2C	Mn	Zn	Ba,Cr,Fe,Pb,Mn,Se,Zn	Yes	0.013	0.20	0.71	Yes	Yes	11	Yes	Yes	0.00	0.23	0.55	No	Yes	0.062	No	Yes	4.8
2012 Ecology Upland Soil Study	SA12-7C	Mn	Zn	Ba,Pb,Mn,Se,Zn	Yes	0.53	0.49	1.8	Yes	Yes	11	Yes	Yes	0.01	0.27	0.64	No	Yes	0.094	No	Yes	19
2012 Ecology Upland Soil Study	SA2-1C	Mn	Zn	Ba,Pb,Mn,Se,Zn	Yes	2.9	0.84	2.1	Yes	Yes	11	Yes	Yes	0.04	0.33	0.37	No	Yes	0.094	No	Yes	56
2012 Ecology Upland Soil Study	SA3-6C	Mn	Pb,Ni,Zn	Ba,Cr,Co,Cu,Fe,Pb,Mn,Ni,Se,Tl,Zn	Yes	7.5	1.2	4.2	Yes	Yes	11	Yes	Yes	6.44	1.1	2.5	Yes	Yes	0.19	Yes	Yes	45
2014 UCR Upland Soil Study	ADA-061	Mn	NA	Sb,Ba,Cr,Pb,Mn,Ni,Se,Zn	Yes	0.079	0.30	1.2	Yes	Yes	11	Yes	Yes	0.04	0.34	0.98	Yes	Yes	0.089	No	Yes	3.3
2012 Ecology Upland Soil Study	SA10-6C	Mn	NA	Ba,Pb,Mn,Se,Zn	Yes	0.10	0.32	1.4	Yes	Yes	10	Yes	Yes	0.00	0.19	0.67	No	Yes	0.094	No	Yes	3.9
2012 Ecology Upland Soil Study	SA13-6C	As,Mn	NA	Pb,Mn,Se,Zn	Yes	0.77	0.55	2.4	Yes	Yes	10	Yes	Yes	<0.001	0.11	0.41	No	Yes	0.12	No	Yes	3.6
2014 UCR Upland Soil Study	ADA-064	Al,Mn	Zn	Sb,Ba,Cr,Pb,Mn,Se,Zn	Yes	0.11	0.32	1.0	Yes	Yes	10	Yes	Yes	0.16	0.43	0.87	No	Yes	0.076	No	Yes	9.4
2014 UCR Upland Soil Study	ADA-107	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Mo,Ni,Se,Zn	Yes	0.22	0.38	1.4	Yes	Yes	10	Yes	Yes	0.43	0.54	1.0	Yes	Yes	0.10	No	Yes	13
2014 UCR Upland Soil Study	ADA-103	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Ni,Se,Zn	Yes	0.085	0.30	1.1	Yes	Yes	9.7	Yes	Yes	0.22	0.46	1.1	Yes	Yes	0.063	No	Yes	4.3
2014 UCR Upland Soil Study	ADA-056	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Se,Zn	Yes	0.030	0.24	0.77	Yes	Yes	9.4	Yes	Yes	0.10	0.39	0.76	No	Yes	0.068	No	Yes	5.3
2012 Ecology Upland Soil Study	SA6-1C	Mn	Pb,Zn	Pb,Mn,Se,Zn	Yes	10	1.4	3.4	Yes	Yes	9.2	Yes	Yes	0.14	0.42	0.44	No	Yes	0.094	No	Yes	53
2012 Ecology Upland Soil Study	SA9-8C	As,Mn	Pb,Zn	Sb,As,Ba,Cr,Pb,Mn,Se,Tl,Zn	Yes	15	1.7	5.8	Yes	Yes	9.2	Yes	Yes	0.12	0.41	0.88	No	Yes	0.28	Yes	Yes	54
2014 UCR Upland Soil Study	ADA-058	Mn	NA	Sb,Ba,Pb,Mn,Mo,Se,Zn	Yes	0.024	0.23	0.78	Yes	Yes	8.9	Yes	Yes	0.03	0.31	0.71	No	Yes	0.048	No	Yes	4.2
2014 UCR Upland Soil Study	ADA-053	Mn	NA	Sb,Ba,Cr,Pb,Mn,Se,Zn	Yes	0.036	0.25	1.0	Yes	Yes	8.8	Yes	Yes	0.01	0.24	0.78	No	Yes	0.074	No	Yes	1.6
2014 UCR Upland Soil Study	ADA-093	As,Mn	Zn	Sb,Ba,Pb,Mn,Se,Zn	Yes	0.46	0.47	1.6	Yes	Yes	8.7	Yes	Yes	0.00	0.23	0.52	No	Yes	0.089	No	Yes	8.5
2014 UCR Upland Soil Study	ADA-059	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Mo,Se,Zn	Yes	0.14	0.34	1.1	Yes	Yes	8.5	Yes	Yes	0.12	0.41	0.84	No	Yes	0.080	No	Yes	7.5
2012 Ecology Upland Soil Study	SA9-1C	As,Mn	Pb,Zn	As,Ba,Cr,Pb,Mn,Se,Tl,Zn	Yes	29	2.6	8.7	Yes	Yes	7.9	Yes	Yes	0.01	0.26	0.55	No	Yes	0.25	Yes	Yes	47
2012 Ecology Upland Soil Study	SA9-5C	As,Mn	Pb,Zn	Sb,As,Ba,Pb,Mn,Se,Zn	Yes	8.7	1.3	4.4	Yes	Yes	7.9	Yes	Yes	0.03	0.32	0.68	No	Yes	0.16	No	Yes	44
2012 Ecology Upland Soil Study	SA1-6C	As,Mn	NA	Pb,Mn,Se,Zn	Yes	0.016	0.21	0.74	Yes	Yes	7.6	Yes	Yes	0.01	0.27	0.65	No	Yes	0.062	No	No	1.3
2014 UCR Upland Soil Study	ADA-055	As,Ba,Mn,Se	Zn	Sb,As,Ba,Cu,Pb,Mn,Mo,Ni,Se,Zn	Yes	0.82	0.56	1.8	Yes	Yes	7.6	Yes	Yes	0.67	0.60	1.2	Yes	Yes	0.12	No	Yes	30
2012 Ecology Upland Soil Study	SA11-5C	Al,As,Mn	Zn	Sb,Ba,Pb,Mn,Se,Zn	Yes	3.6	0.92	3.1	Yes	Yes	7.4	Yes	Yes	<0.001	0.17	0.38	No	Yes	0.16	No	Yes	26
2014 UCR Upland Soil Study	ADA-122	Mn	NA	Sb,Ba,Pb,Mn,Se,Zn	Yes	0.029	0.24	0.85	Yes	Yes	7.4	Yes	Yes	0.02	0.28	0.68	No	Yes	0.055	No	Yes	4.0
2012 Ecology Upland Soil Study	SA12-1C	As,Mn	Zn	As,Cr,Cu,Fe,Pb,Mn,Ni,Se,Zn	Yes	0.50	0.48	1.7	Yes	Yes	7.3	Yes	Yes	2.54	0.84	2.0	Yes	Yes	0.12	No	Yes	18
2014 UCR Upland Soil Study	ADA-084	Mn	NA	Sb,Pb,Mn,Se,Zn	Yes	0.15	0.35	1.5	Yes	Yes	7.2	Yes	Yes	<0.001	0.17	0.61	No	Yes	0.083	No	Yes	2.4
2014 UCR Upland Soil Study	ADA-099	As,Mn	Zn	Sb,Cr,Pb,Mn,Se,Zn	Yes	0.88	0.57	2.2	Yes	Yes	7.2	Yes	Yes	0.01	0.27	0.75	No	Yes	0.10	No	Yes	8.2
2014 UCR Upland Soil Study	ADA-106	Al,Mn,Se	Zn	Sb,Ba,Pb,Mn,Mo,Se,Zn	Yes	0.019	0.22	0.78	Yes	Yes	7.2	Yes	Yes	0.27	0.49	0.89	No	Yes	0.059	No	Yes	11
2012 Ecology Upland Soil Study	SA11-8C	Al,As,Mn	Pb,Zn	Sb,As,Ba,Cr,Cu,Pb,Mn,Se,Tl,Zn	Yes	20	2.0	6.8	Yes	Yes	7.1	Yes	Yes	0.01	0.25	0.54	No	Yes	0.19	Yes	Yes	50
2014 UCR Upland Soil Study	ADA-063	Mn	Zn	Sb,Ba,Pb,Mn,Mo,Se,Zn	Yes	0.27	0.41	1.4	Yes	Yes	7.1	Yes	Yes	0.04	0.34	0.71	No	Yes	0.075	No	Yes	13
2014 UCR Upland Soil Study	ADA-089	As,Mn	Zn	Sb,As,Ba,Cr,Pb,Mn,Se,Zn	Yes	1.5	0.67	2.3	Yes	Yes	7.0	Yes	Yes	0.06	0.36	0.78	No	Yes	0.092	No	Yes	11
2014 UCR Upland Soil Study	ADA-092	As,Mn,Se	Zn	Sb,As,Ba,Cr,Pb,Mn,Mo,Se,Zn	Yes	0.70	0.53	2.3	Yes	Yes	7.0	Yes	Yes	0.01	0.23	0.81	No	Yes	0.11	No	Yes	9.9
2014 UCR Upland Soil Study	ADA-112	Mn	NA	Sb,Ba,Pb,Mn,Se,Zn	Yes	0.016	0.21	0.86	Yes	Yes	6.9	Yes	Yes	<0.001	0.12	0.39	No	Yes	0.063	No	Yes	1.7
2014 UCR Upland Soil Study	ADA-025	As,Mn,Se	Zn	Sb,Ba,Pb,Mn,Mo,Se,Zn	Yes	2.0	0.74	2.4	Yes	Yes	6.8	Yes	Yes	0.16	0.43	0.83	No	Yes	0.096	No	Yes	31
2014 UCR Upland Soil Study	ADA-113	Mn	NA	Sb,Ba,Cr,Pb,Mn,Se,Zn	Yes	0.12	0.33	1.2	Yes	Yes	6.8	Yes	Yes	0.00	0.22	0.55	No	Yes	0.064	No	Yes	2.0
2014 UCR Upland Soil Study	ADA-114	Al,Fe,Mn	Zn	Sb,Ba,Pb,Mn,Se,Zn	Yes	0.092	0.31	1.1	Yes	Yes	6.8	Yes	Yes	0.00	0.23	0.55	No	Yes	0.064	No	Yes	6.5
2012 Ecology Upland Soil Study	SA12-2C	Al,Mn	Zn	Pb,Mn,Se,Zn	Yes	0.66	0.52	1.9	Yes	Yes	6.7	Yes	Yes	0.00	0.22	0.54	No	Yes	0.094	No	Yes	7.5
2012 Ecology Upland Soil Study	SA13-3C	Mn	NA	Pb,Mn,Se,Zn	Yes	0.091	0.31	1.4	Yes	Yes	6.7	Yes	Yes	<0.001	0.13	0.49	No	Yes	0.094	No	Yes	3.9
2012 Ecology Upland Soil Study	SA13-5C	As,Mn	Pb,Zn	Sb,Ba,Cr,Cu,Pb,Mn,Se,Zn	Yes	7.5	1.2	5.4	Yes	Yes	6.7	Yes	Yes	<0.001	0.16	0.58	No	Yes	0.16	No	Yes	21
2014 UCR Upland Soil Study	ADA-049	Mn	Zn	Sb,Ba,Pb,Mn,Mo,Se,Zn	Yes	0.0080	0.18	0.48	Yes	Yes	6.7	Yes	Yes	0.46	0.55	0.71	No	Yes	0.067	No	Yes	21
2012 Ecology Upland Soil Study	SA11-7C	Al,As,Mn,Se	Pb,Zn	Sb,As,Ba,Cu,Pb,Mn,Se,Tl,Zn	Yes	58	4.7	16	Yes	Yes	6.6	Yes	Yes	<0.001	0.095	0.21	No	Yes	0.31	Yes	Yes	77
2012 Ecology Upland Soil Study	SA3-3C	Mn	Zn	Ba,Cr,Pb,Mn,Ni,Se,Zn	Yes	0.30	0.42	1.4	Yes	Yes	6.5	Yes	Yes	1.01	0.66	1.5	Yes	Yes	0.062	No	Yes	7.1
2014 UCR Upland Soil Study	ADA-118	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Se,Zn	Yes	0.25	0.40	1.3	Yes	Yes	6.5	Yes	Yes	0.06	0.36	0.69	No	Yes	0.065	No	Yes	11
2014 UCR Upland Soil Study	ADA-174	Al,Mn	Zn	Sb,Ba,Pb,Mn,Mo,Se,Zn	Yes	0.014	0.20	0.79	Yes	Yes	6.4	Yes	Yes	<0.001	0.14	0.38	No	Yes	0.055	No	Yes	4.9
2012 Ecology Upland Soil Study	SA6-7C	Al,As,Mn	Pb,Zn	Sb,As,Cr,Pb,Mn,Se,Zn	Yes	23	2.2	5.1	Yes	Yes	6.3	Yes	Yes	1.84	0.77	0.80	No	Yes	0.12	No	Yes	68
2014 UCR Upland Soil Study	ADA-010	As,Mn	Zn	Sb,As,Pb,Mn,Se,Zn	Yes	3.5	0.91	3.6	Yes	Yes	6.3	Yes	Yes	<0.001	0.17	0.49	No	Yes	0.13	No	Yes	9.7
2012 Ecology Upland Soil Study	SA12-8C	Mn	Zn	Pb,Mn,Se,Zn	Yes	0.94	0.58	2.1	Yes	Yes	6.2	Yes	Yes	0.00	0.20	0.47	No	Yes	0.062	No	Yes	6.7
2014 UCR Upland Soil Study	ADA-067	Mn	Zn	Sb,Ba,Cr,Cu,Pb,Mn,Mo,Se,Zn	Yes	0.088	0.31	0.88	Yes	Yes	6.2	Yes	Yes	0.62	0.59	0.89	No	Yes	0.071	No	Yes	16
2012 Ecology Upland Soil Study	SA9-9C	As,Mn	Zn	As,Cr,Pb,Mn,Ni,Se,Zn	Yes	3.3	0.89	3.0	Yes	Yes	6.1	Yes	Yes	0.16	0.43	0.93	Yes	Yes	0.094	No	Yes	26
2012 Ecology Upland Soil Study	SA1-8C	Mn	NA	Ba,Pb,Mn,Se,Zn	Yes	0.011	0.19	0.68	Yes	Yes	6.00	Yes	Yes	<0.001	0.14	0.34	No	Yes	0.062	No	No	1.7
2012 Ecology Upland Soil Study	SA11-4C	As,Mn	Pb,Zn	Sb,Ba,Pb,Mn,Se,Tl,Zn	Yes	7.4	1.2	4.2	Yes	Yes	6.0	Yes	Yes	0.00	0.22	0.47	No	Yes	0.19	Yes	Yes	39
2014 UCR Upland Soil Study	ADA-173	Al,Mn	Zn	Sb,Pb,Mn,Mo,Se,Zn	Yes	0.069	0.29	0.96	Yes	Yes	6.0	Yes	Yes	0.00	0.21	0.44	No	Yes	0.071	No	Yes	5.4
2012 Ecology Upland Soil Study	SA3-2C	Mn	NA	Ba,Pb,Mn,Se,Zn	Yes	0.0038	0.15	0.53	Yes	Yes	5.9	Yes	Yes	<0.001	0.15	0.34	No	Yes	0.062	No	No	1.9
2014 UCR Upland Soil Study	ADA-088	As,Mn	Zn	Sb,Cr,Pb,Mn,Se,Zn	Yes	0.73	0.54	2.0	Yes	Yes	5.9	Yes	Yes	0.02	0.30	0.79	No	Yes	0.085	No	Yes	6.3
2014 UCR Upland Soil Study	ADA-090	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Se,Zn	Yes	0.49	0.48	1.8	Yes	Yes	5.9	Yes	Yes	0.00	0.19	0.54	No	Yes	0.092	No	Yes	7.9
2012 Ecology Upland Soil Study	SA2-4C	Al,Mn	Zn	Pb,Mn,Se,Zn	Yes	2.3	0.78	1.9	Yes	Yes	5.8	Yes	Yes	0.03	0.32	0.36	No	Yes	0.094	No	Yes	29
2012 Ecology Upland Soil Study	SA6-3C	Al,As,Mn	Pb,Zn	As,Cr,Pb,Mn,Se,Zn	Yes	17	1.8	4.4	Yes	Yes	5.8	Yes	Yes	1.24	0.70	0.72	No	Yes	0.12	No	Yes	60
2014 UCR Upland Soil Study	ADA-117	Mn	Zn	Sb,Pb,Mn,Se,Zn	Yes	0.83	0.56	1.4	Yes	Yes	5.8	Yes	Yes	0.03	0.32	0.36	No	Yes	0.078	No	Yes	18
2012 Ecology Upland Soil Study	SA12-6C	Mn	Zn	Cu,Pb,Mn,Se,Zn	Yes	0.06	0.28	1.0	Yes	Yes	5.7	Yes	Yes	0.00	0.18	0.43	No	Yes	0.062	No	Yes	4.5
2012 Ecology Upland Soil Study	SA13-2C	Mn,Se	NA	Pb,Mn,Se,Zn	Yes	0.21	0.38	1.7	Yes	Yes	5.7	Yes	Yes	<0.001	0.13	0.46	No	Yes	0.062	No	Yes	2.6
2012 Ecology Upland Soil Study	SA9-3C	Mn	Zn	Ba,Cr,Fe,Pb,Mn,Ni,Se,Zn	Yes	0.27	0.41	1.4	Yes	Yes	5.7	Yes	Yes	0.20	0.46	0.98	Yes	Yes	0.16	No	Yes	10
2012 Ecology Upland Soil Study	SA9-7C	As,Mn	Pb,Zn	Sb,As,Cr,Pb,Mn,Se,Tl,Zn	Yes	8.9	1.3	4.5	Yes	Yes	5.7	Yes	Yes	0.03	0.32	0.68	No	Yes	0.19	Yes	Yes	38
2014 UCR Upland Soil Study	ADA-035	Mn	Zn	Sb,Pb,Mn,Se,Zn	Yes	0.95	0.58	2.0	Yes	Yes	5.7	Yes	Yes	<0.001	0.14	0.30	No	Yes	0.088	No	Yes	17
2014 UCR Upland Soil Study	ADA-096	Mn	Zn	Sb,Ba,Pb,Mn,Se,Zn	Yes	1.03	0.60	2.4	Yes	Yes	5.7	Yes	Yes	<0.001	0.15	0.42	No	Yes	0.083	No	Yes	5.8
2014 UCR Upland Soil Study	ADA-078	As,Mn	Zn	Sb,Ba,Cr,Pb,Se,Zn	Yes	2.7	0.82	2.3	Yes	Yes	5.6	No	Yes	0.06	0.36	0.51	No	Yes	0.097	No	Yes	20
2014 UCR Upland Soil Study	ADA-095	Mn	NA	Sb,Cr,Pb,Se,Zn	Yes	0.076	0.30	1.3	Yes	Yes	5.6	No	Yes	0.00	0.19	0.74	No	Yes	0.072	No	Yes	0.59
2012 Ecology Upland Soil Study	SA11-2C	Mn	NA	Ba,Pb,Se,Zn	Yes	0.026	0.23	0.79	Yes	Yes	5.5	No	Yes	0.01	0.23	0.51	No	Yes	0.062	No	Yes	3.3
2012 Ecology Upland Soil Study	SA13-8C	Al,Mn	NA	Pb,Se,Zn	Yes	0.10	0.32	1.4	Yes	Yes	5.4	No	Yes	<0.001	0.14	0.52	No	Yes	0.062	No	Yes	1.6
2012 Ecology Upland Soil Study	SA4-7C	Mn	Zn	Cr,Pb,Ni,Se,Zn	Yes	1.8	0.72	2.5	Yes	Yes	5.4	No	Yes	0.13	0.42	0.93	Yes	Yes	0.094	No	Yes	8.6
2014 UCR Upland Soil Study	ADA-097	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	Yes	1.9	0.73	3.5	Yes	Yes	5.4	No	Yes	<0.001	0.13	0.58	No	Yes	0.12	No	Yes	6.5

Table 6-2. Hazard Quotients for Plants for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, and Potentially Affected Fraction at Each

						Lead					Manganese			Nickel					Thallium			
Study	Location ID	COPCs with SSL HQ ≥ 1 COPCs with BABs Not included	COPCs with BAB HQ ≥ 1	COPCs with concentration > BTV	Detect	PAF (%)	BAB HQ	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	PAF (%)	BAB HQ	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	PAF (%)
2014 UCR Upland Soil Study	ADA-104	Mn	Zn	Sb,Ba,Pb,Mo,Se,Zn	Yes	0.021	0.22	0.78	Yes	Yes	5.4	No	Yes	0.00	0.21	0.50	No	Yes	0.059	No	Yes	5.5
2014 UCR Upland Soil Study	ADA-115	Mn	NA	Sb,Pb,Se,Zn	Yes	0.15	0.35	1.2	Yes	Yes	5.4	No	Yes	<0.001	0.14	0.33	No	Yes	0.059	No	Yes	2.8
2014 UCR Upland Soil Study	ADA-121	Mn	Zn	Sb,Cr,Pb,Se,Zn	Yes	0.86	0.57	2.0	Yes	Yes	5.4	No	Yes	0.01	0.25	0.59	No	Yes	0.099	No	Yes	12
2014 UCR Upland Soil Study	ADA-179	Mn	Zn	Sb,Pb,Mo,Se,Zn	Yes	0.018	0.21	0.72	Yes	Yes	5.4	No	Yes	0.00	0.19	0.40	No	Yes	0.057	No	Yes	7.2
2014 UCR Upland Soil Study	ADA-181	Mn,Se	Zn	Sb,Ba,Pb,Mo,Se,Zn	Yes	0.012	0.20	0.85	Yes	Yes	5.4	No	Yes	<0.001	0.15	0.54	No	Yes	0.11	No	Yes	4.8
2012 Ecology Upland Soil Study	SA2-8C	Mn	Zn	Cr,Pb,Se,Zn	Yes	0.014	0.20	0.50	Yes	Yes	5.3	No	Yes	1.59	0.74	0.83	No	Yes	0.062	No	No	13
2014 UCR Upland Soil Study	ADA-033	Mn	Zn	Sb,Ba,Pb,Mo,Ni,Se,Zn	Yes	0.063	0.28	0.75	Yes	Yes	5.3	No	Yes	3.34	0.91	1.2	Yes	Yes	0.10	No	Yes	33
2014 UCR Upland Soil Study	ADA-184	Mn,Se	Zn	Sb,Ba,Pb,Mo,Se,Zn	Yes	0.0036	0.15	0.62	Yes	Yes	5.3	No	Yes	0.01	0.26	0.80	No	Yes	0.046	No	Yes	8.2
2012 Ecology Upland Soil Study	SA1-5C	Mn	NA	Pb,Se,Zn	Yes	0.0059	0.17	0.60	Yes	Yes	5.2	No	Yes	0.00	0.22	0.52	No	Yes	0.062	No	No	0.84
2012 Ecology Upland Soil Study	SA6-2C	Mn	Pb,Zn	Pb,Se,Zn	Yes	10	1.4	3.3	Yes	Yes	5.2	No	Yes	0.53	0.57	0.58	No	Yes	0.12	No	Yes	53
2012 Ecology Upland Soil Study	SA9-6C	Mn	Pb,Zn	Sb,Cr,Pb,Se,Tl,Zn	Yes	13	1.6	5.4	Yes	Yes	5.2	No	Yes	0.04	0.34	0.72	No	Yes	0.19	Yes	Yes	28
2014 UCR Upland Soil Study	ADA-177	Al,Fe,Mn	NA	Sb,Pb,Se	Yes	0.0024	0.14	0.59	Yes	Yes	5.2	No	Yes	<0.001	0.17	0.56	No	Yes	0.044	No	Yes	0.45
2012 Ecology Upland Soil Study	SA1-7C	Mn	NA	Pb,Se,Zn	Yes	0.0037	0.15	0.55	Yes	Yes	5.1	No	Yes	0.00	0.22	0.52	No	Yes	0.062	No	No	1.4
2012 Ecology Upland Soil Study	SA2-7C	Mn	Zn	Cr,Pb,Ni,Se,Zn	Yes	0.16	0.36	0.88	Yes	Yes	5.1	No	Yes	4.01	0.97	1.1	Yes	Yes	0.062	No	Yes	13
2012 Ecology Upland Soil Study	SA2-2C	Mn	Zn	Cr,Pb,Se,Zn	Yes	0.07	0.29	0.72	Yes	Yes	5.0	No	Yes	0.26	0.48	0.54	No	Yes	0.062	No	No	24
2012 Ecology Upland Soil Study	SA3-7C	Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	5.0	1.0	3.6	Yes	Yes	5.0	No	Yes	0.01	0.26	0.57	No	Yes	0.094	No	Yes	20
2012 Ecology Upland Soil Study	SA5-3C	Mn	Zn	Pb,Se,Zn	Yes	3.5	0.91	2.5	Yes	Yes	5.0	No	Yes	0.15	0.43	0.62	No	Yes	0.12	No	Yes	35
2014 UCR Upland Soil Study	ADA-045	As,Mn	Pb,Zn	Sb,As,Pb,Se,Zn	Yes	5.4	1.1	4.1	Yes	Yes	5.0	No	Yes	<0.001	0.15	0.42	No	Yes	0.17	No	Yes	14
2014 UCR Upland Soil Study	ADA-085	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.030	0.24	1.2	Yes	Yes	5.0	No	Yes	<0.001	0.13	0.61	No	Yes	0.089	No	Yes	28
2014 UCR Upland Soil Study	ADA-101	Mn	NA	Sb,Pb,Se,Zn	Yes	0.33	0.43	1.9	Yes	Yes	5.0	No	Yes	<0.001	0.13	0.49	No	Yes	0.088	No	Yes	0.45
2014 UCR Upland Soil Study	ADA-116	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.25	0.40	1.1	Yes	Yes	5.0	No	Yes	0.01	0.28	0.39	No	Yes	0.064	No	Yes	8.7
2014 UCR Upland Soil Study	ADA-172	Al,Mn	NA	Sb,Pb,Se	Yes	0.0018	0.13	0.68	Yes	Yes	5.0	No	Yes	<0.001	0.071	0.35	No	Yes	0.039	No	Yes	0.016
2012 Ecology Upland Soil Study	SA10-1C	Mn	Zn	Ba,Cr,Pb,Se,Zn	Yes	1.3	0.64	2.8	Yes	Yes	4.9	No	Yes	0.00	0.19	0.65	No	Yes	0.12	No	Yes	7.0
2014 UCR Upland Soil Study	ADA-039	Mn	Zn	Sb,Ba,Pb,Mo,Se,Zn	Yes	0.0065	0.17	0.40	Yes	Yes	4.9	No	Yes	3.01	0.89	0.87	No	Yes	0.066	No	Yes	28
2014 UCR Upland Soil Study	ADA-111	Mn	Zn	Sb,Cr,Pb,Se,Zn	Yes	0.074	0.29	0.90	Yes	Yes	4.9	No	Yes	0.04	0.33	0.58	No	Yes	0.072	No	Yes	4.5
2014 UCR Upland Soil Study	ADA-175	Al,Mn	NA	Sb,Pb,Se,Zn	Yes	0.017	0.21	0.64	Yes	Yes	4.9	No	Yes	0.06	0.36	0.62	No	Yes	0.057	No	Yes	2.7
2012 Ecology Upland Soil Study	SA7-1C	Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	6.9	1.2	2.6	Yes	Yes	4.8	No	Yes	0.23	0.47	0.41	No	Yes	0.094	No	Yes	48
2014 UCR Upland Soil Study	ADA-076	Al,As,Mn,Se	Zn	Sb,As,Ba,Pb,Mo,Se,Zn	Yes	3.2	0.87	3.3	Yes	Yes	4.8	No	Yes	0.01	0.26	0.69	No	Yes	0.12	No	Yes	33
2014 UCR Upland Soil Study	ADA-105	Mn	Zn	Sb,Ba,Pb,Se,Zn	Yes	1.5	0.67	2.3	Yes	Yes	4.8	No	Yes	0.00	0.22	0.48	No	Yes	0.10	No	Yes	16
2012 Ecology Upland Soil Study	SA1-3C	Mn	NA	Ba,Cr,Pb,Se,Zn	Yes	0.0029	0.15	0.52	Yes	Yes	4.7	No	Yes	0.02	0.29	0.70	No	Yes	0.062	No	No	1.1
2012 Ecology Upland Soil Study	SA4-6C	Mn	Pb,Zn	Cr,Pb,Se,Zn	Yes	7.6	1.2	4.3	Yes	Yes	4.7	No	Yes	0.02	0.29	0.64	No	Yes	0.12	No	Yes	23
2012 Ecology Upland Soil Study	SA7-8C	As,Mn	Co,Pb,Ni,Zn	As,Ba,Cr,Co,Cu,Fe,Pb,Ni,Se,Tl,Zn	Yes	45	3.6	7.8	Yes	Yes	4.7	No	Yes	38.95	2.5	2.2	Yes	Yes	0.28	Yes	Yes	81
2014 UCR Upland Soil Study	ADA-048	Ba,Mn,Se	NA	Sb,Ba,Pb,Mo,Se,Zn	Yes	0.021	0.22	1.1	Yes	Yes	4.7	No	Yes	0.00	0.19	0.81	No	Yes	0.062	No	Yes	2.1
2014 UCR Upland Soil Study	ADA-079	Al,Mn	Zn	Sb,Ba,Pb,Mo,Se,Zn	Yes	0.10	0.32	1.5	Yes	Yes	4.7	No	Yes	<0.001	0.18	0.73	No	Yes	0.071	No	Yes	12
2014 UCR Upland Soil Study	ADA-152	As,Mn	Zn	Sb,As,Cr,Pb,Se,Zn	Yes	2.5	0.8	2.5	Yes	Yes	4.7	No	Yes	0.03	0.32	0.58	No	Yes	0.12	No	Yes	28
2014 UCR Upland Soil Study	ADA-018	Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	7.8	1.2	4.9	Yes	Yes	4.6	No	Yes	<0.001	0.15	0.43	No	Yes	0.16	No	Yes	16
2014 UCR Upland Soil Study	ADA-091	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	Yes	1.5	0.67	2.2	Yes	Yes	4.6	No	Yes	0.17	0.44	0.91	No	Yes	0.11	No	Yes	16
2012 Ecology Upland Soil Study	SA3-4C	Mn	NA	Pb,Se,Zn	Yes	0.0077	0.18	0.62	Yes	Yes	4.5	No	Yes	<0.001	0.13	0.30	No	Yes	0.062	No	No	1.1
2014 UCR Upland Soil Study	ADA-102	Mn	Zn	Sb,Ba,Pb,Se,Zn	Yes	0.26	0.40	1.2	Yes	Yes	4.5	No	Yes	0.02	0.28	0.49	No	Yes	0.073	No	Yes	6.8
2014 UCR Upland Soil Study	ADA-156	As,Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	8.4	1.3	4.6	Yes	Yes	4.5	No	Yes	<0.001	0.17	0.41	No	Yes	0.12	No	Yes	23
2012 Ecology Upland Soil Study	SA12-4C	Mn	NA	Ba,Pb,Se,Zn	Yes	0.32	0.43	1.5	Yes	Yes	4.4	No	Yes	0.00	0.20	0.47	No	Yes	0.062	No	Yes	3.5
2012 Ecology Upland Soil Study	SA5-2C	Mn	Zn	Ba,Cr,Fe,Pb,Ni,Se,Zn	Yes	0.30	0.42	1.2	Yes	Yes	4.4	No	Yes	2.37	0.83	1.2	Yes	Yes	0.16	No	Yes	12
2014 UCR Upland Soil Study	ADA-043	Mn,Se	NA	Sb,Ba,Pb,Mo,Ni,Se,Zn	Yes	0.032	0.24	1.0	Yes	Yes	4.4	No	Yes	0.04	0.32	1.1	Yes	Yes	0.068	No	Yes	3.6
2014 UCR Upland Soil Study	ADA-070	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	Yes	1.5	0.68	2.5	Yes	Yes	4.4	No	Yes	0.00	0.21	0.54	No	Yes	0.11	No	Yes	11
2014 UCR Upland Soil Study	ADA-071	Mn	Zn	Sb,Pb,Se,Zn	Yes	2.7	0.83	2.4	Yes	Yes	4.4	No	Yes	0.02	0.30	0.50	No	Yes	0.10	No	Yes	15
2014 UCR Upland Soil Study	ADA-131	Al,As,Mn,Se	Pb,Zn	Sb,As,Ba,Pb,Se,Zn	Yes	9.2	1.3	4.7	Yes	Yes	4.4	No	Yes	0.03	0.32	0.50	No	Yes	0.15	No	Yes	29
2014 UCR Upland Soil Study	ADA-169	Mn	NA	Sb,Pb,Se	Yes	0.0059	0.17	0.68	Yes	Yes	4.4	No	Yes	0.00	0.22	0.64	No	Yes	0.042	No	Yes	0.20
2014 UCR Upland Soil Study	ADA-044	Mn,Se	Zn	Sb,Ba,Cr,Pb,Mo,Ni,Se,Zn	Yes	0.13	0.34	1.3	Yes	Yes	4.3	No	Yes	0.92	0.65	1.7	Yes	Yes	0.11	No	Yes	21
2014 UCR Upland Soil Study	ADA-119	Mn	NA	Sb,Cr,Pb,Se,Zn	Yes	0.27	0.41	1.5	Yes	Yes	4.3	No	Yes	0.01	0.23	0.56	No	Yes	0.069	No	Yes	4.1
2012 Ecology Upland Soil Study	SA1-4C	Mn	NA	Ba,Pb,Se,Zn	Yes	0.00017	0.09	0.31	Yes	Yes	4.2	No	Yes	0.01	0.26	0.62	No	Yes	0.062	No	No	1.4
2012 Ecology Upland Soil Study	SA7-7C	Al,As,Mn,Se	Pb,Zn	Sb,As,Pb,Se,Tl,Zn	Yes	60	4.9	11	Yes	Yes	4.2	No	Yes	0.30	0.50	0.43	No	Yes	0.25	Yes	Yes	94
2012 Ecology Upland Soil Study	SA8-8C	As,Mn,Se	Pb,Zn	Sb,As,Ba,Cu,Pb,Se,Tl,Zn	Yes	60	5.0	12	Yes	Yes	4.2	No	Yes	0.01	0.28	0.30	No	Yes	0.31	Yes	Yes	91
2014 UCR Upland Soil Study	ADA-034	Mn	Zn	Sb,Pb,Mo,Se,Zn	Yes	0.011	0.19	0.52	Yes	Yes	4.2	No	Yes	0.24	0.47	0.64	No	Yes	0.076	No	Yes	8.0
2014 UCR Upland Soil Study	ADA-057	Mn	NA	Sb,Cr,Pb,Se,Zn	Yes	0.14	0.34	1.1	Yes	Yes	4.2	No	Yes	0.21	0.46	0.81	No	Yes	0.079	No	Yes	3.4
2014 UCR Upland Soil Study	ADA-094	Mn	NA	Sb,Pb,Se,Zn	Yes	0.057	0.28	0.82	Yes	Yes	4.2	No	Yes	0.04	0.34	0.55	No	Yes	0.056	No	Yes	4.0
2014 UCR Upland Soil Study	ADA-170	Al,Mn	Zn	Sb,Pb,Mo,Se,Zn	Yes	0.041	0.26	1.0	Yes	Yes	4.2	No	Yes	<0.001	0.15	0.43	No	Yes	0.069	No	Yes	12
2012 Ecology Upland Soil Study	SA3-8C	Mn	Zn	Pb,Se,Zn	Yes	0.49	0.48	1.7	Yes	Yes	4.1	No	Yes	<0.001	0.14	0.31	No	Yes	0.062	No	Yes	5.9
2014 UCR Upland Soil Study	ADA-028	As,Mn	Zn	Sb,Pb,Se,Zn	Yes	2.4	0.79	2.3	Yes	Yes	4.1	No	Yes	<0.001	0.18	0.29	No	Yes	0.084	No	Yes	8.5
2014 UCR Upland Soil Study	ADA-042	Mn	Zn	Sb,Ba,Pb,Mo,Se,Zn	Yes	0.21	0.38	0.97	Yes	Yes	4.1	No	Yes	0.11	0.40	0.48	No	Yes	0.059	No	Yes	12
2014 UCR Upland Soil Study	ADA-180	Mn,Se	Zn	Sb,Ba,Pb,Mo,Se,Zn	Yes	0.044	0.26	1.0	Yes	Yes	4.1	No	Yes	<0.001	0.18	0.52	No	Yes	0.063	No	Yes	9.4
2012 Ecology Upland Soil Study	SA11-1C	Mn	NA	Cr,Pb,Se,Zn	Yes	0.014	0.20	0.69	Yes	Yes	4.00	No	Yes	0.08	0.38	0.82	No	Yes	0.062	No	Yes	2.3
2012 Ecology Upland Soil Study	SA4-1C	Mn	Zn	Cr,Pb,Se,Zn	Yes	0.63	0.51	1.8	Yes	Yes	4.0	No	Yes	0.01	0.25	0.56	No	Yes	0.094	No	Yes	8.9
2014 UCR Upland Soil Study	ADA-052	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	Yes	3.01	0.86	3.3	Yes	Yes	4.0	No	Yes	0.00	0.21	0.59	No	Yes	0.14	No	Yes	14
2014 UCR Upland Soil Study	ADA-159	As,Mn	Pb,Zn	Sb,Cr,Pb,Se,Zn	Yes	7.3	1.2	3.4	Yes	Yes	4.0	No	Yes	0.01	0.25	0.48	No	Yes	0.11	No	Yes	27
2014 UCR Upland Soil Study	ADA-178	Mn	NA	Sb,Pb,Se,Zn	Yes	0.0016	0.13	0.49	Yes	Yes	4.0	No	Yes	0.01	0.24	0.61	No	Yes	0.040	No	Yes	1.9
2012 Ecology Upland Soil Study	SA13-1C	Mn	NA	Pb,Se,Zn	Yes	0.012	0.20	0.87	Yes	Yes	3.9	No	Yes	<0.001	0.13	0.47	No	Yes	0.062	No	Yes	0.59
2012 Ecology Upland Soil Study	SA3-1C	Mn	NA	Pb,Se	Yes	<0.001	0.07	0.26	Yes	Yes	3.9	No	Yes	0.00	0.23	0.51	No	Yes	0.062	No	No	0.19
2012 Ecology Upland Soil Study	SA5-1C	Mn,Se	Pb,Zn	Sb,Pb,Se,Zn	Yes	4.7	1.0	2.8	Yes	Yes	3.9	No	Yes	0.00	0.20	0.28	No	Yes	0.062	No	Yes	19
2012 Ecology Upland Soil Study	SA8-6C	Mn	Pb,Zn	Pb,Se,Zn	Yes	5.3	1.1	2.6	Yes	Yes	3.9	No	Yes	0.05	0.34	0.37	No	Yes	0.094	No	Yes	44
2014 UCR Upland Soil Study	ADA-047	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	Yes	2.8	0.84	2.6	Yes	Yes	3.9	No	Yes	0.02	0.29	0.54	No	Yes	0.13	No	Yes	27
2014 UCR Upland Soil Study	ADA-154	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	Yes	3.9	0.94	3.0	Yes	Yes	3.9	No	Yes	0.16	0.44	0.73	No	Yes	0.10	No	Yes	25
2014 UCR Upland Soil Study	ADA-176	Mn	NA	Sb,Cr,Pb,Ni,Se	Yes	0.0053	0.17	0.53	Yes	Yes	3.9	No	Yes	0.79	0.62	1.2	Yes	Yes	0.078	No	Yes	1.2
2012 Ecology Upland Soil Study	SA10-5C	Mn	NA	Cr,Pb,Se,Zn	Yes	0.23	0.39	1.7	Yes	Yes	3.8	No	Yes	0.00	0.19	0.66	No	Yes	0.094	No	Yes	1.9
2012 Ecology Upland Soil Study	SA13-7C	As,Mn	NA	Sb,Pb,Se,Zn	Yes	0.70	0.53	2.3	Yes	Yes	3.8	No	Yes	<0.001	0.14	0.50	No	Yes	0.094	No	Yes	1.6
2012 Ecology Upland Soil Study	SA4-4C	Al,Mn	Zn	Cr,Pb,Se,Zn	Yes	0.74	0.54	1.9	Yes	Yes	3.8	No	Yes	0.00	0.23	0.51	No	Yes	0.094	No	Yes	16
2012 Ecology Upland Soil Study	SA4-5C	Mn	NA	Pb,Se,Zn	Yes	0.046	0.26	0.91	Yes	Yes	3.8	No	Yes	0.01	0.26	0.57	No	Yes	0.062	No	Yes	3.3

Table 6-2. Hazard Quotients for Plants for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, and Potentially Affected Fraction at Each

						Lead					Manganese			Nickel					Thallium			
Study	Location ID	COPCs with SSL HQ ≥ 1 COPCs with BABs Not included	COPCs with BAB HQ ≥ 1	COPCs with concentration > BTV	Detect	PAF (%)	BAB HQ	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	PAF (%)	BAB HQ	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	PAF (%)
2012 Ecology Upland Soil Study	SA9-2C	Ba,Cr,Mn	Ni,Zn	Ba,Cr,Co,Cu,Fe,Pb,Ni,Se,Tl,Zn	Yes	0.86	0.57	1.9	Yes	Yes	3.8	No	Yes	30.00	2.2	4.7	Yes	Yes	0.25	Yes	Yes	15
2014 UCR Upland Soil Study	ADA-004	Mn	Zn	Sb,Ba,Pb,Mo,Se,Zn	Yes	0.49	0.48	1.3	Yes	Yes	3.8	No	Yes	0.42	0.54	0.70	No	Yes	0.082	No	Yes	31
2014 UCR Upland Soil Study	ADA-073	Al,As,Mn	Zn	Sb,Pb,Se,Zn	Yes	1.9	0.73	2.3	Yes	Yes	3.8	No	Yes	0.01	0.27	0.48	No	Yes	0.090	No	Yes	14
2012 Ecology Upland Soil Study	SA2-3C	Mn	Zn	Pb,Se,Zn	Yes	0.17	0.36	0.89	Yes	Yes	3.7	No	Yes	0.04	0.33	0.38	No	Yes	0.062	No	No	4.6
2014 UCR Upland Soil Study	ADA-024	As,Mn	Pb,Zn	Sb,As,Cu,Pb,Se,Zn	Yes	7.4	1.2	4.2	Yes	Yes	3.7	No	Yes	<0.001	0.16	0.35	No	Yes	0.13	No	Yes	20
2014 UCR Upland Soil Study	ADA-108	Mn	Zn	Sb,Cr,Pb,Se,Zn	Yes	0.19	0.37	1.4	Yes	Yes	3.7	No	Yes	0.02	0.29	0.74	No	Yes	0.067	No	Yes	4.5
2014 UCR Upland Soil Study	ADA-139	As,Mn	Zn	Sb,Pb,Se,Zn	Yes	1.4	0.66	2.0	Yes	Yes	3.7	No	Yes	0.04	0.34	0.56	No	Yes	0.088	No	Yes	17
2014 UCR Upland Soil Study	ADA-171	Mn	Zn	Sb,Pb,Mo,Se,Zn	Yes	0.031	0.24	0.83	Yes	Yes	3.7	No	Yes	0.00	0.21	0.46	No	Yes	0.065	No	Yes	23
2012 Ecology Upland Soil Study	SA8-7C	As,Mn	Pb,Zn	Sb,As,Pb,Se,Tl,Zn	Yes	46	3.7	8.9	Yes	Yes	3.6	No	Yes	0.15	0.43	0.46	No	Yes	0.28	Yes	Yes	83
2014 UCR Upland Soil Study	ADA-051	Mn,Se	Zn	Sb,Ba,Cu,Pb,Mo,Ni,Se,Zn	Yes	0.084	0.30	0.95	Yes	Yes	3.6	No	Yes	0.32	0.51	0.93	Yes	Yes	0.066	No	Yes	25
2014 UCR Upland Soil Study	ADA-081	Mn	Zn	Sb,Cr,Pb,Se,Zn	Yes	0.45	0.47	1.3	Yes	Yes	3.6	No	Yes	0.07	0.38	0.55	No	Yes	0.067	No	Yes	6.2
2014 UCR Upland Soil Study	ADA-145	Mn	Zn	Sb,Pb,Se,Zn	Yes	2.4	0.79	2.6	Yes	Yes	3.6	No	Yes	0.00	0.20	0.41	No	Yes	0.086	No	Yes	13
2014 UCR Upland Soil Study	ADA-060	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	Yes	2.4	0.78	2.6	Yes	Yes	3.5	No	Yes	0.03	0.32	0.67	No	Yes	0.13	No	Yes	14
2014 UCR Upland Soil Study	ADA-126	As,Mn	Pb,Zn	Sb,Cu,Pb,Se,Zn	Yes	6.1	1.1	3.2	Yes	Yes	3.5	No	Yes	0.00	0.19	0.28	No	Yes	0.099	No	Yes	21
2014 UCR Upland Soil Study	ADA-127	As,Mn	Zn	Sb,Ba,Pb,Se,Zn	Yes	0.63	0.51	1.6	Yes	Yes	3.5	No	Yes	0.24	0.47	0.83	No	Yes	0.074	No	Yes	18
2014 UCR Upland Soil Study	ADA-161	Al,Fe,Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	5.4	1.1	3.0	Yes	Yes	3.5	No	Yes	0.01	0.26	0.37	No	Yes	0.11	No	Yes	43
2014 UCR Upland Soil Study	ADA-164	As,Mn,Se	Pb,Zn	Sb,Pb,Se,Zn	Yes	5.9	1.1	3.8	Yes	Yes	3.5	No	Yes	<0.001	0.14	0.31	No	Yes	0.12	No	Yes	19
2014 UCR Upland Soil Study	ADA-008	As,Mn	Pb,Zn	Sb,Cr,Pb,Se,Zn	Yes	5.1	1.0	3.4	Yes	Yes	3.4	No	Yes	0.02	0.29	0.58	No	Yes	0.11	No	Yes	15
2014 UCR Upland Soil Study	ADA-062	Mn	Zn	Sb,Pb,Se,Zn	Yes	1.09	0.61	2.3	Yes	Yes	3.3	No	Yes	0.00	0.18	0.49	No	Yes	0.098	No	Yes	7.1
2012 Ecology Upland Soil Study	SA2-6C	As,Mn	Pb,Zn	Cr,Pb,Se,Zn	Yes	9.6	1.4	3.4	Yes	Yes	3.2	No	Yes	0.76	0.62	0.69	No	Yes	0.16	No	Yes	57
2012 Ecology Upland Soil Study	SA8-1C	As,Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	8.7	1.3	3.2	Yes	Yes	3.2	No	Yes	0.01	0.28	0.30	No	Yes	0.12	No	Yes	64
2014 UCR Upland Soil Study	ADA-026	Mn,Se	Zn	Sb,Ba,Pb,Mo,Ni,Se,Zn	Yes	0.021	0.22	0.87	Yes	Yes	3.2	No	Yes	0.09	0.38	1.1	Yes	Yes	0.070	No	Yes	13
2014 UCR Upland Soil Study	ADA-066	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.65	0.52	1.5	Yes	Yes	3.2	No	Yes	0.01	0.27	0.42	No	Yes	0.076	No	Yes	12
2014 UCR Upland Soil Study	ADA-109	Mn	Zn	Sb,Pb,Se,Zn	Yes	1.4	0.65	2.7	Yes	Yes	3.2	No	Yes	<0.001	0.12	0.40	No	Yes	0.095	No	Yes	9.0
2014 UCR Upland Soil Study	ADA-133	Mn	Zn	Sb,Pb,Se,Zn	Yes	2.3	0.78	2.1	Yes	Yes	3.2	No	Yes	0.02	0.30	0.42	No	Yes	0.087	No	Yes	20
2014 UCR Upland Soil Study	ADA-153	As,Mn	Zn	Sb,Pb,Se,Zn	Yes	1.9	0.72	2.7	Yes	Yes	3.2	No	Yes	<0.001	0.14	0.36	No	Yes	0.10	No	Yes	14
2012 Ecology Upland Soil Study	SA11-6C	As,Mn	Pb,Zn	Cr,Pb,Se,Zn	Yes	10	1.4	4.8	Yes	Yes	3.1	No	Yes	0.01	0.28	0.60	No	Yes	0.16	No	Yes	15
2012 Ecology Upland Soil Study	SA6-6C	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	23	2.2	5.2	Yes	Yes	3.1	No	Yes	<0.001	0.17	0.17	No	Yes	0.12	No	Yes	52
2014 UCR Upland Soil Study	ADA-082	Mn	NA	Sb,Cr,Pb,Se,Zn	Yes	0.13	0.34	1.3	Yes	Yes	3.1	No	Yes	0.00	0.19	0.52	No	Yes	0.068	No	Yes	2.1
2012 Ecology Upland Soil Study	SA12-3C	Mn,Se	NA	Pb,Se,Zn	Yes	0.59	0.51	1.8	Yes	Yes	3.0	No	Yes	<0.001	0.16	0.38	No	Yes	0.062	No	Yes	3.3
2012 Ecology Upland Soil Study	SA4-3C	Al,As,Fe,Mn	Zn	Cr,Pb,Se,Zn	Yes	4.1	1.0	3.3	Yes	Yes	3.0	No	Yes	0.00	0.20	0.45	No	Yes	0.12	No	Yes	28
2012 Ecology Upland Soil Study	SA9-10C	As,Mn	Pb,Zn	As,Cr,Pb,Se,Zn	Yes	5.4	1.1	3.6	Yes	Yes	3.0	No	Yes	0.04	0.33	0.71	No	Yes	0.12	No	Yes	23
2014 UCR Upland Soil Study	ADA-017	As,Mn	Zn	Sb,Pb,Se,Zn	Yes	2.9	0.84	2.2	Yes	Yes	3.0	No	Yes	0.00	0.23	0.30	No	Yes	0.096	No	Yes	20
2014 UCR Upland Soil Study	ADA-021	As,Mn	NA	Sb,Cu,Pb,Mo,Ni,Se,Zn	Yes	0.0035	0.15	0.56	Yes	Yes	3.0	No	Yes	0.11	0.40	1.0	Yes	Yes	0.039	No	Yes	0.73
2014 UCR Upland Soil Study	ADA-054	As,Mn	Zn	Sb,As,Pb,Se,Zn	Yes	2.4	0.79	3.3	Yes	Yes	3.0	No	Yes	<0.001	0.12	0.39	No	Yes	0.13	No	Yes	14
2014 UCR Upland Soil Study	ADA-124	Al,Fe,Mn	Zn	Sb,Pb,Se,Zn	Yes	2.5	0.80	1.8	Yes	Yes	3.0	No	Yes	0.02	0.31	0.25	No	Yes	0.064	No	Yes	17
2014 UCR Upland Soil Study	ADA-141	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.34	0.43	1.2	Yes	Yes	3.0	No	Yes	0.02	0.30	0.40	No	Yes	0.060	No	Yes	10
2014 UCR Upland Soil Study	ADA-155	Al,Mn	Zn	Sb,Pb,Se,Zn	Yes	2.4	0.79	2.1	Yes	Yes	3.0	No	Yes	<0.001	0.17	0.21	No	Yes	0.082	No	Yes	25
2014 UCR Upland Soil Study	ADA-001	Mn	Zn	Sb,Pb,Se,Zn	Yes	2.9	0.84	2.6	Yes	Yes	2.9	No	Yes	0.01	0.27	0.49	No	Yes	0.12	No	Yes	15
2014 UCR Upland Soil Study	ADA-046	Mn	Zn	Sb,Pb,Se,Zn	Yes	2.4	0.79	2.2	Yes	Yes	2.9	No	Yes	0.00	0.19	0.28	No	Yes	0.081	No	Yes	11
2014 UCR Upland Soil Study	ADA-165	As,Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	12	1.5	4.2	Yes	Yes	2.9	No	Yes	0.00	0.22	0.31	No	Yes	0.15	No	Yes	52
2014 UCR Upland Soil Study	ADA-168	As,Mn	Pb,Zn	Sb,As,Pb,Se,Zn	Yes	5.3	1.1	2.6	Yes	Yes	2.9	No	Yes	0.04	0.33	0.36	No	Yes	0.12	No	Yes	44
2012 Ecology Upland Soil Study	SA3-5C	Mn	NA	Pb,Se,Zn	Yes	0.039	0.25	0.88	Yes	Yes	2.8	No	Yes	<0.001	0.17	0.37	No	Yes	0.062	No	No	0.85
2012 Ecology Upland Soil Study	SA4-8C	Mn	NA	Pb,Se,Zn	Yes	0.11	0.32	1.1	Yes	Yes	2.8	No	Yes	<0.001	0.17	0.38	No	Yes	0.062	No	No	4.0
2012 Ecology Upland Soil Study	SA8-5C	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	29	2.5	6.1	Yes	Yes	2.8	No	Yes	0.01	0.25	0.27	No	Yes	0.16	No	Yes	52
2012 Ecology Upland Soil Study	SA8-4C	Mn	Pb,Zn	Pb,Se,Zn	Yes	12	1.6	3.7	Yes	Yes	2.7	No	Yes	0.00	0.23	0.25	No	Yes	0.094	No	Yes	33
2014 UCR Upland Soil Study	ADA-146	Mn	Zn	Sb,Pb,Se,Zn	Yes	3.6	0.91	2.4	Yes	Yes	2.7	No	Yes	0.00	0.22	0.29	No	Yes	0.099	No	Yes	28
2014 UCR Upland Soil Study	ADA-182	Mn,Se	Zn	Sb,Pb,Mo,Se,Zn	Yes	<0.001	0.11	0.37	Yes	Yes	2.7	No	Yes	0.05	0.34	0.72	No	Yes	0.047	No	Yes	8.7
2012 Ecology Upland Soil Study	SA4-2C	Mn	NA	Pb,Se,Zn	Yes	0.11	0.33	1.1	Yes	Yes	2.6	No	Yes	<0.001	0.18	0.40	No	Yes	0.062	No	Yes	2.0
2014 UCR Upland Soil Study	ADA-005	As,Mn,Se	Zn	Sb,Pb,Mo,Ni,Se,Zn	Yes	0.017	0.21	0.62	Yes	Yes	2.6	No	Yes	0.84	0.63	1.0	Yes	Yes	0.10	No	Yes	11
2014 UCR Upland Soil Study	ADA-050	As,Mn,Se	Zn	Sb,Cr,Cu,Pb,Se,Zn	Yes	2.7	0.83	3.2	Yes	Yes	2.6	No	Yes	0.03	0.32	0.91	No	Yes	0.17	No	Yes	22
2012 Ecology Upland Soil Study	SA5-8C	As,Mn	Pb,Zn	As,Cr,Pb,Se,Zn	Yes	4.8	1.0	2.8	Yes	Yes	2.5	No	Yes	0.09	0.38	0.55	No	Yes	0.12	No	Yes	11
2012 Ecology Upland Soil Study	SA7-5C	Al,As,Mn	Pb,Zn	Sb,As,Cu,Pb,Se,Tl,Zn	Yes	43	3.5	7.6	Yes	Yes	2.5	No	Yes	0.17	0.44	0.38	No	Yes	0.19	Yes	Yes	72
2012 Ecology Upland Soil Study	SA7-6C	Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	18	1.9	4.1	Yes	Yes	2.5	No	Yes	0.05	0.35	0.30	No	Yes	0.16	No	Yes	76
2012 Ecology Upland Soil Study	SA8-2C	Al,As,Mn	Pb,Zn	Sb,As,Pb,Se,Zn	Yes	7.8	1.3	3.0	Yes	Yes	2.5	No	Yes	0.00	0.22	0.23	No	Yes	0.094	No	Yes	42
2014 UCR Upland Soil Study	ADA-015	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.28	0.41	1.2	Yes	Yes	2.5	No	Yes	<0.001	0.17	0.26	No	Yes	0.060	No	Yes	5.3
2012 Ecology Upland Soil Study	SA5-4C	Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	5.0	1.0	2.9	Yes	Yes	2.4	No	Yes	0.00	0.23	0.33	No	Yes	0.094	No	Yes	27
2014 UCR Upland Soil Study	ADA-019	Mn	NA	Sb,Cr,Pb,Se,Zn	Yes	0.011	0.19	0.64	Yes	Yes	2.4	No	Yes	0.05	0.34	0.69	No	Yes	0.048	No	Yes	1.4
2014 UCR Upland Soil Study	ADA-158	As,Mn	Pb,Zn	Sb,As,Pb,Se,Zn	Yes	16	1.8	4.8	Yes	Yes	2.4	No	Yes	0.05	0.35	0.33	No	Yes	0.15	No	Yes	44
2012 Ecology Upland Soil Study	SA11-3C	Mn,Se	NA	Pb,Se,Zn	Yes	0.057	0.28	0.94	Yes	Yes	2.3	No	Yes	0.00	0.23	0.49	No	Yes	0.062	No	Yes	2.2
2014 UCR Upland Soil Study	ADA-002	Mn,Se	Zn	Sb,Pb,Mo,Ni,Se,Zn	Yes	0.0038	0.16	0.41	Yes	Yes	2.3	No	Yes	1.38	0.72	0.95	Yes	Yes	0.080	No	Yes	15
2014 UCR Upland Soil Study	ADA-110	Mn	Zn	Sb,Pb,Se,Zn	Yes	1.2	0.62	1.8	Yes	Yes	2.2	No	Yes	0.00	0.21	0.32	No	Yes	0.085	No	Yes	13
2014 UCR Upland Soil Study	ADA-125	Mn	Zn	Sb,Pb,Se,Zn	Yes	1.1	0.62	1.3	Yes	Yes	2.2	No	Yes	0.02	0.31	0.26	No	Yes	0.056	No	Yes	9.5
2014 UCR Upland Soil Study	ADA-136	Mn	Zn	Sb,Pb,Se,Zn	Yes	1.7	0.70	1.8	Yes	Yes	2.2	No	Yes	0.00	0.23	0.28	No	Yes	0.072	No	Yes	21
2014 UCR Upland Soil Study	ADA-142	Mn	Zn	Sb,Pb,Se,Zn	Yes	2.2	0.76	1.9	Yes	Yes	2.2	No	Yes	<0.001	0.18	0.21	No	Yes	0.078	No	Yes	17
2014 UCR Upland Soil Study	ADA-183	Mn,Se	Zn	Sb,Ba,Pb,Mo,Ni,Se,Zn	Yes	<0.001	0.088	0.41	Yes	Yes	2.2	No	Yes	0.07	0.37	1.5	Yes	Yes	0.055	No	Yes	19
2012 Ecology Upland Soil Study	SA6-8C	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.33	0.43	1.0	Yes	Yes	2.1	No	Yes	0.00	0.23	0.24	No	Yes	0.062	No	No	5.1
2014 UCR Upland Soil Study	ADA-020	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.054	0.27	0.59	Yes	Yes	2.1	No	Yes	0.23	0.47	0.38	No	Yes	0.055	No	Yes	8.8
2014 UCR Upland Soil Study	ADA-065	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.70	0.53	1.2	Yes	Yes	2.1	No	Yes	0.02	0.29	0.27	No	Yes	0.062	No	Yes	11
2012 Ecology Upland Soil Study	SA5-5C	Mn	Zn	Pb,Se,Zn	Yes	0.16	0.36	0.98	Yes	Yes	2.0	No	Yes	0.02	0.31	0.44	No	Yes	0.062	No	Yes	4.8
2014 UCR Upland Soil Study	ADA-006	Mn	Zn	Sb,Pb,Se,Zn	Yes	1.3	0.64	1.6	Yes	Yes	2.0	No	Yes	0.02	0.29	0.32	No	Yes	0.072	No	Yes	15
2014 UCR Upland Soil Study	ADA-148	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	10	1.4	2.8	Yes	Yes	2.0	No	Yes	0.05	0.36	0.27	No	Yes	0.11	No	Yes	39
2014 UCR Upland Soil Study	ADA-162	As,Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	18	1.9	5.7	Yes	Yes	2.0	No	Yes	<0.001	0.12	0.20	No	Yes	0.16	No	Yes	43
2012 Ecology Upland Soil Study	SA5-7C	Mn	Pb,Zn	Pb,Se,Zn	Yes	6.7	1.2	3.2	Yes	Yes	1.9	No	Yes	0.00	0.20	0.29	No	Yes	0.12	No	Yes	37
2012 Ecology Upland Soil Study	SA2-5C	Mn	NA	Pb,Se	Yes	0.028	0.24	0.58	Yes	Yes	1.8	No	Yes	0.06	0.36	0.40	No	Yes	0.062	No	No	3.6
2014 UCR Upland Soil Study	ADA-016	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.29	0.42	0.92	Yes	Yes	1.8	No	Yes	0.00	0.23	0.28	No	Yes	0.052	No	Yes	7.7

Table 6-2. Hazard Quotients for Plants for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, and Potentially Affected Fraction at Each

						Lead					Manganese			Nickel					Thallium			
Study	Location ID	COPCs with SSL HQ ≥ 1 COPCs with BABs Not included	COPCs with BAB HQ ≥ 1	COPCs with concentration > BTV	Detect	PAF (%)	BAB HQ	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	PAF (%)	BAB HQ	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	PAF (%)
2014 UCR Upland Soil Study	ADA-023	As,Mn,Se	Zn	Sb,Cr,Pb,Mo,Se,Zn	Yes	0.23	0.39	1.2	Yes	Yes	1.8	No	Yes	0.27	0.49	0.67	No	Yes	0.095	No	Yes	15
2015 Bossburg Study	UDU-05-ICS	Mn	NA	Sb,Cr,Pb,Se,Zn	Yes	0.0032	0.15	0.40	Yes	Yes	1.8	No	Yes	0.12	0.41	0.55	No	Yes	0.059	No	Yes	0.84
2012 Ecology Upland Soil Study	SA7-3C	Al,As,Mn	Pb,Zn	Sb,As,Pb,Se,Zn	Yes	27	2.5	5.3	Yes	Yes	1.7	No	Yes	0.02	0.30	0.26	No	Yes	0.16	No	Yes	41
2012 Ecology Upland Soil Study	SA8-3C	Mn	Zn	Pb,Se,Zn	Yes	0.38	0.45	1.1	Yes	Yes	1.7	No	Yes	0.06	0.36	0.39	No	Yes	0.062	No	No	10
2012 Ecology Upland Soil Study	SA7-2C	Mn	Pb,Zn	Pb,Se,Zn	Yes	7.2	1.2	2.6	Yes	Yes	1.6	No	Yes	0.15	0.43	0.38	No	Yes	0.12	No	Yes	50
2014 UCR Upland Soil Study	ADA-135	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.44	0.47	0.97	Yes	Yes	1.6	No	Yes	0.44	0.54	0.35	No	Yes	0.056	No	Yes	33
2015 Bossburg Study	UDU-06-ICS	Mn,Se	NA	Sb,Pb,Se	Yes	<0.001	0.095	0.32	Yes	Yes	1.6	No	Yes	0.01	0.26	0.55	No	Yes	0.042	No	Yes	0.060
2012 Ecology Upland Soil Study	SA9-4C	Mn,Se	Pb,Zn	Sb,Pb,Se,Zn	Yes	7.6	1.2	4.2	Yes	Yes	1.5	No	Yes	0.01	0.25	0.54	No	Yes	0.12	No	Yes	26
2014 UCR Upland Soil Study	ADA-132	Al,Fe,Mn	Zn	Sb,Pb,Se,Zn	Yes	1.7	0.70	1.9	Yes	Yes	1.5	No	Yes	0.00	0.21	0.28	No	Yes	0.080	No	Yes	17
2014 UCR Upland Soil Study	ADA-143	Mn	Zn	Sb,Pb,Se,Zn	Yes	0.82	0.56	1.2	Yes	Yes	1.5	No	Yes	0.02	0.29	0.23	No	Yes	0.059	No	Yes	17
2014 UCR Upland Soil Study	ADA-144	As,Mn	Zn	Sb,Pb,Se,Zn	Yes	2.4	0.80	2.2	Yes	Yes	1.5	No	Yes	<0.001	0.12	0.16	No	Yes	0.081	No	Yes	17
2014 UCR Upland Soil Study	ADA-150	Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	9.1	1.3	2.7	Yes	Yes	1.5	No	Yes	0.02	0.30	0.22	No	Yes	0.095	No	Yes	36
2014 UCR Upland Soil Study	ADA-160	Mn	Zn	Sb,Pb,Se,Zn	Yes	2.4	0.79	1.9	Yes	Yes	1.5	No	Yes	0.00	0.21	0.22	No	Yes	0.076	No	Yes	18
2015 Bossburg Study	UDU-01-ICS	Mn	Zn	Sb,Pb,Se	Yes	3.6	0.91	1.5	Yes	Yes	1.5	No	Yes	0.54	0.57	0.29	No	Yes	0.042	No	Yes	12
2015 Bossburg Study	UDU-02-ICS	Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	8.1	1.3	2.2	Yes	Yes	1.5	No	Yes	0.52	0.56	0.29	No	Yes	0.041	No	Yes	16
2015 Bossburg Study	UDU-04-ICS	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	93	14	21	Yes	Yes	1.5	No	Yes	0.67	0.60	0.26	No	Yes	0.057	No	Yes	42
2012 Ecology Upland Soil Study	SA13-4C	Mn,Se	NA	Pb,Se,Zn	Yes	<0.001	0.06	0.27	Yes	Yes	1.4	No	Yes	0.00	0.19	0.70	No	Yes	0.062	No	No	0.56
2014 UCR Upland Soil Study	ADA-128	Mn	Zn	Sb,Pb,Se,Zn	Yes	3.0	0.85	1.9	Yes	Yes	1.4	No	Yes	0.00	0.21	0.19	No	Yes	0.069	No	Yes	20
2014 UCR Upland Soil Study	ADA-147	Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	5.6	1.1	2.9	Yes	Yes	1.4	No	Yes	<0.001	0.11	0.15	No	Yes	0.086	No	Yes	17
2015 Bossburg Study	UDU-03-ICS	Mn	Pb,Zn	Sb,Cu,Pb,Se,Zn	Yes	25	2.3	3.4	Yes	Yes	1.3	No	Yes	1.06	0.67	0.27	No	Yes	0.036	No	Yes	19
2012 Ecology Upland Soil Study	SA7-4C	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	4.9	1.0	2.2	Yes	Yes	1.2	No	Yes	<0.001	0.18	0.16	No	Yes	0.062	No	Yes	25
2014 UCR Upland Soil Study	ADA-151	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	Yes	8.8	1.3	2.7	Yes	Yes	1.0	No	Yes	0.03	0.32	0.25	No	Yes	0.099	No	Yes	43
2012 Ecology Upland Soil Study	SA6-5C	NA	NA	Pb,Se	Yes	0.018	0.21	0.50	Yes	Yes	0.83	No	Yes	<0.001	0.18	0.18	No	Yes	0.062	No	No	0.92
2012 Ecology Upland Soil Study	SA6-4C	NA	NA	Pb,Se	Yes	0.079	0.30	0.70	Yes	Yes	0.74	No	Yes	<0.001	0.18	0.19	No	Yes	0.062	No	No	2.7
2012 Ecology Upland Soil Study	SA10-4C	Se	NA	Sb,Pb,Se,Zn	Yes	0.34	0.43	1.8	Yes	Yes	0.20	No	Yes	<0.001	0.10	0.34	No	Yes	0.062	No	No	0.7

Source: U.S. Environmental Protection Agency (EPA). 2005. *Guidance for Developing Ecological Soil Screening Levels* . OSWER Directive 9285.7-55. Office of Solid Waste and Er

Notes:

HQs, PAFs, and BTV comparisons for each sample are presented in Appendix F

Qualitative bioavailability score: OR - Out of range due to high organic matter; 0 = very low; 1 = low; 2 = medium; 3 = high; Based on EPA (2005b).

> = greater than

≥ = greater than or equal to

Al = aluminum

As = arsenic

Ba = barium

BAB = bioavailability-adjusted benchmark

BTV = background threshold value

Co = cobalt

COPC = chemical of potential concern

Cr = chromium

Cu = copper

Fe = iron

HQ = hazard quotient

ID = identification

Mn = manganese

Mo = molybdenum

NA = not applicable

Ni = nickel

PAF = potentially affected fraction

Pb = lead

Sb = antimony

Se = selenium

SSL = soil screening level

Tl = thallium

UCR = Upper Columbia River

Zn = zinc

Table 6-2. Hazard Quotients for Plants for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, and Potentially Affected Fraction at Each

					Zinc			
Study	Location ID	COPCs with SSL HQ ≥ 1 COPCs with BABs Not included	COPCs with BAB HQ ≥ 1	COPCs with concentration > BTV	BAB HQ	SSL HQ	>BTV	Detect
2012 Ecology Upland Soil Study	SA10-2C	As,Mn,Se	Pb,Zn	Sb,As,Ba,Co,Cu,Fe,Pb,Mn,Ni,Se,Tl,Zn	4.5	8.3	Yes	Yes
2012 Ecology Upland Soil Study	SA10-7C	As,Mn	Zn	As,Ba,Pb,Mn,Ni,Se,Zn	1.7	3.2	Yes	Yes
2012 Ecology Upland Soil Study	SA10-3C	As,Mn	Zn	Sb,As,Ba,Cu,Pb,Mn,Ni,Se,Zn	2.7	5.2	Yes	Yes
2012 Ecology Upland Soil Study	SA10-8C	As,Mn	Zn	Pb,Mn,Se,Zn	1.3	2.5	Yes	Yes
2012 Ecology Upland Soil Study	SA11-9C	As,Mn,Se	Pb,Zn	Sb,As,Ba,Cr,Cu,Pb,Mn,Ni,Se,Tl,Zn	3.7	4.7	Yes	Yes
2012 Ecology Upland Soil Study	SA12-9C	Mn	NA	Ba,Pb,Mn,Ni,Se,Zn	0.69	1.0	Yes	Yes
2012 Ecology Upland Soil Study	SA1-1C	Mn,Se	NA	Ba,Cr,Pb,Mn,Se,Zn	0.80	1.1	Yes	Yes
2012 Ecology Upland Soil Study	SA1-2C	Mn	Zn	Ba,Cr,Fe,Pb,Mn,Se,Zn	1.0	1.4	Yes	Yes
2012 Ecology Upland Soil Study	SA12-7C	Mn	Zn	Ba,Pb,Mn,Se,Zn	1.9	2.8	Yes	Yes
2012 Ecology Upland Soil Study	SA2-1C	Mn	Zn	Ba,Pb,Mn,Se,Zn	4.4	3.1	Yes	Yes
2012 Ecology Upland Soil Study	SA3-6C	Mn	Pb,Ni,Zn	Ba,Cr,Co,Cu,Fe,Pb,Mn,Ni,Se,Tl,Zn	3.5	4.1	Yes	Yes
2014 UCR Upland Soil Study	ADA-061	Mn	NA	Sb,Ba,Cr,Pb,Mn,Ni,Se,Zn	0.91	1.3	Yes	Yes
2012 Ecology Upland Soil Study	SA10-6C	Mn	NA	Ba,Pb,Mn,Se,Zn	1.0	1.7	Yes	Yes
2012 Ecology Upland Soil Study	SA13-6C	As,Mn	NA	Pb,Mn,Se,Zn	0.94	1.7	Yes	Yes
2014 UCR Upland Soil Study	ADA-064	Al,Mn	Zn	Sb,Ba,Cr,Pb,Mn,Se,Zn	1.4	1.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-107	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Mo,Ni,Se,Zn	1.6	2.1	Yes	Yes
2014 UCR Upland Soil Study	ADA-103	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Ni,Se,Zn	1.0	1.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-056	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Se,Zn	1.1	1.2	Yes	Yes
2012 Ecology Upland Soil Study	SA6-1C	Mn	Pb,Zn	Pb,Mn,Se,Zn	4.1	2.9	Yes	Yes
2012 Ecology Upland Soil Study	SA9-8C	As,Mn	Pb,Zn	Sb,As,Ba,Cr,Pb,Mn,Se,Tl,Zn	4.2	5.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-058	Mn	NA	Sb,Ba,Pb,Mn,Mo,Se,Zn	0.99	1.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-053	Mn	NA	Sb,Ba,Cr,Pb,Mn,Se,Zn	0.71	1.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-093	As,Mn	Zn	Sb,Ba,Pb,Mn,Se,Zn	1.3	1.7	Yes	Yes
2014 UCR Upland Soil Study	ADA-059	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Mo,Se,Zn	1.2	1.5	Yes	Yes
2012 Ecology Upland Soil Study	SA9-1C	As,Mn	Pb,Zn	As,Ba,Cr,Pb,Mn,Se,Tl,Zn	3.6	4.9	Yes	Yes
2012 Ecology Upland Soil Study	SA9-5C	As,Mn	Pb,Zn	Sb,As,Ba,Pb,Mn,Se,Zn	3.4	4.5	Yes	Yes
2012 Ecology Upland Soil Study	SA1-6C	As,Mn	NA	Pb,Mn,Se,Zn	0.67	0.84	Yes	Yes
2014 UCR Upland Soil Study	ADA-055	As,Ba,Mn,Se	Zn	Sb,As,Ba,Cu,Pb,Mn,Mo,Ni,Se,Zn	2.5	3.4	Yes	Yes
2012 Ecology Upland Soil Study	SA11-5C	Al,As,Mn	Zn	Sb,Ba,Pb,Mn,Se,Zn	2.3	2.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-122	Mn	NA	Sb,Ba,Pb,Mn,Se,Zn	0.97	1.4	Yes	Yes
2012 Ecology Upland Soil Study	SA12-1C	As,Mn	Zn	As,Cr,Cu,Fe,Pb,Mn,Ni,Se,Zn	1.9	2.7	Yes	Yes
2014 UCR Upland Soil Study	ADA-084	Mn	NA	Sb,Pb,Mn,Se,Zn	0.82	1.7	Yes	Yes
2014 UCR Upland Soil Study	ADA-099	As,Mn	Zn	Sb,Cr,Pb,Mn,Se,Zn	1.3	2.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-106	Al,Mn,Se	Zn	Sb,Ba,Pb,Mn,Mo,Se,Zn	1.4	1.5	Yes	Yes
2012 Ecology Upland Soil Study	SA11-8C	Al,As,Mn	Pb,Zn	Sb,As,Ba,Cr,Cu,Pb,Mn,Se,Tl,Zn	3.9	4.1	Yes	Yes
2014 UCR Upland Soil Study	ADA-063	Mn	Zn	Sb,Ba,Pb,Mn,Mo,Se,Zn	1.6	1.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-089	As,Mn	Zn	Sb,As,Ba,Cr,Pb,Mn,Se,Zn	1.5	2.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-092	As,Mn,Se	Zn	Sb,As,Ba,Cr,Pb,Mn,Mo,Se,Zn	1.4	2.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-112	Mn	NA	Sb,Ba,Pb,Mn,Se,Zn	0.74	1.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-025	As,Mn,Se	Zn	Sb,Ba,Pb,Mn,Mo,Se,Zn	2.6	3.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-113	Mn	NA	Sb,Ba,Cr,Pb,Mn,Se,Zn	0.77	1.1	Yes	Yes
2014 UCR Upland Soil Study	ADA-114	Al,Fe,Mn	Zn	Sb,Ba,Pb,Mn,Se,Zn	1.2	1.2	Yes	Yes
2012 Ecology Upland Soil Study	SA12-2C	Al,Mn	Zn	Pb,Mn,Se,Zn	1.2	1.4	Yes	Yes
2012 Ecology Upland Soil Study	SA13-3C	Mn	NA	Pb,Mn,Se,Zn	1.0	1.8	Yes	Yes
2012 Ecology Upland Soil Study	SA13-5C	As,Mn	Pb,Zn	Sb,Ba,Cr,Cu,Pb,Mn,Se,Zn	2.0	4.1	Yes	Yes
2014 UCR Upland Soil Study	ADA-049	Mn	Zn	Sb,Ba,Pb,Mn,Mo,Se,Zn	2.1	1.8	Yes	Yes
2012 Ecology Upland Soil Study	SA11-7C	Al,As,Mn,Se	Pb,Zn	Sb,As,Ba,Cu,Pb,Mn,Se,Tl,Zn	6.9	7.2	Yes	Yes
2012 Ecology Upland Soil Study	SA3-3C	Mn	Zn	Ba,Cr,Pb,Mn,Ni,Se,Zn	1.2	1.7	Yes	Yes
2014 UCR Upland Soil Study	ADA-118	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Se,Zn	1.5	1.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-174	Al,Mn	Zn	Sb,Ba,Pb,Mn,Mo,Se,Zn	1.0	1.4	Yes	Yes
2012 Ecology Upland Soil Study	SA6-7C	Al,As,Mn	Pb,Zn	Sb,As,Cr,Pb,Mn,Se,Zn	5.6	3.4	Yes	Yes
2014 UCR Upland Soil Study	ADA-010	As,Mn	Zn	Sb,As,Pb,Mn,Se,Zn	1.4	2.5	Yes	Yes
2012 Ecology Upland Soil Study	SA12-8C	Mn	Zn	Pb,Mn,Se,Zn	1.2	1.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-067	Mn	Zn	Sb,Ba,Cr,Cu,Pb,Mn,Mo,Se,Zn	1.8	1.7	Yes	Yes
2012 Ecology Upland Soil Study	SA9-9C	As,Mn	Zn	As,Cr,Pb,Mn,Ni,Se,Zn	2.3	2.7	Yes	Yes
2012 Ecology Upland Soil Study	SA1-8C	Mn	NA	Ba,Pb,Mn,Se,Zn	0.73	0.94	Yes	Yes
2012 Ecology Upland Soil Study	SA11-4C	As,Mn	Pb,Zn	Sb,Ba,Pb,Mn,Se,Tl,Zn	3.1	4.4	Yes	Yes
2014 UCR Upland Soil Study	ADA-173	Al,Mn	Zn	Sb,Pb,Mn,Mo,Se,Zn	1.1	1.2	Yes	Yes
2012 Ecology Upland Soil Study	SA3-2C	Mn	NA	Ba,Pb,Mn,Se,Zn	0.76	0.89	Yes	Yes
2014 UCR Upland Soil Study	ADA-088	As,Mn	Zn	Sb,Cr,Pb,Mn,Se,Zn	1.2	1.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-090	Mn	Zn	Sb,Ba,Cr,Pb,Mn,Se,Zn	1.3	1.9	Yes	Yes
2012 Ecology Upland Soil Study	SA2-4C	Al,Mn	Zn	Pb,Mn,Se,Zn	2.5	1.6	Yes	Yes
2012 Ecology Upland Soil Study	SA6-3C	Al,As,Mn	Pb,Zn	As,Cr,Pb,Mn,Se,Zn	4.7	2.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-117	Mn	Zn	Sb,Pb,Mn,Se,Zn	1.9	1.3	Yes	Yes
2012 Ecology Upland Soil Study	SA12-6C	Mn	Zn	Cu,Pb,Mn,Se,Zn	1.0	1.6	Yes	Yes
2012 Ecology Upland Soil Study	SA13-2C	Mn,Se	NA	Pb,Mn,Se,Zn	0.83	1.9	Yes	Yes
2012 Ecology Upland Soil Study	SA9-3C	Mn	Zn	Ba,Cr,Fe,Pb,Mn,Ni,Se,Zn	1.4	1.8	Yes	Yes
2012 Ecology Upland Soil Study	SA9-7C	As,Mn	Pb,Zn	Sb,As,Cr,Pb,Mn,Se,Tl,Zn	3.0	3.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-035	Mn	Zn	Sb,Pb,Mn,Se,Zn	1.8	2.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-096	Mn	Zn	Sb,Ba,Pb,Mn,Se,Zn	1.1	1.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-078	As,Mn	Zn	Sb,Ba,Cr,Pb,Se,Zn	2.0	1.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-095	Mn	NA	Sb,Cr,Pb,Se,Zn	0.53	1.2	Yes	Yes
2012 Ecology Upland Soil Study	SA11-2C	Mn	NA	Ba,Pb,Se,Zn	0.91	1.2	Yes	Yes
2012 Ecology Upland Soil Study	SA13-8C	Al,Mn	NA	Pb,Se,Zn	0.72	1.2	Yes	Yes
2012 Ecology Upland Soil Study	SA4-7C	Mn	Zn	Cr,Pb,Ni,Se,Zn	1.3	1.7	Yes	Yes
2014 UCR Upland Soil Study	ADA-097	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	1.2	2.8	Yes	Yes

Table 6-2. Hazard Quotients for Plants for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, and Potentially Affected Fraction at Each

					Zinc			
Study	Location ID	COPCs with SSL HQ ≥ 1 COPCs with BABs Not included	COPCs with BAB HQ ≥ 1	COPCs with concentration > BTV	BAB HQ	SSL HQ	>BTV	Detect
2014 UCR Upland Soil Study	ADA-104	Mn	Zn	Sb,Ba,Pb,Mo,Se,Zn	1.1	1.4	Yes	Yes
2014 UCR Upland Soil Study	ADA-115	Mn	NA	Sb,Pb,Se,Zn	0.86	1.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-121	Mn	Zn	Sb,Cr,Pb,Se,Zn	1.5	2.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-179	Mn	Zn	Sb,Pb,Mo,Se,Zn	1.2	1.4	Yes	Yes
2014 UCR Upland Soil Study	ADA-181	Mn,Se	Zn	Sb,Ba,Pb,Mo,Se,Zn	1.0	1.9	Yes	Yes
2012 Ecology Upland Soil Study	SA2-8C	Mn	Zn	Cr,Pb,Se,Zn	1.6	1.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-033	Mn	Zn	Sb,Ba,Pb,Mo,Ni,Se,Zn	2.7	3.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-184	Mn,Se	Zn	Sb,Ba,Pb,Mo,Se,Zn	1.3	2.2	Yes	Yes
2012 Ecology Upland Soil Study	SA1-5C	Mn	NA	Pb,Se,Zn	0.59	0.79	Yes	Yes
2012 Ecology Upland Soil Study	SA6-2C	Mn	Pb,Zn	Pb,Se,Zn	4.0	2.8	Yes	Yes
2012 Ecology Upland Soil Study	SA9-6C	Mn	Pb,Zn	Sb,Cr,Pb,Se,Tl,Zn	2.4	3.4	Yes	Yes
2014 UCR Upland Soil Study	ADA-177	Al,Fe,Mn	NA	Sb,Pb,Se	0.50	0.65	No	Yes
2012 Ecology Upland Soil Study	SA1-7C	Mn	NA	Pb,Se,Zn	0.69	0.94	Yes	Yes
2012 Ecology Upland Soil Study	SA2-7C	Mn	Zn	Cr,Pb,Ni,Se,Zn	1.6	1.2	Yes	Yes
2012 Ecology Upland Soil Study	SA2-2C	Mn	Zn	Cr,Pb,Se,Zn	2.2	1.6	Yes	Yes
2012 Ecology Upland Soil Study	SA3-7C	Mn	Pb,Zn	Sb,Pb,Se,Zn	2.0	2.4	Yes	Yes
2012 Ecology Upland Soil Study	SA5-3C	Mn	Zn	Pb,Se,Zn	2.8	3.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-045	As,Mn	Pb,Zn	Sb,As,Pb,Se,Zn	1.7	2.7	Yes	Yes
2014 UCR Upland Soil Study	ADA-085	Mn	Zn	Sb,Pb,Se,Zn	2.5	6.7	Yes	Yes
2014 UCR Upland Soil Study	ADA-101	Mn	NA	Sb,Pb,Se,Zn	0.50	1.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-116	Mn	Zn	Sb,Pb,Se,Zn	1.3	1.1	Yes	Yes
2014 UCR Upland Soil Study	ADA-172	Al,Mn	NA	Sb,Pb,Se	0.23	0.45	No	Yes
2012 Ecology Upland Soil Study	SA10-1C	Mn	Zn	Ba,Cr,Pb,Se,Zn	1.2	2.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-039	Mn	Zn	Sb,Ba,Pb,Mo,Se,Zn	2.4	1.7	Yes	Yes
2014 UCR Upland Soil Study	ADA-111	Mn	Zn	Sb,Cr,Pb,Se,Zn	1.0	1.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-175	Al,Mn	NA	Sb,Pb,Se,Zn	0.85	0.73	Yes	Yes
2012 Ecology Upland Soil Study	SA7-1C	Mn	Pb,Zn	Sb,Pb,Se,Zn	3.7	2.1	Yes	Yes
2014 UCR Upland Soil Study	ADA-076	Al,As,Mn,Se	Zn	Sb,As,Ba,Pb,Mo,Se,Zn	2.7	3.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-105	Mn	Zn	Sb,Ba,Pb,Se,Zn	1.8	2.4	Yes	Yes
2012 Ecology Upland Soil Study	SA1-3C	Mn	NA	Ba,Cr,Pb,Se,Zn	0.65	0.83	Yes	Yes
2012 Ecology Upland Soil Study	SA4-6C	Mn	Pb,Zn	Cr,Pb,Se,Zn	2.2	2.7	Yes	Yes
2012 Ecology Upland Soil Study	SA7-8C	As,Mn	Co,Pb,Ni,Zn	As,Ba,Cr,Co,Cu,Fe,Pb,Ni,Se,Tl,Zn	7.7	4.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-048	Ba,Mn,Se	NA	Sb,Ba,Pb,Mo,Se,Zn	0.78	1.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-079	Al,Mn	Zn	Sb,Ba,Pb,Mo,Se,Zn	1.5	2.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-152	As,Mn	Zn	Sb,As,Cr,Pb,Se,Zn	2.4	2.7	Yes	Yes
2014 UCR Upland Soil Study	ADA-018	Mn	Pb,Zn	Sb,Pb,Se,Zn	1.8	2.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-091	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	1.8	2.2	Yes	Yes
2012 Ecology Upland Soil Study	SA3-4C	Mn	NA	Pb,Se,Zn	0.63	0.80	Yes	Yes
2014 UCR Upland Soil Study	ADA-102	Mn	Zn	Sb,Ba,Pb,Se,Zn	1.2	1.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-156	As,Mn	Pb,Zn	Sb,Pb,Se,Zn	2.1	2.8	Yes	Yes
2012 Ecology Upland Soil Study	SA12-4C	Mn	NA	Ba,Pb,Se,Zn	0.93	1.6	Yes	Yes
2012 Ecology Upland Soil Study	SA5-2C	Mn	Zn	Ba,Cr,Fe,Pb,Ni,Se,Zn	1.5	1.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-043	Mn,Se	NA	Sb,Ba,Pb,Mo,Ni,Se,Zn	0.94	1.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-070	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	1.4	2.1	Yes	Yes
2014 UCR Upland Soil Study	ADA-071	Mn	Zn	Sb,Pb,Se,Zn	1.7	1.7	Yes	Yes
2014 UCR Upland Soil Study	ADA-131	Al,As,Mn,Se	Pb,Zn	Sb,As,Ba,Pb,Se,Zn	2.5	2.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-169	Mn	NA	Sb,Pb,Se	0.40	0.68	No	Yes
2014 UCR Upland Soil Study	ADA-044	Mn,Se	Zn	Sb,Ba,Cr,Pb,Mo,Ni,Se,Zn	2.1	3.000	Yes	Yes
2014 UCR Upland Soil Study	ADA-119	Mn	NA	Sb,Cr,Pb,Se,Zn	0.98	1.5	Yes	Yes
2012 Ecology Upland Soil Study	SA1-4C	Mn	NA	Ba,Pb,Se,Zn	0.69	0.92	Yes	Yes
2012 Ecology Upland Soil Study	SA7-7C	Al,As,Mn,Se	Pb,Zn	Sb,As,Pb,Se,Tl,Zn	13	7.1	Yes	Yes
2012 Ecology Upland Soil Study	SA8-8C	As,Mn,Se	Pb,Zn	Sb,As,Ba,Cu,Pb,Se,Tl,Zn	11	7.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-034	Mn	Zn	Sb,Pb,Mo,Se,Zn	1.3	1.4	Yes	Yes
2014 UCR Upland Soil Study	ADA-057	Mn	NA	Sb,Cr,Pb,Se,Zn	0.92	1.1	Yes	Yes
2014 UCR Upland Soil Study	ADA-094	Mn	NA	Sb,Pb,Se,Zn	0.97	0.95	Yes	Yes
2014 UCR Upland Soil Study	ADA-170	Al,Mn	Zn	Sb,Pb,Mo,Se,Zn	1.6	2.2	Yes	Yes
2012 Ecology Upland Soil Study	SA3-8C	Mn	Zn	Pb,Se,Zn	1.1	1.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-028	As,Mn	Zn	Sb,Pb,Se,Zn	1.3	1.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-042	Mn	Zn	Sb,Ba,Pb,Mo,Se,Zn	1.5	1.1	Yes	Yes
2014 UCR Upland Soil Study	ADA-180	Mn,Se	Zn	Sb,Ba,Pb,Mo,Se,Zn	1.4	2.3	Yes	Yes
2012 Ecology Upland Soil Study	SA11-1C	Mn	NA	Cr,Pb,Se,Zn	0.81	1.1	Yes	Yes
2012 Ecology Upland Soil Study	SA4-1C	Mn	Zn	Cr,Pb,Se,Zn	1.3	1.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-052	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	1.6	2.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-159	As,Mn	Pb,Zn	Sb,Cr,Pb,Se,Zn	2.4	2.4	Yes	Yes
2014 UCR Upland Soil Study	ADA-178	Mn	NA	Sb,Pb,Se,Zn	0.76	0.99	Yes	Yes
2012 Ecology Upland Soil Study	SA13-1C	Mn	NA	Pb,Se,Zn	0.53	1.1	Yes	Yes
2012 Ecology Upland Soil Study	SA3-1C	Mn	NA	Pb,Se	0.40	0.52	No	Yes
2012 Ecology Upland Soil Study	SA5-1C	Mn,Se	Pb,Zn	Sb,Pb,Se,Zn	1.9	2.0	Yes	Yes
2012 Ecology Upland Soil Study	SA8-6C	Mn	Pb,Zn	Pb,Se,Zn	3.4	2.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-047	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	2.4	3.00	Yes	Yes
2014 UCR Upland Soil Study	ADA-154	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	2.3	2.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-176	Mn	NA	Sb,Cr,Pb,Ni,Se	0.66	0.68	No	Yes
2012 Ecology Upland Soil Study	SA10-5C	Mn	NA	Cr,Pb,Se,Zn	0.76	1.6	Yes	Yes
2012 Ecology Upland Soil Study	SA13-7C	As,Mn	NA	Sb,Pb,Se,Zn	0.71	1.4	Yes	Yes
2012 Ecology Upland Soil Study	SA4-4C	Al,Mn	Zn	Cr,Pb,Se,Zn	1.8	2.0	Yes	Yes
2012 Ecology Upland Soil Study	SA4-5C	Mn	NA	Pb,Se,Zn	0.91	1.2	Yes	Yes

Table 6-2. Hazard Quotients for Plants for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, and Potentially Affected Fraction at Each

Study	Location ID	COPCs with SSL HQ ≥ 1 COPCs with BABs Not included	COPCs with BAB HQ ≥ 1	COPCs with concentration > BTV	Zinc			
					BAB HQ	SSL HQ	>BTV	Detect
2012 Ecology Upland Soil Study	SA9-2C	Ba,Cr,Mn	Ni,Zn	Ba,Cr,Co,Cu,Fe,Pb,Ni,Se,Tl,Zn	1.7	2.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-004	Mn	Zn	Sb,Ba,Pb,Mo,Se,Zn	2.6	2.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-073	Al,As,Mn	Zn	Sb,Pb,Se,Zn	1.7	1.5	Yes	Yes
2012 Ecology Upland Soil Study	SA2-3C	Mn	Zn	Pb,Se,Zn	1.0	0.81	Yes	Yes
2014 UCR Upland Soil Study	ADA-024	As,Mn	Pb,Zn	Sb,As,Cu,Pb,Se,Zn	2.0	2.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-108	Mn	Zn	Sb,Cr,Pb,Se,Zn	1.0	1.4	Yes	Yes
2014 UCR Upland Soil Study	ADA-139	As,Mn	Zn	Sb,Pb,Se,Zn	1.8	1.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-171	Mn	Zn	Sb,Pb,Mo,Se,Zn	2.2	2.7	Yes	Yes
2012 Ecology Upland Soil Study	SA8-7C	As,Mn	Pb,Zn	Sb,As,Pb,Se,Tl,Zn	8.1	5.4	Yes	Yes
2014 UCR Upland Soil Study	ADA-051	Mn,Se	Zn	Sb,Ba,Cu,Pb,Mo,Ni,Se,Zn	2.2	2.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-081	Mn	Zn	Sb,Cr,Pb,Se,Zn	1.2	0.97	Yes	Yes
2014 UCR Upland Soil Study	ADA-145	Mn	Zn	Sb,Pb,Se,Zn	1.6	2.1	Yes	Yes
2014 UCR Upland Soil Study	ADA-060	As,Mn	Zn	Sb,Cr,Pb,Se,Zn	1.7	2.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-126	As,Mn	Pb,Zn	Sb,Cu,Pb,Se,Zn	2.1	2.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-127	As,Mn	Zn	Sb,Ba,Pb,Se,Zn	1.9	2.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-161	Al,Fe,Mn	Pb,Zn	Sb,Pb,Se,Zn	3.3	2.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-164	As,Mn,Se	Pb,Zn	Sb,Pb,Se,Zn	1.9	2.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-008	As,Mn	Pb,Zn	Sb,Cr,Pb,Se,Zn	1.7	2.1	Yes	Yes
2014 UCR Upland Soil Study	ADA-062	Mn	Zn	Sb,Pb,Se,Zn	1.2	1.9	Yes	Yes
2012 Ecology Upland Soil Study	SA2-6C	As,Mn	Pb,Zn	Cr,Pb,Se,Zn	4.4	3.2	Yes	Yes
2012 Ecology Upland Soil Study	SA8-1C	As,Mn	Pb,Zn	Sb,Pb,Se,Zn	5.1	3.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-026	Mn,Se	Zn	Sb,Ba,Pb,Mo,Ni,Se,Zn	1.6	2.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-066	Mn	Zn	Sb,Pb,Se,Zn	1.5	1.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-109	Mn	Zn	Sb,Pb,Se,Zn	1.3	2.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-133	Mn	Zn	Sb,Pb,Se,Zn	2.0	1.7	Yes	Yes
2014 UCR Upland Soil Study	ADA-153	As,Mn	Zn	Sb,Pb,Se,Zn	1.7	2.4	Yes	Yes
2012 Ecology Upland Soil Study	SA11-6C	As,Mn	Pb,Zn	Cr,Pb,Se,Zn	1.7	1.9	Yes	Yes
2012 Ecology Upland Soil Study	SA6-6C	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	4.0	2.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-082	Mn	NA	Sb,Cr,Pb,Se,Zn	0.79	1.2	Yes	Yes
2012 Ecology Upland Soil Study	SA12-3C	Mn,Se	NA	Pb,Se,Zn	0.91	1.2	Yes	Yes
2012 Ecology Upland Soil Study	SA4-3C	Al,As,Fe,Mn	Zn	Cr,Pb,Se,Zn	2.5	2.3	Yes	Yes
2012 Ecology Upland Soil Study	SA9-10C	As,Mn	Pb,Zn	As,Cr,Pb,Se,Zn	2.1	2.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-017	As,Mn	Zn	Sb,Pb,Se,Zn	2.0	1.7	Yes	Yes
2014 UCR Upland Soil Study	ADA-021	As,Mn	NA	Sb,Cu,Pb,Mo,Ni,Se,Zn	0.57	0.98	Yes	Yes
2014 UCR Upland Soil Study	ADA-054	As,Mn	Zn	Sb,As,Pb,Se,Zn	1.7	2.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-124	Al,Fe,Mn	Zn	Sb,Pb,Se,Zn	1.8	0.92	Yes	Yes
2014 UCR Upland Soil Study	ADA-141	Mn	Zn	Sb,Pb,Se,Zn	1.4	1.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-155	Al,Mn	Zn	Sb,Pb,Se,Zn	2.3	1.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-001	Mn	Zn	Sb,Pb,Se,Zn	1.7	1.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-046	Mn	Zn	Sb,Pb,Se,Zn	1.5	1.4	Yes	Yes
2014 UCR Upland Soil Study	ADA-165	As,Mn	Pb,Zn	Sb,Pb,Se,Zn	4.0	3.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-168	As,Mn	Pb,Zn	Sb,As,Pb,Se,Zn	3.4	2.6	Yes	Yes
2012 Ecology Upland Soil Study	SA3-5C	Mn	NA	Pb,Se,Zn	0.59	0.90	Yes	Yes
2012 Ecology Upland Soil Study	SA4-8C	Mn	NA	Pb,Se,Zn	1.0	1.2	Yes	Yes
2012 Ecology Upland Soil Study	SA8-5C	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	4.0	2.6	Yes	Yes
2012 Ecology Upland Soil Study	SA8-4C	Mn	Pb,Zn	Pb,Se,Zn	2.7	1.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-146	Mn	Zn	Sb,Pb,Se,Zn	2.4	2.1	Yes	Yes
2014 UCR Upland Soil Study	ADA-182	Mn,Se	Zn	Sb,Pb,Mo,Se,Zn	1.3	1.5	Yes	Yes
2012 Ecology Upland Soil Study	SA4-2C	Mn	NA	Pb,Se,Zn	0.76	1.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-005	As,Mn,Se	Zn	Sb,Pb,Mo,Ni,Se,Zn	1.5	1.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-050	As,Mn,Se	Zn	Sb,Cr,Cu,Pb,Se,Zn	2.1	3.4	Yes	Yes
2012 Ecology Upland Soil Study	SA5-8C	As,Mn	Pb,Zn	As,Cr,Pb,Se,Zn	1.5	1.4	Yes	Yes
2012 Ecology Upland Soil Study	SA7-5C	Al,As,Mn	Pb,Zn	Sb,As,Cu,Pb,Se,Tl,Zn	6.1	3.1	Yes	Yes
2012 Ecology Upland Soil Study	SA7-6C	Mn	Pb,Zn	Sb,Pb,Se,Zn	6.7	4.1	Yes	Yes
2012 Ecology Upland Soil Study	SA8-2C	Al,As,Mn	Pb,Zn	Sb,As,Pb,Se,Zn	3.3	2.1	Yes	Yes
2014 UCR Upland Soil Study	ADA-015	Mn	Zn	Sb,Pb,Se,Zn	1.1	0.94	Yes	Yes
2012 Ecology Upland Soil Study	SA5-4C	Mn	Pb,Zn	Sb,Pb,Se,Zn	2.4	2.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-019	Mn	NA	Sb,Cr,Pb,Se,Zn	0.69	0.95	Yes	Yes
2014 UCR Upland Soil Study	ADA-158	As,Mn	Pb,Zn	Sb,As,Pb,Se,Zn	3.4	3.0	Yes	Yes
2012 Ecology Upland Soil Study	SA11-3C	Mn,Se	NA	Pb,Se,Zn	0.80	1.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-002	Mn,Se	Zn	Sb,Pb,Mo,Ni,Se,Zn	1.7	1.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-110	Mn	Zn	Sb,Pb,Se,Zn	1.6	1.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-125	Mn	Zn	Sb,Pb,Se,Zn	1.4	0.75	Yes	Yes
2014 UCR Upland Soil Study	ADA-136	Mn	Zn	Sb,Pb,Se,Zn	2.0	1.7	Yes	Yes
2014 UCR Upland Soil Study	ADA-142	Mn	Zn	Sb,Pb,Se,Zn	1.8	1.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-183	Mn,Se	Zn	Sb,Ba,Pb,Mo,Ni,Se,Zn	1.9	3.7	Yes	Yes
2012 Ecology Upland Soil Study	SA6-8C	Mn	Zn	Sb,Pb,Se,Zn	1.1	0.80	Yes	Yes
2014 UCR Upland Soil Study	ADA-020	Mn	Zn	Sb,Pb,Se,Zn	1.3	0.84	Yes	Yes
2014 UCR Upland Soil Study	ADA-065	Mn	Zn	Sb,Pb,Se,Zn	1.4	1.0	Yes	Yes
2012 Ecology Upland Soil Study	SA5-5C	Mn	Zn	Pb,Se,Zn	1.0	1.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-006	Mn	Zn	Sb,Pb,Se,Zn	1.7	1.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-148	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	3.1	1.4	Yes	Yes
2014 UCR Upland Soil Study	ADA-162	As,Mn	Pb,Zn	Sb,Pb,Se,Zn	3.4	3.4	Yes	Yes
2012 Ecology Upland Soil Study	SA5-7C	Mn	Pb,Zn	Pb,Se,Zn	3.0	2.9	Yes	Yes
2012 Ecology Upland Soil Study	SA2-5C	Mn	NA	Pb,Se	0.94	0.66	No	Yes
2014 UCR Upland Soil Study	ADA-016	Mn	Zn	Sb,Pb,Se,Zn	1.3	0.79	Yes	Yes

Table 6-2. Hazard Quotients for Plants for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, and Potentially Affected Fraction at Each

Study	Location ID	COPCs with SSL HQ ≥ 1 COPCs with BABs Not included	COPCs with BAB HQ ≥ 1	COPCs with concentration > BTV	Zinc			
					BAB HQ	SSL HQ	>BTV	Detect
2014 UCR Upland Soil Study	ADA-023	As,Mn,Se	Zn	Sb,Cr,Pb,Mo,Se,Zn	1.7	2.0	Yes	Yes
2015 Bossburg Study	UDU-05-ICS	Mn	NA	Sb,Cr,Pb,Se,Zn	0.59	0.72	Yes	Yes
2012 Ecology Upland Soil Study	SA7-3C	Al,As,Mn	Pb,Zn	Sb,As,Pb,Se,Zn	3.2	1.8	Yes	Yes
2012 Ecology Upland Soil Study	SA8-3C	Mn	Zn	Pb,Se,Zn	1.4	0.93	Yes	Yes
2012 Ecology Upland Soil Study	SA7-2C	Mn	Pb,Zn	Pb,Se,Zn	3.8	2.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-135	Mn	Zn	Sb,Pb,Se,Zn	2.7	1.3	Yes	Yes
2015 Bossburg Study	UDU-06-ICS	Mn,Se	NA	Sb,Pb,Se	0.30	0.64	No	Yes
2012 Ecology Upland Soil Study	SA9-4C	Mn,Se	Pb,Zn	Sb,Pb,Se,Zn	2.3	3.1	Yes	Yes
2014 UCR Upland Soil Study	ADA-132	Al,Fe,Mn	Zn	Sb,Pb,Se,Zn	1.8	1.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-143	Mn	Zn	Sb,Pb,Se,Zn	1.8	1.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-144	As,Mn	Zn	Sb,Pb,Se,Zn	1.8	1.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-150	Mn	Pb,Zn	Sb,Pb,Se,Zn	2.9	1.4	Yes	Yes
2014 UCR Upland Soil Study	ADA-160	Mn	Zn	Sb,Pb,Se,Zn	1.9	1.2	Yes	Yes
2015 Bossburg Study	UDU-01-ICS	Mn	Zn	Sb,Pb,Se	1.5	0.65	No	Yes
2015 Bossburg Study	UDU-02-ICS	Mn	Pb,Zn	Sb,Pb,Se,Zn	1.7	0.76	Yes	Yes
2015 Bossburg Study	UDU-04-ICS	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	3.3	1.1	Yes	Yes
2012 Ecology Upland Soil Study	SA13-4C	Mn,Se	NA	Pb,Se,Zn	0.53	1.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-128	Mn	Zn	Sb,Pb,Se,Zn	2.0	1.4	Yes	Yes
2014 UCR Upland Soil Study	ADA-147	Mn	Pb,Zn	Sb,Pb,Se,Zn	1.8	1.4	Yes	Yes
2015 Bossburg Study	UDU-03-ICS	Mn	Pb,Zn	Sb,Cu,Pb,Se,Zn	1.9	0.71	Yes	Yes
2012 Ecology Upland Soil Study	SA7-4C	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	2.3	1.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-151	Al,Mn	Pb,Zn	Sb,Pb,Se,Zn	3.3	1.5	Yes	Yes
2012 Ecology Upland Soil Study	SA6-5C	NA	NA	Pb,Se	0.61	0.44	No	Yes
2012 Ecology Upland Soil Study	SA6-4C	NA	NA	Pb,Se	0.85	0.54	No	Yes
2012 Ecology Upland Soil Study	SA10-4C	Se	NA	Sb,Pb,Se,Zn	0.56	1.0	Yes	Yes

Source: U.S. Environmental Protection Agency (EPA). 2005. *Guidance for Developing Ecological Soil Screening Levels* . OSWER Directive 9285.7-55. Office of Solid Waste and Er

Notes:

HQs, PAFs, and BTV comparisons for each sample are presented in Appendix F

Qualitative bioavailability score: OR - Out of range due to high organic matter; 0 = very low; 1 = low; 2 = medium; 3 = high; Based on EPA (2005b).

> = greater than

≥ = greater than or equal to

Al = aluminum

As = arsenic

Ba = barium

BAB = bioavailability-adjusted benchmark

BTV = background threshold value

Co = cobalt

COPC = chemical of potential concern

Cr = chromium

Cu = copper

Fe = iron

HQ = hazard quotient

ID = identification

Mn = manganese

Mo = molybdenum

NA = not applicable

Ni = nickel

PAF = potentially affected fraction

Pb = lead

Sb = antimony

Se = selenium

SSL = soil screening level

Tl = thallium

UCR = Upper Columbia River

Zn = zinc

Table 6-3. Summary of COPC Concentrations Compared to Benchmarks and Background Threshold Values for Each Study

Comparisons for metal concentration-based benchmarks

COPC	Study	Soil Benchmark[a]	Site < Benchmark	Site ≥ Benchmark & Site ≤ BTV	Site ≥ Benchmark & Site > BTV
Antimony	2012 Ecology Upland Soil Study	SSL	106 (100%)	NA	NA
Antimony	2014 UCR Upland Soil Study	SSL	141 (100%)	NA	NA
Antimony	2015 Bossburg Study	SSL	6 (100%)	NA	NA
Arsenic	2012 Ecology Upland Soil Study	Eco-SSL	72 (68%)	11 (10%)	23 (22%)
Arsenic	2014 UCR Upland Soil Study	Eco-SSL	99 (70%)	30 (21%)	12 (9%)
Arsenic	2015 Bossburg Study	Eco-SSL	6 (100%)	NA	NA
Barium	2012 Ecology Upland Soil Study	SSL	105 (99%)	NA	1 (1%)
Barium	2014 UCR Upland Soil Study	SSL	139 (99%)	NA	2 (1%)
Barium	2015 Bossburg Study	SSL	6 (100%)	NA	NA
Chromium	2012 Ecology Upland Soil Study	SSL	105 (99%)	NA	1 (1%)
Chromium	2014 UCR Upland Soil Study	SSL	141 (100%)	NA	NA
Chromium	2015 Bossburg Study	SSL	6 (100%)	NA	NA
Cobalt	2012 Ecology Upland Soil Study	BAB	105 (99%)	NA	1 (1%)
Cobalt	2014 UCR Upland Soil Study	BAB	141 (100%)	NA	NA
Cobalt	2015 Bossburg Study	BAB	6 (100%)	NA	NA
Copper	2012 Ecology Upland Soil Study	BAB	106 (100%)	NA	NA
Copper	2014 UCR Upland Soil Study	BAB	141 (100%)	NA	NA
Copper	2015 Bossburg Study	BAB	6 (100%)	NA	NA
Lead	2012 Ecology Upland Soil Study	BAB	64 (60%)	NA	42 (40%)
Lead	2014 UCR Upland Soil Study	BAB	123 (87%)	NA	18 (13%)
Lead	2015 Bossburg Study	BAB	3 (50%)	NA	3 (50%)
Manganese	2012 Ecology Upland Soil Study	Eco-SSL	3 (3%)	65 (61%)	38 (36%)
Manganese	2014 UCR Upland Soil Study	Eco-SSL	NA	109 (77%)	32 (23%)
Manganese	2015 Bossburg Study	Eco-SSL	NA	6 (100%)	NA
Molybdenum	2014 UCR Upland Soil Study	BAB	141 (100%)	NA	NA
Nickel	2012 Ecology Upland Soil Study	BAB	103 (97%)	NA	3 (3%)
Nickel	2014 UCR Upland Soil Study	BAB	141 (100%)	NA	NA
Nickel	2015 Bossburg Study	BAB	6 (100%)	NA	NA
Selenium	2012 Ecology Upland Soil Study	Eco-SSL	93 (88%)	NA	13 (12%)
Selenium	2014 UCR Upland Soil Study	Eco-SSL	120 (85%)	NA	21 (15%)
Selenium	2015 Bossburg Study	Eco-SSL	5 (83%)	NA	1 (17%)
Thallium	2012 Ecology Upland Soil Study	SSL	106 (100%)	NA	NA
Thallium	2014 UCR Upland Soil Study	SSL	141 (100%)	NA	NA
Thallium	2015 Bossburg Study	SSL	6 (100%)	NA	NA
Zinc	2012 Ecology Upland Soil Study	BAB	33 (31%)	NA	73 (69%)
Zinc	2014 UCR Upland Soil Study	BAB	24 (17%)	NA	117 (83%)
Zinc	2015 Bossburg Study	BAB	2 (33%)	1 (17%)	3 (50%)

Comparisons for pH-based benchmarks

COPC	Study	Soil Benchmark[a]	pH > Benchmark	pH ≤ benchmark & Site ≤ BTV
Aluminum	2012 Ecology Upland Soil Study	Eco-SSL	89 (84%)	17 (16%)
Aluminum	2014 UCR Upland Soil Study	Eco-SSL	122 (87%)	19 (13%)
Aluminum	2015 Bossburg Study	Eco-SSL	5 (83%)	1 (17%)
Iron	2012 Ecology Upland Soil Study	Eco-SSL	105 (99%)	1 (1%)
Iron	2014 UCR Upland Soil Study	Eco-SSL	136 (96%)	5 (4%)
Iron	2015 Bossburg Study	Eco-SSL	6 (100%)	NA

Notes:

[a] Comparisons are made to the BAB if applicable, or if a BAB is not applicable, the Eco-SSL or SSL.

HQs and BTV comparisons for each sample are presented in Table 6-2 and in Appendix F

> = greater than

≥ = greater than or equal to

< = less than

≤ = less than or equal to

BAB = bioavailability-adjusted benchmark

BTV = background threshold value

COPC = chemical of potential concern

Eco-SSL = ecological soil screening level

NA = not applicable

PAF = potentially affected fraction

SSL = soil screening level

UCR = Upper Columbia River

Table 6-4. Summary of Plant LOE Uncertainties

Uncertainty		Overestimation or Underestimation of the Potential for Adverse Effects	Specific Areas of Applicability	Notes
Problem Formulation				
General LOE uncertainties	foliar uptake	0	NA	Foliar uptake was identified as a potentially complete but minor exposure pathway in the BERA Work Plan (TAI, 2011a). The paucity of data on the foliar exposure pathway for metals presents an uncertainty, but these uncertainties are not expected to be significant.
Exposure Assessment				
	detection limits	0	NA	The full MRL or MDL is used to calculate HQs for nondetected soil chemistry results (Section 3.3.2), which is likely to overestimate the actual soil concentration. However, all soil chemistry results for COPCs from the 2014 UCR Upland Soil Study that were used in the terrestrial plants risk analyses were detected. Therefore, this uncertainty is not expected to impact the assessment of potential adverse effects to plants.
	sample density	?	NA	Concentrations of COPCs in soil outside of the sample locations included in the Upland BERA data sets may be inferred based on results from nearby samples. These inferences may potentially overestimate or underestimate exposure and associated effects.
	replicate ICS results	↓	NA	DU EPCs may under- or overestimate the true average COPC concentration due to variability and sampling error. The 2015 Bossburg, and 2014 UCR Upland Soil studies included collection of one and three replicate ICS soil samples, respectively from a subset of DUs. Replicates were used to calculate 95 UCL on the mean COPC concentrations following EPA guidance. Uncertainty analyses shown in Table 6-5 indicate that use of the 95 UCL on the mean increases the number of DUs exceeding the benchmark for multiple COPCs.
Effects Assessment				
Soil Screening Level Benchmarks (Eco-SSLs and SSLs)	general	? ? ↑	NA	Eco-SSLs/SSLs have not been assessed for their predictive ability (i.e., the benchmark's ability to correctly assign a COPC concentration as toxic or not toxic). Therefore, it is not possible to assess their false positive and false negative error rates. In addition, concentration-response information associated with the Eco-SSLs is not available. The toxicity tests underlying the Eco-SSLs/SSLs were primarily conducted on plant species of agricultural significance; the most common test species were ryegrass, alfalfa, and barley. It is uncertain whether non-crop species are more sensitive to metals than crop species. The soil toxicity studies that underly the Eco-SSLs/SSLs are typically conducted in soils that favor higher bioavailability conditions, and in unaged and/or unleached soils. When such soils are spiked with metal salts, toxicity estimates can be inflated by a factor of 2 to more than an order of magnitude relative to conditions in the field (Appendix D).
	aluminum and iron Eco-SSL	↑	NA	Soil pH may not be a reliable predictor for toxicity due to soluble aluminum or iron. It does not account for other binding mechanisms such as organic carbon and inorganic molecules or the natural variability of plants to tolerate or adapt to different levels of metals in soil. For example, adaptations to acidic soils and aluminum exposure have been identified in woody plant species of temperature forests, which may account for some of the variable aluminum tolerance across plant species (Brunner and Sperisen, 2013).
	arsenic Eco-SSL	↓		Four acceptable studies with toxicity values less than Eco-SSL were excluded from SSL derivation, two barley growth studies because LOECs are unbounded (Jiang and Singh, 1994), and radish and bean population MATCs because they were tested under low bioavailability conditions (Woolson and Isensee, 1981). Subsequent to Eco-SSL publication, New Zealand derived a somewhat lower soil quality benchmark protective of plants as the 5th percentile of an SSD accounting for leaching and aging of soils (Cavanagh and Munir, 2019).
	barium SSL	?	NA	The SSL for barium relies on only one study with one species and an MATC endpoint.
	chromium SSL	?	NA	The SSL for chromium relies on data for only one species and MATC endpoints.
	Eco-SSLs based on high bioavailability metals	↑	arsenic, barium, chromium, cobalt, copper, lead, manganese, selenium, and zinc	Eco-SSLs/SSLs were based on metal species with high/very high bioavailability (cations barium, cobalt, copper, lead, manganese, and zinc; anions arsenic, chromium, and selenium). Qualitative bioavailability scores for soil samples from the 2014 UCR Upland Soil Study (Table D4-1) indicate that 2.3% of soil samples (4 of 174 [Table 6-2]) contain metal cations with high/very high bioavailability for plants. For metal anions, 0.6% of soil samples (1 of 174 [Table 6-2]) have high/very high bioavailability. Eco-SSLs/SSLs generally exclude toxicity data for low bioavailability soils, including studies with higher and lower effects thresholds than included; however, with the exception of arsenic as described in the main text, this uncertainty is more likely to lead to overestimation of the potential for adverse effects. Because BABs were available, Eco-SSLs/SSLs for cobalt, copper, lead, and zinc were not used to make risk conclusions.
Bioavailability-Adjusted Benchmarks	general uncertainties	? ? ?	cobalt, copper, lead, molybdenum, nickel, zinc	BABs have not been assessed for their predictive ability (i.e., the benchmark's ability to correctly assign a COPC concentration as toxic or not toxic in plant toxicity studies). Therefore, it is not possible to calculate false positive and false negative rates. With the exception of copper, none of the plant test species that underlie the benchmarks were identified at the UCR. Study species are mostly relevant at the taxonomic level of order. BABs are derived from the best-fit SSD; 95% confidence limits on the BABs are broad indicating risks may be under- or overestimated (Table 6-6).
	molybdenum benchmark uncertainties	?	NA	The predictive model for molybdenum is based on two studies that include five plant species, none of which are present in the Terrestrial Study Area. BABs for all other COPCs include at least five studies and incorporate a minimum of seven plant species in determining the EC20.

Table 6-4. Summary of Plant LOE Uncertainties

Uncertainty		Overestimation or Underestimation of the Potential for Adverse Effects	Specific Areas of Applicability	Notes
	lack of bioavailability-adjusted benchmarks	↑	aluminum, antimony, arsenic, barium, chromium, iron, manganese, selenium, and thallium	BABs could not be calculated for all COPCs. Reliance on benchmarks that do not account for bioavailability in the field are likely to overestimate the potential for adverse effects for these COPCs.
Risk Characterization				
HQ interpretation	use of HQs	?	NA	HQs do not give a quantitative prediction of the likelihood or severity of adverse effects, although they are expected to increase as the HQ increases. HQs less than 1 provide compelling evidence of negligible risk. When HQ is greater than or equal to 1, additional consideration must be given to the dose-response data underlying the effects data.
Metal interactions and essentiality	single chemical HQs	?	NA	As discussed in Section 6.2.1.1, interaction of metal mixtures are complex with uncertain implications on estimates of toxicity. Depending on the type of toxicological interaction (e.g., additivity, antagonism, potentiation, or synergism) and the respective exposures for the metals, the single chemical HQ may under- or overestimate the potential for adverse effects.
	essential nutrients	?	copper, manganese, molybdenum, nickel, and zinc	Of the COPCs for plants, copper, manganese, molybdenum, nickel, and zinc are identified as essential for plants (EPA, 2007a). Essential levels of those metals for plants in the Terrestrial Study Area were not developed in the Upland BERA because they are likely to vary by species and region. The extent to which the nutritional requirements or optimal conditions of test plant species are representative of plants in the Terrestrial Study Area is uncertain. The implications of this uncertainty on the estimation of risks to terrestrial plants is uncertain.
Background analysis				
Background analysis	BTV data set	?	NA	As discussed in Section 2.4.1.2, BTVs are in the same range, but not lower, than other available BTVs.

Sources:

Brunner, I., and C. Sperisen. 2013. "Aluminum exclusion and aluminum tolerance in woody plants." *Frontiers in Plant Science* . Vol. 4. pp. 172. https://doi.org/10.3389/fpls.2013.00172.
Cavanaugh, J.E., and K Munir. *Updated Development of Soil Guideline Values for the Protection of Ecological Receptors (Eco-SGVs): Technical Document* . Manaaki Whenua – Landcare Research. Prepared for: Regional Waste and Contaminated Land Forum, Land Monitoring Forum and Land Managers Group. June.
Jiang, Q. Q. and B.R. Singh. 1994. "Effect of different forms and sources of arsenic on crop yield and arsenic concentration." *Water, Air, & Soil Pollution* . Vol. 74, No. 3/4. pp. 321-343.
Teck American Incorporated (TAI). 2011. *Upper Columbia River Baseline Ecological Risk Assessment (BERA) Work Plan, Volumes I–III* . Prepared for TAI by Parametrix, Bellevue, WA.
U.S. Environmental Protection Agency (EPA). 2007. *Framework for Metals Risk Assessment* . EPA 120/R 07/001. Office of the Science Advisor Washington, Risk Assessment Forum.
Woolson, E. A. and A.R. Isensee. 1981. "Soil Residue Accumulation from Three Applied Arsenic Sources." *Weed Science* . Vol. 29, No. 1. pp. 17-21.

Notes:

↑ = likely to overestimate the potential for adverse effects
↓ = likely to underestimate the potential for adverse effects
? = uncertain and may either overestimate or underestimate the potential for adverse effects
0 = not expected to be a major source of uncertainty
95 UCL
BAB = bioavailability-adjusted benchmarks
BERA = baseline ecological risk assessment
BTV = background threshold value
COPC = chemical of potential concern
DU = decision unit
EC20 = concentration that causes a 20 percent effect
Eco-SSL = ecological soil screening level
EPA = U.S. Environmental Protection Agency
EPC = exposure point concentration
HQ = hazard quotient
ICS - incremental composite sample
LOE = line of evidence
LOEC = lowest observed effect concentration
MATC = maximum acceptable toxicant concentration
MDL = method detection limit
MRL = method reporting limit
NA = not applicable
SSD = species sensitivity distribution
SSL = soil screening level
UCR = Upper Columbia River

Table 6-5. Analysis of Uncertainty in Plant EPCs for Incremental Composite Samples - Comparison of Mean with 95 UCL of Mean

		2015 Bossburg Study				2014 UCR Upland Soil Study			
COPC [a]	**95 UCL/mean for all triplicate samples [b]**	**Count HQ≥1 (Mean/Benchmark)**	**Count HQ≥1 (95 UCL/Benchmark)[c]**	**Count HQ≥5 (Mean/Benchmark)**	**Count HQ≥5 (95 UCL/Benchmark)[c]**	**Count HQ≥1 (Mean/Benchmark)**	**Count HQ≥1 (95 UCL/Benchmark)[c]**	**Count HQ≥5 (Mean/Benchmark)**	**Count HQ≥5 (95 UCL/Benchmark)[c]**
Aluminum	1.09	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Antimony	1.23	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Arsenic	1.16	0 (0%)	0 (0%)	0 (0%)	0 (0%)	42 (30%)	62 (44%)	0 (0%)	0 (0%)
Barium	1.13	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (1%)	3 (2%)	0 (0%)	0 (0%)
Chromium	1.15	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Cobalt	1.12	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Copper	1.15	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Iron	1.09	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Lead	1.27	3 (50%)	4 (67%)	1 (17%)	1 (17%)	18 (13%)	22 (16%)	0 (0%)	0 (0%)
Manganese	1.13	6 (100%)	6 (100%)	0 (0%)	0 (0%)	141 (100%)	141 (100%)	48 (34%)	63 (45%)
Molybdenum	1.18	NA	NA	NA	NA	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nickel	1.13	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (1%)	0 (0%)	0 (0%)
Selenium	1.19	1 (17%)	1 (17%)	0 (0%)	0 (0%)	21 (15%)	27 (19%)	1 (1%)	1 (1%)
Thallium	1.14	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Zinc	1.16	4 (67%)	4 (67%)	0 (0%)	0 (0%)	117 (83%)	124 (88%)	0 (0%)	0 (0%)
Arithmetic mean [d]	1.15	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

[a] Benchmark basis is Eco-SSL or SSL for those COPCs shown in plain text, and BAB for those shown in italics.

[b] Calculated over all triplicate samples from the 2014 UCR Upland Soil Study (n=16) and the 2015 Bossburg Soil Study (n=1) (Appendix F)

[c] Count includes HQs from all DUs using either 95 UCL (for triplicate locations) or concentration multiplied by 1.15 (for non-triplicate locations) as the EPC.

[d] Arithmetic mean of ratio of 95 UCL:mean for triplicate sample DUs was used to adjust DUs that did not have incremental composite soil sample triplicates.

≥ = greater than or equal to

95 UCL = 95 percent upper confidence limit of the mean

BAB = bioavailability-adjusted benchmark

COPC = chemical of potential concern

DU = decision unit

Eco-SSL = ecological soil screening level

EPC = exposure point concentration

HQ = hazard quotient

NA = not applicable

SSL = soil screening level

UCR = Upper Columbia River

Table 6-6. Analysis of Uncertainty in Plant BABs Using the Lower Confidence Limit on the BAB

COPC	Soil Study	BAB (range) mg/kg	BAB LCL (range) mg/kg	BAB UCL (range) mg/kg	Count HQ≥1 (EPC/BAB)	Count HQ≥1 (EPC/BAB LCL)
Cobalt	2012 Ecology Upland Soil Study	20.5 - 106	6.90 - 37.6	34.9 - 176	1	***9***
Cobalt	2014 UCR Upland Soil Study	14.0 - 150	4.70 - 53.0	25.0 - 247	0	***2***
Cobalt	2015 Bossburg Study	8.00 - 57.0	2.50 - 20.0	14.0 - 96.0	0	***4***
Copper	2012 Ecology Upland Soil Study	143 - 345	84.7 - 196	188 - 463	0	0
Copper	2014 UCR Upland Soil Study	118 - 414	70.0 - 231	155 - 559	0	0
Copper	2015 Bossburg Study	87.0 - 250	51.0 - 145	114 - 332	0	***1***
Lead	2012 Ecology Upland Soil Study	259 - 527	109 - 222	435 - 884	42	***68***
Lead	2014 UCR Upland Soil Study	243 - 613	103 - 259	407 - 1,030	18	***77***
Lead	2015 Bossburg Study	177 - 404	75.0 - 171	297 - 677	3	***4***
Molybdenum	2012 Ecology Upland Soil Study	ND	ND	ND	ND	ND
Molybdenum	2014 UCR Upland Soil Study	2.10 - 468	0.200 - 328	5.80 - 538	0	***4***
Molybdenum	2015 Bossburg Study	ND	ND	ND	ND	ND
Nickel	2012 Ecology Upland Soil Study	32.9 - 138	15.7 - 65.4	50.7 - 214	3	***14***
Nickel	2014 UCR Upland Soil Study	29.0 - 188	14.0 - 89.0	32.0 - 291	0	***13***
Nickel	2015 Bossburg Study	15.0 - 81.0	7.20 - 38	23.0 - 125	0	***4***
Zinc	2012 Ecology Upland Soil Study	80.1 - 366	25.3 - 115.7	145 - 664	73	***106***
Zinc	2014 UCR Upland Soil Study	73.0 - 511	23.0 - 162	132 - 929	116	***140***
Zinc	2015 Bossburg Study	52.0 - 336	16.0 - 106	94.0- 611	4	***5***

Notes:

Bold italic results indicate an increase in HQ count relative to HQ count using median BAB.

≥ = greater than or equal to

BAB = bioavailability adjusted benchmark; fifth percentile (HC5) of the species sensitivity distribution of plant EC20s

COPC = chemical of potential concern

EC20 = concentration that causes a 20 percent effect

EPC = exposure point concentration

HQ = hazard quotient

LCL = lower confidence limit

mg/kg = milligram(s) per kilogram

ND = no data

UCL = upper confidence limit

UCR = Upper Columbia River

Table 6-7. Background Threshold Value Uncertainty

COPC	BTV used in the Upland BERA (mg/kg)	90th Percentile Natural Background Concentration Range (mg/kg) [a]	Range Midpoint (mg/kg) [a]
Aluminum	40,500	24,870 - 81,320	53,095
Antimony	0.41	0.49 - 2.03	1.26
Arsenic	23.3	3 - 20	12
Barium	395	432 - 1,137	785
Cadmium	0.74	0.4 - 0.84	0.44
Chromium	23.8	35 - 164	100
Cobalt	20.4	--	--
Copper	41.5	16 - 49	33
Iron	31,200	26,950 - 54,900	40,925
Lead	27.2	19 - 43	31
Manganese	1,240	621 - 2,493	1,557
Mercury	0.12	0.02 - 0.15	0.09
Molybdenum	1.4	--	--
Nickel	35	12 - 50	31
Selenium	0.098	--	--
Silver	0.078	0.4 - 1.4	0.9
Thallium	0.56	0.2 - 0.7	0.5
Vanadium	47.5	--	--
Zinc	111	55 - 139	97

Sources: Washington State Department of Ecology (Ecology). 2019. *Upland Regional Soil Background Characterization in Northeast Washington Watersheds* . Publication No. 19-03-014.
TAI. 2020a. Final technical memorandum, assessment of background concentrations of metals and metalloids in upland soils. Upper Columbia River RI/FS. Prepared for TAI by ERM and Exponent, Seattle, WA.

[a] values from Ecology (2019b).
-- = value not available
BERA = baseline ecological risk assessment
BTV = background threshold value
COPC = chemical of potential concern
mg/kg = milligram(s) per kilogram

Table 7-1. Summary of HQs and PAFs for Invertebrates for Each Study

			Eco-SSL/SSL				Bioavailability-Adjusted Benchmark					
Analyte	Study	Number of Sample Locations	Count of HQs ≥ 1	Percent of HQs ≥ 1 or pH < Benchmark	Count of HQs > 5	Percent of HQs > 5	Count of HQs ≥ 1	Percent of HQs ≥ 1	Count of HQs > 5	Percent of HQs > 5	Median PAF	Maximum PAF
Aluminum	2012 Ecology Upland Soil Study	106	17[a]	16	NA	NA	NA	NA	NA	NA	NA	NA
Aluminum	2014 UCR Upland Soil Study	141	19[a]	13	NA	NA	NA	NA	NA	NA	NA	NA
Aluminum	2015 Bossburg Study	6	1[a]	17	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	2012 Ecology Upland Soil Study	106	0	0	0	0	NA	NA	NA	NA	NA	NA
Arsenic	2014 UCR Upland Soil Study	141	0	0	0	0	NA	NA	NA	NA	NA	NA
Arsenic	2015 Bossburg Study	6	0	0	0	0	NA	NA	NA	NA	NA	NA
Barium	2012 Ecology Upland Soil Study	106	44	42	1	0.94	NA	NA	NA	NA	NA	NA
Barium	2014 UCR Upland Soil Study	141	59	42	0	0	NA	NA	NA	NA	NA	NA
Barium	2015 Bossburg Study	6	0	0	0	0	NA	NA	NA	NA	NA	NA
Chromium	2012 Ecology Upland Soil Study	106	6	5.7	1	0.94	NA	NA	NA	NA	NA	NA
Chromium	2014 UCR Upland Soil Study	141	1	0.71	0	0	NA	NA	NA	NA	NA	NA
Chromium	2015 Bossburg Study	6	0	0	0	0	NA	NA	NA	NA	NA	NA
Cobalt	2012 Ecology Upland Soil Study	106	0	0	0	0	0	0	0	0	<1	<1
Cobalt	2014 UCR Upland Soil Study	141	0	0	0	0	0	0	0	0	<1	<1
Cobalt	2015 Bossburg Study	6	0	0	0	0	0	0	0	0	<1	<1
Copper	2012 Ecology Upland Soil Study	106	0	0	0	0	1	0.94	0	0	<1	5.4
Copper	2014 UCR Upland Soil Study	141	0	0	0	0	0	0	0	0	<1	2
Copper	2015 Bossburg Study	6	0	0	0	0	1	17	0	0	<1	10
Iron	2012 Ecology Upland Soil Study	106	1[a]	0.94	NA	NA	NA	NA	NA	NA	NA	NA
Iron	2014 UCR Upland Soil Study	141	5[a]	3.5	NA	NA	NA	NA	NA	NA	NA	NA
Iron	2015 Bossburg Study	6	0[a]	0	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	2012 Ecology Upland Soil Study	106	94	89	12	11	NA	NA	NA	NA	NA	NA
Manganese	2014 UCR Upland Soil Study	141	127	90	2	1.4	NA	NA	NA	NA	NA	NA
Manganese	2015 Bossburg Study	6	0	0	0	0	NA	NA	NA	NA	NA	NA
Molybdenum	2014 UCR Upland Soil Study	141	0	0	0	0	0	0	0	0	<1	<1
Silver	2012 Ecology Upland Soil Study	106	0	0	0	0	NA	NA	NA	NA	NA	NA
Silver	2014 UCR Upland Soil Study	141	0	0	0	0	NA	NA	NA	NA	NA	NA
Silver	2015 Bossburg Study	6	0	0	0	0	NA	NA	NA	NA	NA	NA
Thallium	2012 Ecology Upland Soil Study	106	0	0	0	0	NA	NA	NA	NA	NA	NA
Thallium	2014 UCR Upland Soil Study	141	0	0	0	0	NA	NA	NA	NA	NA	NA
Thallium	2015 Bossburg Study	6	0	0	0	0	NA	NA	NA	NA	NA	NA
Vanadium	2012 Ecology Upland Soil Study	106	0	0	0	0	NA	NA	NA	NA	NA	NA
Vanadium	2014 UCR Upland Soil Study	141	0	0	0	0	NA	NA	NA	NA	NA	NA
Vanadium	2015 Bossburg Study	6	0	0	0	0	NA	NA	NA	NA	NA	NA
Zinc	2012 Ecology Upland Soil Study	106	102	96	16	15	47	44	2	1.9	2.4	91
Zinc	2014 UCR Upland Soil Study	141	136	96	1	0.71	38	27	0	0	2	29
Zinc	2015 Bossburg Study	6	2	33	0	0	2	33	0	0	2.7	17

Notes:

[a] Screening levels for aluminum and iron are based on pH rather than chemical concentration

HQs and PAFs for each sample are presented in Appendix F

\> = greater than

≥ = greater than or equal to

< = less than

Eco-SSL = ecological soil screening level

HQ = hazard quotient

NA = not applicable, no bioavailability-based benchmark available

PAF = potentially affected fraction (as percent)

SSL = soil screening level

UCR = Upper Columbia River

Table 7-2. Hazard Quotients for Invertebrates for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, and Potentially Affected Fraction at Each Sampling Location for Each Study

					Anionic metals																							
						Arsenic			Chromium			Molybdenum				Vanadium				Aluminum[b]			Barium			Cobalt		
Study	Location ID	Summary COPCs with SSL HQ ≥ 1 (COPCs with BABs Not included)	Summary COPCs with BAB HQ ≥ 1	Summary COPCs with concentration > BTV	Anionic metal bioavailability score [a]	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	BAB HQ	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	Cationic metal bioavailability score[a]	pH >= 5.5	>BTV	Detect	SSL HQ	>BTV	Detect	PAF (%)	BAB HQ	SSL HQ
2012 Ecology Upland Soil Study	SA1-1C	Ba,Mn	NA	Ba,Cr,Mn,Ag,Zn	OR	0.070	No	Yes	0.83	Yes	Yes	NA	NA	NA	NA	0.12	No	Yes	OR	TRUE	No	Yes	2.0	Yes	Yes	<0.001	0.089	0.084
2012 Ecology Upland Soil Study	SA1-2C	Ba,Mn	NA	Ba,Cr,Fe,Mn,Ag,Zn	0	0.090	No	Yes	0.52	Yes	Yes	NA	NA	NA	NA	0.14	No	Yes	2	TRUE	No	Yes	3.4	Yes	Yes	<0.001	0.10	0.095
2012 Ecology Upland Soil Study	SA1-3C	Ba,Mn	NA	Ba,Cr,Ag,Zn	OR	0.080	No	Yes	0.48	Yes	Yes	NA	NA	NA	NA	0.12	No	Yes	OR	TRUE	No	Yes	1.3	Yes	Yes	<0.001	0.082	0.077
2012 Ecology Upland Soil Study	SA1-4C	Ba,Mn	NA	Ba,Ag,Zn	1	0.061	No	Yes	0.38	No	Yes	NA	NA	NA	NA	0.11	No	Yes	3	TRUE	No	Yes	1.5	Yes	Yes	<0.001	0.066	0.062
2012 Ecology Upland Soil Study	SA1-5C	Mn	NA	Ag,Zn	OR	0.11	No	Yes	0.41	No	Yes	NA	NA	NA	NA	0.11	No	Yes	OR	TRUE	No	Yes	0.81	No	Yes	<0.001	0.068	0.064
2012 Ecology Upland Soil Study	SA1-6C	Mn	NA	Mn,Ag,Zn	0	0.14	No	Yes	0.4	No	Yes	NA	NA	NA	NA	0.096	No	Yes	2	TRUE	No	Yes	0.79	No	Yes	<0.001	0.074	0.069
2012 Ecology Upland Soil Study	SA1-7C	Mn	NA	Ag,Zn	0	0.082	No	Yes	0.34	No	Yes	NA	NA	NA	NA	0.095	No	Yes	2	TRUE	No	Yes	0.68	No	Yes	<0.001	0.058	0.055
2012 Ecology Upland Soil Study	SA1-8C	Ba,Mn	NA	Ba,Mn,Ag,Zn	OR	0.068	No	Yes	0.26	No	Yes	NA	NA	NA	NA	0.078	No	Yes	OR	TRUE	No	Yes	1.2	Yes	Yes	<0.001	0.049	0.046
2012 Ecology Upland Soil Study	SA10-1C	Ba,Mn	NA	Ba,Cr,Ag,Zn	OR	0.078	No	Yes	0.60	Yes	Yes	NA	NA	NA	NA	0.14	No	Yes	OR	TRUE	No	Yes	1.5	Yes	Yes	<0.001	0.063	0.069
2012 Ecology Upland Soil Study	SA10-2C	Ba,Mn	Zn	As,Ba,Co,Cu,Fe,Mn,Ag,Tl,Zn	OR	0.36	Yes	Yes	0.36	No	Yes	NA	NA	NA	NA	0.084	No	Yes	OR	TRUE	No	Yes	1.5	Yes	Yes	0.0029	0.15	0.17
2012 Ecology Upland Soil Study	SA10-3C	Ba,Mn	Zn	As,Ba,Cu,Mn,Ag,Zn	OR	0.20	Yes	Yes	0.26	No	Yes	NA	NA	NA	NA	0.073	No	Yes	OR	TRUE	No	Yes	1.6	Yes	Yes	<0.001	0.084	0.093
2012 Ecology Upland Soil Study	SA10-4C	NA	NA	Ag,Zn	OR	0.037	No	Yes	0.20	No	Yes	NA	NA	NA	NA	0.073	No	Yes	OR	TRUE	No	Yes	0.40	No	Yes	<0.001	0.02	0.022
2012 Ecology Upland Soil Study	SA10-5C	Mn	NA	Cr,Ag,Zn	OR	0.075	No	Yes	0.46	Yes	Yes	NA	NA	NA	NA	0.087	No	Yes	OR	TRUE	No	Yes	0.69	No	Yes	<0.001	0.06	0.066
2012 Ecology Upland Soil Study	SA10-6C	Ba,Mn	NA	Ba,Mn,Ag,Zn	OR	0.11	No	Yes	0.36	No	Yes	NA	NA	NA	NA	0.091	No	Yes	OR	TRUE	No	Yes	1.3	Yes	Yes	<0.001	0.074	0.082
2012 Ecology Upland Soil Study	SA10-7C	Ba,Mn	NA	As,Ba,Mn,Ag,Zn	OR	0.26	Yes	Yes	0.36	No	Yes	NA	NA	NA	NA	0.076	No	Yes	OR	TRUE	No	Yes	1.5	Yes	Yes	<0.001	0.087	0.095
2012 Ecology Upland Soil Study	SA10-8C	Ba,Mn	NA	Mn,Ag,Zn	1	0.14	No	Yes	0.37	No	Yes	NA	NA	NA	NA	0.087	No	Yes	1	TRUE	No	Yes	1.1	No	Yes	<0.001	0.063	0.069
2012 Ecology Upland Soil Study	SA11-1C	Mn	NA	Cr,Ag,Zn	2	0.080	No	Yes	0.56	Yes	Yes	NA	NA	NA	NA	0.14	No	Yes	2	TRUE	No	Yes	0.70	No	Yes	<0.001	0.093	0.083
2012 Ecology Upland Soil Study	SA11-2C	Ba,Mn	NA	Ba,Ag,Zn	2	0.069	No	Yes	0.34	No	Yes	NA	NA	NA	NA	0.11	No	Yes	2	TRUE	No	Yes	1.3	Yes	Yes	<0.001	0.068	0.061
2012 Ecology Upland Soil Study	SA11-3C	Mn	NA	Ag,Zn	1	0.059	No	Yes	0.41	No	Yes	NA	NA	NA	NA	0.10	No	Yes	1	TRUE	No	Yes	0.77	No	Yes	<0.001	0.052	0.046
2012 Ecology Upland Soil Study	SA11-4C	Ba,Mn	Zn	Ba,Mn,Ag,Tl,Zn	OR	0.14	No	Yes	0.38	No	Yes	NA	NA	NA	NA	0.089	No	Yes	OR	TRUE	No	Yes	1.5	Yes	Yes	<0.001	0.058	0.052
2012 Ecology Upland Soil Study	SA11-5C	Al,Ba,Mn	Zn	Ba,Mn,Ag,Zn	0	0.14	No	Yes	0.26	No	Yes	NA	NA	NA	NA	0.084	No	Yes	2	FALSE	No	Yes	1.3	Yes	Yes	<0.001	0.055	0.049
2012 Ecology Upland Soil Study	SA11-6C	Mn	NA	Cr,Ag,Zn	OR	0.15	No	Yes	0.55	Yes	Yes	NA	NA	NA	NA	0.16	No	Yes	OR	TRUE	No	Yes	0.58	No	Yes	<0.001	0.075	0.067
2012 Ecology Upland Soil Study	SA11-7C	Al,Ba,Mn	Zn	As,Ba,Cu,Mn,Ag,Tl,Zn	OR	0.19	Yes	Yes	0.15	No	Yes	NA	NA	NA	NA	0.039	No	Yes	OR	FALSE	No	Yes	2.7	Yes	Yes	<0.001	0.035	0.032
2012 Ecology Upland Soil Study	SA11-8C	Al,Ba,Mn	Zn	As,Ba,Cr,Cu,Mn,Ag,Tl,Zn	1	0.24	Yes	Yes	0.45	Yes	Yes	NA	NA	NA	NA	0.11	No	Yes	3	FALSE	No	Yes	1.6	Yes	Yes	<0.001	0.070	0.062
2012 Ecology Upland Soil Study	SA11-9C	Ba,Mn	Zn	As,Ba,Cr,Cu,Mn,Ag,Tl,Zn	OR	0.23	Yes	Yes	0.55	Yes	Yes	NA	NA	NA	NA	0.11	No	Yes	OR	TRUE	No	Yes	1.3	Yes	Yes	<0.001	0.10	0.094
2012 Ecology Upland Soil Study	SA12-1C	Mn	Zn	As,Cr,Cu,Fe,Mn,Ag,Zn	2	0.17	Yes	Yes	0.61	Yes	Yes	NA	NA	NA	NA	0.15	No	Yes	2	TRUE	No	Yes	0.81	No	Yes	0.0016	0.15	0.14
2012 Ecology Upland Soil Study	SA12-2C	Al,Mn	NA	Mn,Ag,Zn	0	0.11	No	Yes	0.38	No	Yes	NA	NA	NA	NA	0.11	No	Yes	2	FALSE	No	Yes	0.76	No	Yes	<0.001	0.072	0.068
2012 Ecology Upland Soil Study	SA12-3C	Mn	NA	Ag,Zn	OR	0.072	No	Yes	0.28	No	Yes	NA	NA	NA	NA	0.085	No	Yes	OR	TRUE	No	Yes	0.47	No	Yes	<0.001	0.053	0.050
2012 Ecology Upland Soil Study	SA12-4C	Ba,Mn	NA	Ba,Ag,Zn	1	0.065	No	Yes	0.28	No	Yes	NA	NA	NA	NA	0.080	No	Yes	1	TRUE	No	Yes	1.3	Yes	Yes	<0.001	0.055	0.052
2012 Ecology Upland Soil Study	SA12-6C	Ba,Mn	NA	Cu,Mn,Ag,Zn	1	0.088	No	Yes	0.26	No	Yes	NA	NA	NA	NA	0.081	No	Yes	1	TRUE	No	Yes	1.1	No	Yes	<0.001	0.053	0.050
2012 Ecology Upland Soil Study	SA12-7C	Ba,Mn	Zn	Ba,Mn,Ag,Zn	2	0.11	No	Yes	0.40	No	Yes	NA	NA	NA	NA	0.11	No	Yes	2	TRUE	No	Yes	1.8	Yes	Yes	<0.001	0.071	0.066
2012 Ecology Upland Soil Study	SA12-8C	Ba,Mn	NA	Mn,Ag,Zn	1	0.10	No	Yes	0.31	No	Yes	NA	NA	NA	NA	0.089	No	Yes	3	TRUE	No	Yes	1.1	No	Yes	<0.001	0.059	0.055
2012 Ecology Upland Soil Study	SA12-9C	Ba,Mn	NA	Ba,Mn,Ag,Zn	2	0.090	No	Yes	0.40	No	Yes	NA	NA	NA	NA	0.097	No	Yes	2	TRUE	No	Yes	1.2	Yes	Yes	<0.001	0.085	0.079
2012 Ecology Upland Soil Study	SA13-1C	Mn	NA	Ag,Zn	OR	0.050	No	Yes	0.38	No	Yes	NA	NA	NA	NA	0.13	No	Yes	OR	TRUE	No	Yes	0.83	No	Yes	<0.001	0.058	0.065
2012 Ecology Upland Soil Study	SA13-2C	Mn	NA	Mn,Ag,Zn	OR	0.039	No	Yes	0.37	No	Yes	NA	NA	NA	NA	0.093	No	Yes	OR	TRUE	No	Yes	0.94	No	Yes	<0.001	0.048	0.055
2012 Ecology Upland Soil Study	SA13-3C	Ba,Mn	NA	Mn,Ag,Zn	1	0.084	No	Yes	0.33	No	Yes	NA	NA	NA	NA	0.079	No	Yes	3	TRUE	No	Yes	1.2	No	Yes	<0.001	0.047	0.053
2012 Ecology Upland Soil Study	SA13-4C	NA	NA	Ag,Zn	0	0.035	No	Yes	0.39	No	Yes	NA	NA	NA	NA	0.10	No	Yes	2	TRUE	No	Yes	0.48	No	Yes	<0.001	0.061	0.069
2012 Ecology Upland Soil Study	SA13-5C	Ba,Mn	Zn	Ba,Cr,Cu,Mn,Ag,Zn	OR	0.12	No	Yes	0.49	Yes	Yes	NA	NA	NA	NA	0.13	No	Yes	OR	TRUE	No	Yes	1.4	Yes	Yes	<0.001	0.075	0.085
2012 Ecology Upland Soil Study	SA13-6C	Mn	NA	Mn,Ag,Zn	1	0.15	No	Yes	0.32	No	Yes	NA	NA	NA	NA	0.11	No	Yes	3	TRUE	No	Yes	0.89	No	Yes	<0.001	0.048	0.054
2012 Ecology Upland Soil Study	SA13-7C	Mn	NA	Ag,Zn	1	0.14	No	Yes	0.39	No	Yes	NA	NA	NA	NA	0.12	No	Yes	3	TRUE	No	Yes	0.89	No	Yes	<0.001	0.061	0.069
2012 Ecology Upland Soil Study	SA13-8C	Al,Mn	NA	Ag,Zn	0	0.11	No	Yes	0.38	No	Yes	NA	NA	NA	NA	0.12	No	Yes	2	FALSE	No	Yes	0.82	No	Yes	<0.001	0.053	0.060
2012 Ecology Upland Soil Study	SA2-1C	Ba,Mn	Zn	Ba,Mn,Ag,Zn	OR	0.11	No	Yes	0.29	No	Yes	NA	NA	NA	NA	0.077	No	Yes	OR	TRUE	No	Yes	2.3	Yes	Yes	<0.001	0.074	0.049
2012 Ecology Upland Soil Study	SA2-2C	Ba,Mn	Zn	Cr,Ag,Zn	1	0.080	No	Yes	0.56	Yes	Yes	NA	NA	NA	NA	0.11	No	Yes	3	TRUE	No	Yes	1.0	No	Yes	<0.001	0.099	0.065
2012 Ecology Upland Soil Study	SA2-3C	Mn	NA	Ag,Zn	2	0.054	No	Yes	0.27	No	Yes	NA	NA	NA	NA	0.060	No	Yes	2	TRUE	No	Yes	0.97	No	Yes	<0.001	0.062	0.041
2012 Ecology Upland Soil Study	SA2-4C	Al,Mn	Zn	Mn,Ag,Zn	1	0.11	No	Yes	0.30	No	Yes	NA	NA	NA	NA	0.10	No	Yes	3	FALSE	No	Yes	0.93	No	Yes	<0.001	0.08	0.053
2012 Ecology Upland Soil Study	SA2-5C	NA	NA	Ag	0	0.048	No	Yes	0.36	No	Yes	NA	NA	NA	NA	0.12	No	Yes	2	TRUE	No	Yes	0.27	No	Yes	<0.001	0.079	0.052
2012 Ecology Upland Soil Study	SA2-6C	Mn	Zn	Cr,Ag,Zn	0	0.15	No	Yes	0.85	Yes	Yes	NA	NA	NA	NA	0.094	No	Yes	2	TRUE	No	Yes	0.62	No	Yes	<0.001	0.11	0.072
2012 Ecology Upland Soil Study	SA2-7C	Mn	NA	Cr,Ag,Zn	OR	0.12	No	Yes	0.5	Yes	Yes	NA	NA	NA	NA	0.097	No	Yes	OR	TRUE	No	Yes	0.63	No	Yes	0.0018	0.20	0.14
2012 Ecology Upland Soil Study	SA2-8C	Ba,Mn	NA	Cr,Ag,Zn	2	0.11	No	Yes	0.53	Yes	Yes	NA	NA	NA	NA	0.087	No	Yes	2	TRUE	No	Yes	1.2	No	Yes	<0.001	0.099	0.065
2012 Ecology Upland Soil Study	SA3-1C	Mn	NA	Ag	1	0.042	No	Yes	0.36	No	Yes	NA	NA	NA	NA	0.081	No	Yes	3	TRUE	No	Yes	0.96	No	Yes	<0.001	0.054	0.049
2012 Ecology Upland Soil Study	SA3-2C	Ba,Mn	NA	Ba,Mn,Ag,Zn	1	0.039	No	Yes	0.21	No	Yes	NA	NA	NA	NA	0.060	No	Yes	3	TRUE	No	Yes	1.3	Yes	Yes	<0.001	0.039	0.035
2012 Ecology Upland Soil Study	SA3-3C	Ba,Cr,Mn	NA	Ba,Cr,Mn,Ag,Zn	2	0.099	No	Yes	1.1	Yes	Yes	NA	NA	NA	NA	0.12	No	Yes	2	TRUE	No	Yes	1.3	Yes	Yes	<0.001	0.093	0.085
2012 Ecology Upland Soil Study	SA3-4C	Mn	NA	Ag,Zn	1	0.084	No	Yes	0.22	No	Yes	NA	NA	NA	NA	0.064	No	Yes	3	TRUE	No	Yes	0.83	No	Yes	<0.001	0.042	0.038
2012 Ecology Upland Soil Study	SA3-5C	Mn	NA	Ag,Zn	2	0.057	No	Yes	0.36	No	Yes	NA	NA	NA	NA	0.066	No	Yes	2	TRUE	No	Yes	0.82	No	Yes	<0.001	0.047	0.043
2012 Ecology Upland Soil Study	SA3-6C	Ba,Cr,Mn	Zn	Ba,Cr,Co,Cu,Fe,Mn,Ag,Tl,Zn	OR	0.12	No	Yes	1.9	Yes	Yes	NA	NA	NA	NA	0.13	No	Yes	OR	TRUE	No	Yes	2.8	Yes	Yes	0.0051	0.2	0.18
2012 Ecology Upland Soil Study	SA3-7C	Mn	NA	Ag,Zn	OR	0.093	No	Yes	0.36	No	Yes	NA	NA	NA	NA	0.062	No	Yes	OR	TRUE	No	Yes	0.91	No	Yes	<0.001	0.057	0.052
2012 Ecology Upland Soil Study	SA3-8C	Mn	NA	Ag,Zn	0	0.052	No	Yes	0.26	No	Yes	NA	NA	NA	NA	0.060	No	Yes	2	TRUE	No	Yes	0.95	No	Yes	<0.001	0.042	0.038
2012 Ecology Upland Soil Study	SA4-1C	Mn	NA	Cr,Ag,Zn	OR	0.093	No	Yes	0.48	Yes	Yes	NA	NA	NA	NA	0.097	No	Yes	OR	TRUE	No	Yes	0.88	No	Yes	<0.001	0.081	0.074
2012 Ecology Upland Soil Study	SA4-2C	Mn	NA	Ag,Zn	OR	0.059	No	Yes	0.38	No	Yes	NA	NA	NA	NA	0.11	No	Yes	OR	TRUE	No	Yes	0.51	No	Yes	<0.001	0.064	0.058
2012 Ecology Upland Soil Study	SA4-3C	Al,Fe,Mn	NA	Cr,Ag,Zn	OR	0.13	No	Yes	0.51	Yes	Yes	NA	NA	NA	NA	0.15	No	Yes	OR	FALSE	No	Yes	0.41	No	Yes	<0.001	0.082	0.075
2012 Ecology Upland Soil Study	SA4-4C	Al,Mn	NA	Cr,Ag,Zn	OR	0.077	No	Yes	0.49	Yes	Yes	NA	NA	NA	NA	0.097	No	Yes	OR	FALSE	No	Yes	0.65	No	Yes	<0.001	0.070	0.064
2012 Ecology Upland Soil Study	SA4-5C	Mn	NA	Ag,Zn	0	0.078	No	Yes	0.36	No	Yes	NA	NA	NA	NA	0.090	No	Yes	2	TRUE	No	Yes	0.53	No	Yes	<0.001	0.079	0.072
2012 Ecology Upland Soil Study	SA4-6C	Mn	Zn	Cr,Ag,Zn	OR	0.12	No	Yes	0.54	Yes	Yes	NA	NA	NA	NA	0.086	No	Yes	OR	TRUE	No	Yes	0.63	No	Yes	<0.001	0.075	0.068
2012 Ecology Upland Soil Study	SA4-7C	Ba,Mn	NA	Cr,Ag,Zn	0	0.098	No	Yes	0.94	Yes	Yes	NA	NA	NA	NA	0.10	No	Yes	2	TRUE	No	Yes	1.2	No	Yes	<0.001	0.079	0.072
2012 Ecology Upland Soil Study	SA4-8C	Mn	NA	Ag,Zn	0	0.082	No	Yes	0.24	No	Yes	NA	NA	NA	NA	0.063	No	Yes	2	TRUE	No	Yes	0.55	No	Yes	<0.001	0.051	0.046
2012 Ecology Upland Soil Study	SA5-1C	Mn	Zn	Ag,Zn	OR	0.072	No	Yes	0.29	No	Yes	NA	NA	NA	NA	0.07	No	Yes	OR	TRUE	No	Yes	0.6	No	Yes	<0.001	0.052	0.038
2012 Ecology Upland Soil Study	SA5-2C	Ba,Cr,Mn	NA	Ba,Cr,Fe,Ag,V,Zn	OR	0.079	No	Yes	3.2	Yes	Yes	NA	NA	NA	NA	0.25	Yes	Yes	OR	TRUE	No	Yes	2.3	Yes	Yes	0.0032	0.21	0.15
2012 Ecology Upland Soil Study	SA5-3C	Mn	Zn	Ag,Zn	1	0.11	No	Yes	0.39	No	Yes	NA	NA	NA	NA	0.078	No	Yes	1	TRUE	No	Yes	0.89	No	Yes	<0.001	0.079	0.058
2012 Ecology Upland Soil Study	SA5-4C	Mn	Zn	Ag,Zn	1	0.068	No	Yes	0.34	No	Yes	NA	NA	NA	NA	0.075	No	Yes	1	TRUE	No	Yes	0.69	No	Yes	<0.001	0.058	0.043
2012 Ecology Upland Soil Study	SA5-5C	NA	NA	Ag,Zn	OR	0.055	No	Yes	0.37	No	Yes	NA	NA	NA	NA	0.090	No	Yes	OR	TRUE	No	Yes	0.48	No	Yes	<0.001	0.069	0.051

Table 7-2. Hazard Quotients for Invertebrates for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, and Potentially Affected Fraction at Each Sampling Location for Each Study

					Anionic metals																							
						Arsenic			Chromium			Molybdenum				Vanadium				Aluminum[b]			Barium			Cobalt		
Study	Location ID	Summary COPCs with SSL HQ ≥ 1 (COPCs with BABs Not included)	Summary COPCs with BAB HQ ≥ 1	Summary COPCs with concentration > BTV	Anionic metal bioavailability score[a]	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	BAB HQ	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	Cationic metal bioavailability score[a]	pH >= 5.5	>BTV	Detect	SSL HQ	>BTV	Detect	PAF (%)	BAB HQ	SSL HQ
2012 Ecology Upland Soil Study	SA5-7C	NA	Zn	Ag,Zn	1	0.066	No	Yes	0.27	No	Yes	NA	NA	NA	NA	0.072	No	Yes	1	TRUE	No	Yes	0.39	No	Yes	<0.001	0.050	0.037
2012 Ecology Upland Soil Study	SA5-8C	Mn	NA	As,Cr,Ag,Zn	1	0.17	Yes	Yes	0.59	Yes	Yes	NA	NA	NA	NA	0.14	No	Yes	1	TRUE	No	Yes	0.53	No	Yes	<0.001	0.099	0.073
2012 Ecology Upland Soil Study	SA6-1C	Ba,Mn	Zn	Mn,Ag,Zn	OR	0.10	No	Yes	0.35	No	Yes	NA	NA	NA	NA	0.076	No	Yes	OR	TRUE	No	Yes	1.1	No	Yes	<0.001	0.10	0.064
2012 Ecology Upland Soil Study	SA6-2C	Mn	Zn	Ag,Zn	1	0.10	No	Yes	0.36	No	Yes	NA	NA	NA	NA	0.079	No	Yes	2	TRUE	No	Yes	0.97	No	Yes	<0.001	0.11	0.068
2012 Ecology Upland Soil Study	SA6-3C	Al,Ba,Mn	Zn	As,Cr,Mn,Ag,Zn	OR	0.17	Yes	Yes	0.71	Yes	Yes	NA	NA	NA	NA	0.097	No	Yes	OR	FALSE	No	Yes	1.0	No	Yes	<0.001	0.14	0.090
2012 Ecology Upland Soil Study	SA6-4C	NA	NA	Ag	0	0.037	No	Yes	0.16	No	Yes	NA	NA	NA	NA	0.042	No	Yes	2	TRUE	No	Yes	0.13	No	Yes	<0.001	0.03	0.019
2012 Ecology Upland Soil Study	SA6-5C	NA	NA	Ag	1	0.045	No	Yes	0.15	No	Yes	NA	NA	NA	NA	0.039	No	Yes	3	TRUE	No	Yes	0.11	No	Yes	<0.001	0.027	0.017
2012 Ecology Upland Soil Study	SA6-6C	Al,Mn	Zn	Ag,Zn	OR	0.062	No	Yes	0.13	No	Yes	NA	NA	NA	NA	0.036	No	Yes	OR	FALSE	No	Yes	0.42	No	Yes	<0.001	0.031	0.020
2012 Ecology Upland Soil Study	SA6-7C	Al,Mn	Zn	As,Cr,Mn,Ag,Zn	OR	0.24	Yes	Yes	0.49	Yes	Yes	NA	NA	NA	NA	0.077	No	Yes	OR	FALSE	No	Yes	0.89	No	Yes	<0.001	0.11	0.072
2012 Ecology Upland Soil Study	SA6-8C	Mn	NA	Ag,Zn	OR	0.084	No	Yes	0.16	No	Yes	NA	NA	NA	NA	0.043	No	Yes	OR	TRUE	No	Yes	0.36	No	Yes	<0.001	0.035	0.022
2012 Ecology Upland Soil Study	SA7-1C	Mn	Zn	Ag,Zn	OR	0.11	No	Yes	0.28	No	Yes	NA	NA	NA	NA	0.064	No	Yes	OR	TRUE	No	Yes	0.88	No	Yes	<0.001	0.072	0.042
2012 Ecology Upland Soil Study	SA7-2C	NA	Zn	Ag,Zn	2	0.058	No	Yes	0.32	No	Yes	NA	NA	NA	NA	0.078	No	Yes	2	TRUE	No	Yes	0.30	No	Yes	<0.001	0.074	0.043
2012 Ecology Upland Soil Study	SA7-3C	Al	Zn	As,Ag,Zn	OR	0.19	Yes	Yes	0.18	No	Yes	NA	NA	NA	NA	0.060	No	Yes	OR	FALSE	No	Yes	0.36	No	Yes	<0.001	0.045	0.026
2012 Ecology Upland Soil Study	SA7-4C	Al	NA	Ag,Zn	OR	0.065	No	Yes	0.12	No	Yes	NA	NA	NA	NA	0.031	No	Yes	OR	FALSE	No	Yes	0.17	No	Yes	<0.001	0.028	0.016
2012 Ecology Upland Soil Study	SA7-5C	Al,Mn	Zn	As,Cu,Ag,Tl,Zn	OR	0.23	Yes	Yes	0.26	No	Yes	NA	NA	NA	NA	0.08	No	Yes	OR	FALSE	No	Yes	0.51	No	Yes	<0.001	0.076	0.045
2012 Ecology Upland Soil Study	SA7-6C	Mn	Zn	Ag,Zn	0	0.10	No	Yes	0.22	No	Yes	NA	NA	NA	NA	0.057	No	Yes	2	TRUE	No	Yes	0.51	No	Yes	<0.001	0.060	0.035
2012 Ecology Upland Soil Study	SA7-7C	Al,Mn	Zn	As,Ag,Tl,Zn	0	0.16	Yes	Yes	0.32	No	Yes	NA	NA	NA	NA	0.076	No	Yes	2	FALSE	No	Yes	0.83	No	Yes	<0.001	0.084	0.049
2012 Ecology Upland Soil Study	SA7-8C	Ba,Cr,Mn	Cu,Zn	As,Ba,Cr,Co,Cu,Fe,Ag,Tl,V,Zn	1	0.25	Yes	Yes	2.8	Yes	Yes	NA	NA	NA	NA	0.26	Yes	Yes	3	TRUE	No	Yes	1.6	Yes	Yes	0.0094	0.29	0.17
2012 Ecology Upland Soil Study	SA8-1C	Mn	Zn	Ag,Zn	0	0.13	No	Yes	0.21	No	Yes	NA	NA	NA	NA	0.053	No	Yes	2	TRUE	No	Yes	0.58	No	Yes	<0.001	0.051	0.033
2012 Ecology Upland Soil Study	SA8-2C	Al,Mn	Zn	As,Ag,Zn	OR	0.19	Yes	Yes	0.16	No	Yes	NA	NA	NA	NA	0.053	No	Yes	OR	FALSE	No	Yes	0.48	No	Yes	<0.001	0.043	0.028
2012 Ecology Upland Soil Study	SA8-3C	NA	NA	Ag,Zn	1	0.078	No	Yes	0.30	No	Yes	NA	NA	NA	NA	0.10	No	Yes	3	TRUE	No	Yes	0.25	No	Yes	<0.001	0.076	0.049
2012 Ecology Upland Soil Study	SA8-4C	Mn	Zn	Ag,Zn	OR	0.076	No	Yes	0.19	No	Yes	NA	NA	NA	NA	0.053	No	Yes	OR	TRUE	No	Yes	0.49	No	Yes	<0.001	0.041	0.027
2012 Ecology Upland Soil Study	SA8-5C	Al,Mn	Zn	Ag,Zn	OR	0.11	No	Yes	0.21	No	Yes	NA	NA	NA	NA	0.064	No	Yes	OR	FALSE	No	Yes	0.36	No	Yes	<0.001	0.046	0.030
2012 Ecology Upland Soil Study	SA8-6C	Mn	Zn	Ag,Zn	1	0.11	No	Yes	0.25	No	Yes	NA	NA	NA	NA	0.065	No	Yes	3	TRUE	No	Yes	0.58	No	Yes	<0.001	0.06	0.039
2012 Ecology Upland Soil Study	SA8-7C	Mn	Zn	As,Ag,Tl,Zn	OR	0.25	Yes	Yes	0.28	No	Yes	NA	NA	NA	NA	0.085	No	Yes	OR	TRUE	No	Yes	0.81	No	Yes	<0.001	0.098	0.064
2012 Ecology Upland Soil Study	SA8-8C	Ba,Mn	Zn	As,Ba,Cu,Ag,Tl,Zn	0	0.29	Yes	Yes	0.21	No	Yes	NA	NA	NA	NA	0.044	No	Yes	2	TRUE	No	Yes	1.3	Yes	Yes	<0.001	0.058	0.038
2012 Ecology Upland Soil Study	SA9-10C	Mn	Zn	As,Cr,Ag,Zn	OR	0.20	Yes	Yes	0.46	Yes	Yes	NA	NA	NA	NA	0.099	No	Yes	OR	TRUE	No	Yes	0.57	No	Yes	<0.001	0.071	0.063
2012 Ecology Upland Soil Study	SA9-1C	Ba,Mn	Zn	As,Ba,Cr,Mn,Ag,Tl,Zn	1	0.19	Yes	Yes	0.77	Yes	Yes	NA	NA	NA	NA	0.12	No	Yes	1	TRUE	No	Yes	2.2	Yes	Yes	<0.001	0.086	0.077
2012 Ecology Upland Soil Study	SA9-2C	Ba,Cr,Mn	NA	Ba,Cr,Co,Cu,Fe,Ag,Tl,V,Zn	1	0.067	No	Yes	8.2	Yes	Yes	NA	NA	NA	NA	0.25	Yes	Yes	1	TRUE	No	Yes	7.8	Yes	Yes	0.0068	0.21	0.19
2012 Ecology Upland Soil Study	SA9-3C	Ba,Cr,Mn	NA	Ba,Cr,Fe,Mn,Ag,V,Zn	0	0.090	No	Yes	1.6	Yes	Yes	NA	NA	NA	NA	0.21	Yes	Yes	2	TRUE	No	Yes	1.8	Yes	Yes	<0.001	0.12	0.11
2012 Ecology Upland Soil Study	SA9-4C	NA	Zn	Ag,Zn	2	0.12	No	Yes	0.34	No	Yes	NA	NA	NA	NA	0.064	No	Yes	2	TRUE	No	Yes	0.36	No	Yes	<0.001	0.053	0.048
2012 Ecology Upland Soil Study	SA9-5C	Ba,Mn	Zn	As,Ba,Mn,Ag,Zn	1	0.18	Yes	Yes	0.32	No	Yes	NA	NA	NA	NA	0.059	No	Yes	1	TRUE	No	Yes	1.3	Yes	Yes	<0.001	0.067	0.060
2012 Ecology Upland Soil Study	SA9-6C	Ba,Mn	Zn	Cr,Ag,Tl,Zn	OR	0.092	No	Yes	0.44	Yes	Yes	NA	NA	NA	NA	0.086	No	Yes	OR	TRUE	No	Yes	1.1	No	Yes	<0.001	0.074	0.066
2012 Ecology Upland Soil Study	SA9-7C	Ba,Mn	Zn	As,Cr,Mn,Ag,Tl,Zn	1	0.24	Yes	Yes	0.42	Yes	Yes	NA	NA	NA	NA	0.098	No	Yes	3	TRUE	No	Yes	1.1	No	Yes	<0.001	0.074	0.066
2012 Ecology Upland Soil Study	SA9-8C	Ba,Mn	Zn	As,Ba,Cr,Mn,Ag,Tl,Zn	OR	0.17	Yes	Yes	0.59	Yes	Yes	NA	NA	NA	NA	0.071	No	Yes	OR	TRUE	No	Yes	1.6	Yes	Yes	<0.001	0.098	0.088
2012 Ecology Upland Soil Study	SA9-9C	Ba,Mn	Zn	As,Cr,Mn,Ag,Zn	1	0.22	Yes	Yes	0.52	Yes	Yes	NA	NA	NA	NA	0.089	No	Yes	3	TRUE	No	Yes	1.1	No	Yes	<0.001	0.088	0.078
2014 UCR Upland Soil Study	ADA-001	Mn	NA	Ag,Zn	0	0.11	No	Yes	0.33	No	Yes	0.015	0.0026	No	Yes	0.09	No	Yes	2	TRUE	No	Yes	0.58	No	Yes	<0.001	0.08	0.066
2014 UCR Upland Soil Study	ADA-002	Mn	Zn	Mo,Ag,V,Zn	2	0.092	No	Yes	0.39	No	Yes	0.058	0.019	Yes	Yes	0.18	Yes	Yes	2	TRUE	No	Yes	0.79	No	Yes	<0.001	0.10	0.071
2014 UCR Upland Soil Study	ADA-004	Ba,Mn	Zn	Ba,Mo,Ag,Zn	0	0.10	No	Yes	0.24	No	Yes	0.10	0.019	Yes	Yes	0.11	No	Yes	2	TRUE	No	Yes	1.3	Yes	Yes	<0.001	0.067	0.048
2014 UCR Upland Soil Study	ADA-005	Mn	NA	Mo,Ag,V,Zn	2	0.13	No	Yes	0.38	No	Yes	0.056	0.026	Yes	Yes	0.20	Yes	Yes	2	TRUE	No	Yes	0.78	No	Yes	<0.001	0.098	0.077
2014 UCR Upland Soil Study	ADA-006	NA	NA	Ag,Zn	1	0.080	No	Yes	0.26	No	Yes	0.019	0.0022	No	Yes	0.079	No	Yes	3	TRUE	No	Yes	0.38	No	Yes	<0.001	0.057	0.037
2014 UCR Upland Soil Study	ADA-008	Mn	NA	Cr,Ag,Zn	0	0.13	No	Yes	0.44	Yes	Yes	0.019	0.003	No	Yes	0.11	No	Yes	2	TRUE	No	Yes	0.88	No	Yes	<0.001	0.058	0.050
2014 UCR Upland Soil Study	ADA-010	Mn	NA	As,Mn,Ag,Zn	OR	0.16	Yes	Yes	0.32	No	Yes	0.014	0.0032	No	Yes	0.078	No	Yes	OR	TRUE	No	Yes	0.59	No	Yes	<0.001	0.070	0.071
2014 UCR Upland Soil Study	ADA-015	Mn	NA	Ag,Zn	0	0.054	No	Yes	0.20	No	Yes	0.033	0.0030	No	Yes	0.054	No	Yes	2	TRUE	No	Yes	0.49	No	Yes	<0.001	0.038	0.029
2014 UCR Upland Soil Study	ADA-016	NA	NA	Ag,Zn	1	0.054	No	Yes	0.22	No	Yes	0.25	0.0024	No	Yes	0.051	No	Yes	3	TRUE	No	Yes	0.29	No	Yes	<0.001	0.037	0.027
2014 UCR Upland Soil Study	ADA-017	Mn	Zn	Ag,Zn	1	0.12	No	Yes	0.25	No	Yes	0.016	0.0031	No	Yes	0.075	No	Yes	3	TRUE	No	Yes	0.54	No	Yes	<0.001	0.054	0.038
2014 UCR Upland Soil Study	ADA-018	Mn	NA	Ag,Zn	0	0.10	No	Yes	0.36	No	Yes	0.010	0.0050	No	Yes	0.089	No	Yes	2	TRUE	No	Yes	0.8	No	Yes	<0.001	0.052	0.053
2014 UCR Upland Soil Study	ADA-019	Mn	NA	Cr,Ag,Zn	1	0.09	No	Yes	0.52	Yes	Yes	0.020	0.0028	No	Yes	0.14	No	Yes	1	TRUE	No	Yes	0.48	No	Yes	<0.001	0.079	0.069
2014 UCR Upland Soil Study	ADA-020	Mn	NA	Ag,Zn	2	0.067	No	Yes	0.35	No	Yes	0.030	0.0032	No	Yes	0.12	No	Yes	3	TRUE	No	Yes	0.55	No	Yes	<0.001	0.10	0.057
2014 UCR Upland Soil Study	ADA-021	Mn	NA	Cu,Mo,Ag,Zn	OR	0.15	No	Yes	0.41	No	Yes	0.073	0.0065	Yes	Yes	0.084	No	Yes	OR	TRUE	No	Yes	0.59	No	Yes	<0.001	0.12	0.11
2014 UCR Upland Soil Study	ADA-023	NA	NA	Cr,Mo,Ag,V,Zn	2	0.12	No	Yes	0.46	Yes	Yes	0.071	0.016	Yes	Yes	0.17	Yes	Yes	2	TRUE	No	Yes	0.62	No	Yes	<0.001	0.088	0.065
2014 UCR Upland Soil Study	ADA-024	Mn	Zn	As,Cu,Ag,Zn	OR	0.18	Yes	Yes	0.25	No	Yes	0.020	0.0033	No	Yes	0.075	No	Yes	OR	TRUE	No	Yes	0.75	No	Yes	<0.001	0.044	0.040
2014 UCR Upland Soil Study	ADA-025	Ba,Mn	Zn	Ba,Mn,Mo,Ag,Zn	1	0.14	No	Yes	0.14	No	Yes	0.28	0.025	Yes	Yes	0.065	No	Yes	1	TRUE	No	Yes	2.5	Yes	Yes	<0.001	0.064	0.054
2014 UCR Upland Soil Study	ADA-026	Ba,Mn	NA	Ba,Mo,Ag,Zn	OR	0.074	No	Yes	0.17	No	Yes	0.16	0.024	Yes	Yes	0.098	No	Yes	OR	TRUE	No	Yes	1.9	Yes	Yes	<0.001	0.044	0.045
2014 UCR Upland Soil Study	ADA-028	Mn	NA	Ag,Zn	1	0.13	No	Yes	0.24	No	Yes	0.015	0.0029	No	Yes	0.071	No	Yes	1	TRUE	No	Yes	0.67	No	Yes	<0.001	0.051	0.041
2014 UCR Upland Soil Study	ADA-033	Ba,Mn	Zn	Ba,Mo,Ag,Zn	2	0.089	No	Yes	0.19	No	Yes	0.080	0.017	Yes	Yes	0.10	No	Yes	2	TRUE	No	Yes	1.6	Yes	Yes	<0.001	0.067	0.047
2014 UCR Upland Soil Study	ADA-034	Mn	NA	Mo,Ag,Zn	2	0.063	No	Yes	0.25	No	Yes	0.042	0.011	Yes	Yes	0.11	No	Yes	2	TRUE	No	Yes	0.96	No	Yes	<0.001	0.072	0.052
2014 UCR Upland Soil Study	ADA-035	Mn	Zn	Mn,Ag,Zn	1	0.10	No	Yes	0.22	No	Yes	0.016	0.0031	No	Yes	0.07	No	Yes	1	TRUE	No	Yes	0.93	No	Yes	<0.001	0.043	0.039
2014 UCR Upland Soil Study	ADA-039	Ba,Mn	Zn	Ba,Mo,Ag,Zn	2	0.054	No	Yes	0.25	No	Yes	0.068	0.013	Yes	Yes	0.11	No	Yes	2	TRUE	No	Yes	1.9	Yes	Yes	<0.001	0.081	0.050
2014 UCR Upland Soil Study	ADA-042	Ba,Mn	NA	Ba,Mo,Ag,Zn	1	0.076	No	Yes	0.30	No	Yes	0.048	0.011	Yes	Yes	0.09	No	Yes	3	TRUE	No	Yes	1.4	Yes	Yes	<0.001	0.084	0.058
2014 UCR Upland Soil Study	ADA-043	Ba,Mn	NA	Ba,Mo,Ag,Zn	OR	0.083	No	Yes	0.41	No	Yes	0.037	0.012	Yes	Yes	0.11	No	Yes	OR	TRUE	No	Yes	3.5	Yes	Yes	<0.001	0.096	0.10
2014 UCR Upland Soil Study	ADA-044	Ba,Mn	Zn	Ba,Cr,Mo,Ag,V,Zn	OR	0.095	No	Yes	0.66	Yes	Yes	0.13	0.013	Yes	Yes	0.17	Yes	Yes	OR	TRUE	No	Yes	1.3	Yes	Yes	<0.001	0.089	0.087
2014 UCR Upland Soil Study	ADA-045	Mn	NA	As,Ag,Zn	OR	0.18	Yes	Yes	0.26	No	Yes	0.016	0.0025	No	Yes	0.079	No	Yes	OR	TRUE	No	Yes	0.78	No	Yes	<0.001	0.054	0.054
2014 UCR Upland Soil Study	ADA-046	Mn	NA	Ag,Zn	0	0.092	No	Yes	0.23	No	Yes	0.014	0.0025	No	Yes	0.073	No	Yes	2	TRUE	No	Yes	0.7	No	Yes	<0.001	0.050	0.038
2014 UCR Upland Soil Study	ADA-047	Mn	Zn	Cr,Ag,Zn	1	0.13	No	Yes	0.48	Yes	Yes	0.029	0.0034	No	Yes	0.13	No	Yes	1	TRUE	No	Yes	0.71	No	Yes	<0.001	0.080	0.067
2014 UCR Upland Soil Study	ADA-048	Ba,Mn	NA	Ba,Mo,Ag,Zn	OR	0.071	No	Yes	0.27	No	Yes	0.056	0.011	Yes	Yes	0.079	No	Yes	OR	TRUE	No	Yes	4.3	Yes	Yes	<0.001	0.060	0.073
2014 UCR Upland Soil Study	ADA-049	Ba,Mn	Zn	Ba,Mn,Mo,Ag,Zn	1	0.079	No	Yes	0.23	No	Yes	0.13	0.017	Yes	Yes	0.13	No	Yes	1	TRUE	No	Yes	1.9	Yes	Yes	<0.001	0.089	0.063
2014 UCR Upland Soil Study	ADA-050	Mn	Zn	Cr,Cu,Ag,V,Zn	OR	0.14	No	Yes	0.57	Yes	Yes	0.051	0.0055	No	Yes	0.21	Yes	Yes	OR	TRUE	No	Yes	0.65	No	Yes	<0.001	0.090	0.092
2014 UCR Upland Soil Study	ADA-051	Ba,Mn	Zn	Ba,Cu,Mo,Ag,Zn	1	0.065	No	Yes	0.21	No	Yes	0.081	0.012	Yes	Yes	0.091	No	Yes	1	TRUE	No	Yes	2.4	Yes	Yes	<0.001	0.070	0.058
2014 UCR Upland Soil Study	ADA-052	Ba,Mn	NA	Cr,Ag,Zn	OR	0.12	No	Yes	0.50	Yes	Yes	0.024	0.0036	No	Yes	0.12	No	Yes	OR	TRUE	No	Yes	1.0	No	Yes	<0.001	0.066	0.067

Table 7-2. Hazard Quotients for Invertebrates for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, and Potentially Affected Fraction at Each Sampling Location for Each Study

					Anionic metals																							
						Arsenic			Chromium			Molybdenum				Vanadium				Aluminum[b]			Barium			Cobalt		
Study	Location ID	Summary COPCs with SSL HQ ≥ 1 (COPCs with BABs Not included)	Summary COPCs with BAB HQ ≥ 1	Summary COPCs with concentration > BTV	Anionic metal bioavailability score [a]	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	BAB HQ	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	Cationic metal bioavailability score[a]	pH >= 5.5	>BTV	Detect	SSL HQ	>BTV	Detect	PAF (%)	BAB HQ	SSL HQ
2014 UCR Upland Soil Study	ADA-053	Ba,Mn	NA	Ba,Cr,Mn,Ag,Zn	OR	0.073	No	Yes	0.61	Yes	Yes	0.016	0.0037	No	Yes	0.13	No	Yes	OR	TRUE	No	Yes	1.7	Yes	Yes	<0.001	0.072	0.077
2014 UCR Upland Soil Study	ADA-054	Mn	NA	As,Ag,Zn	OR	0.16	Yes	Yes	0.29	No	Yes	0.045	0.0042	No	Yes	0.10	No	Yes	OR	TRUE	No	Yes	0.70	No	Yes	<0.001	0.046	0.050
2014 UCR Upland Soil Study	ADA-055	Ba,Mn	Zn	As,Ba,Cu,Mn,Mo,Ag,Zn	OR	0.16	Yes	Yes	0.26	No	Yes	0.15	0.026	Yes	Yes	0.13	No	Yes	OR	TRUE	No	Yes	4.5	Yes	Yes	<0.001	0.084	0.072
2014 UCR Upland Soil Study	ADA-056	Ba,Mn	NA	Ba,Cr,Mn,Ag,Zn	0	0.075	No	Yes	0.57	Yes	Yes	0.016	0.0039	No	Yes	0.11	No	Yes	2	TRUE	No	Yes	1.7	Yes	Yes	<0.001	0.091	0.078
2014 UCR Upland Soil Study	ADA-057	Mn	NA	Cr,Ag,V,Zn	1	0.095	No	Yes	0.62	Yes	Yes	0.017	0.0036	No	Yes	0.16	Yes	Yes	1	TRUE	No	Yes	0.86	No	Yes	<0.001	0.11	0.088
2014 UCR Upland Soil Study	ADA-058	Ba,Mn	NA	Ba,Mn,Mo,Ag,Zn	OR	0.052	No	Yes	0.35	No	Yes	0.026	0.0065	Yes	Yes	0.07	No	Yes	OR	TRUE	No	Yes	1.3	Yes	Yes	<0.001	0.09	0.082
2014 UCR Upland Soil Study	ADA-059	Ba,Mn	NA	Ba,Cr,Mn,Mo,Ag,Zn	OR	0.077	No	Yes	0.52	Yes	Yes	0.040	0.0067	Yes	Yes	0.12	No	Yes	OR	TRUE	No	Yes	1.8	Yes	Yes	<0.001	0.098	0.086
2014 UCR Upland Soil Study	ADA-060	Mn	NA	Cr,Ag,Zn	OR	0.14	No	Yes	0.52	Yes	Yes	0.039	0.0036	No	Yes	0.12	No	Yes	OR	TRUE	No	Yes	0.68	No	Yes	<0.001	0.084	0.075
2014 UCR Upland Soil Study	ADA-061	Ba,Cr,Mn	NA	Ba,Cr,Mn,Ag,Zn	OR	0.098	No	Yes	1.4	Yes	Yes	0.041	0.0033	No	Yes	0.14	No	Yes	OR	TRUE	No	Yes	1.9	Yes	Yes	<0.001	0.10	0.10
2014 UCR Upland Soil Study	ADA-062	Mn	NA	Ag,Zn	OR	0.10	No	Yes	0.35	No	Yes	0.024	0.003	No	Yes	0.10	No	Yes	OR	TRUE	No	Yes	0.71	No	Yes	<0.001	0.054	0.054
2014 UCR Upland Soil Study	ADA-063	Ba,Mn	NA	Ba,Mn,Mo,Ag,Zn	OR	0.094	No	Yes	0.29	No	Yes	0.084	0.0074	Yes	Yes	0.092	No	Yes	OR	TRUE	No	Yes	4.2	Yes	Yes	<0.001	0.081	0.071
2014 UCR Upland Soil Study	ADA-064	Al,Ba,Mn	NA	Ba,Cr,Mn,Ag,Zn	OR	0.11	No	Yes	0.65	Yes	Yes	0.048	0.0056	No	Yes	0.10	No	Yes	OR	FALSE	No	Yes	1.6	Yes	Yes	<0.001	0.096	0.084
2014 UCR Upland Soil Study	ADA-065	Mn	NA	Ag,Zn	2	0.070	No	Yes	0.19	No	Yes	0.020	0.0023	No	Yes	0.069	No	Yes	2	TRUE	No	Yes	0.31	No	Yes	<0.001	0.053	0.032
2014 UCR Upland Soil Study	ADA-066	Mn	NA	Ag,Zn	0	0.078	No	Yes	0.35	No	Yes	0.036	0.0039	No	Yes	0.089	No	Yes	2	TRUE	No	Yes	0.64	No	Yes	<0.001	0.065	0.050
2014 UCR Upland Soil Study	ADA-067	Ba,Mn	NA	Ba,Cr,Cu,Mn,Mo,Ag,Zn	1	0.073	No	Yes	0.44	Yes	Yes	0.085	0.012	Yes	Yes	0.11	No	Yes	1	TRUE	No	Yes	2.5	Yes	Yes	<0.001	0.11	0.086
2014 UCR Upland Soil Study	ADA-070	Ba,Mn	NA	Cr,Ag,Zn	OR	0.13	No	Yes	0.46	Yes	Yes	0.019	0.0033	No	Yes	0.13	No	Yes	OR	TRUE	No	Yes	1.1	No	Yes	<0.001	0.068	0.066
2014 UCR Upland Soil Study	ADA-071	Mn	NA	Ag,Zn	0	0.10	No	Yes	0.37	No	Yes	0.035	0.0042	No	Yes	0.11	No	Yes	2	TRUE	No	Yes	0.87	No	Yes	<0.001	0.064	0.051
2014 UCR Upland Soil Study	ADA-073	Al,Mn	NA	Ag,Zn	OR	0.13	No	Yes	0.35	No	Yes	0.031	0.0042	No	Yes	0.11	No	Yes	OR	FALSE	No	Yes	0.87	No	Yes	<0.001	0.059	0.048
2014 UCR Upland Soil Study	ADA-076	Al,Ba,Mn	Zn	As,Ba,Mo,Ag,Zn	OR	0.16	Yes	Yes	0.36	No	Yes	0.046	0.0068	Yes	Yes	0.10	No	Yes	OR	FALSE	No	Yes	1.2	Yes	Yes	<0.001	0.062	0.060
2014 UCR Upland Soil Study	ADA-078	Ba,Mn	NA	Ba,Cr,Ag,Zn	0	0.14	No	Yes	0.43	Yes	Yes	0.020	0.0033	No	Yes	0.14	No	Yes	2	TRUE	No	Yes	1.3	Yes	Yes	<0.001	0.082	0.060
2014 UCR Upland Soil Study	ADA-079	Al,Ba,Mn	NA	Ba,Mo,Ag,Zn	OR	0.097	No	Yes	0.37	No	Yes	0.11	0.014	Yes	Yes	0.10	No	Yes	OR	FALSE	No	Yes	2.8	Yes	Yes	<0.001	0.042	0.050
2014 UCR Upland Soil Study	ADA-081	Mn	NA	Cr,Ag,Zn	0	0.096	No	Yes	0.52	Yes	Yes	0.024	0.0034	No	Yes	0.16	No	Yes	2	TRUE	No	Yes	0.65	No	Yes	<0.001	0.077	0.058
2014 UCR Upland Soil Study	ADA-082	Mn	NA	Cr,Ag,Zn	OR	0.084	No	Yes	0.43	Yes	Yes	0.017	0.0033	No	Yes	0.12	No	Yes	OR	TRUE	No	Yes	0.87	No	Yes	<0.001	0.060	0.059
2014 UCR Upland Soil Study	ADA-084	Mn	NA	Mn,Ag,Zn	OR	0.082	No	Yes	0.38	No	Yes	0.026	0.0030	No	Yes	0.093	No	Yes	OR	TRUE	No	Yes	0.99	No	Yes	<0.001	0.062	0.070
2014 UCR Upland Soil Study	ADA-085	Mn	Zn	Ag,Zn	OR	0.070	No	Yes	0.32	No	Yes	0.029	0.0060	No	Yes	0.11	No	Yes	OR	TRUE	No	Yes	0.9	No	Yes	<0.001	0.047	0.059
2014 UCR Upland Soil Study	ADA-088	Ba,Mn	NA	Cr,Mn,Ag,Zn	OR	0.13	No	Yes	0.58	Yes	Yes	0.039	0.0040	No	Yes	0.12	No	Yes	OR	TRUE	No	Yes	1.1	No	Yes	<0.001	0.087	0.085
2014 UCR Upland Soil Study	ADA-089	Ba,Mn	NA	As,Ba,Cr,Mn,Ag,Zn	OR	0.16	Yes	Yes	0.44	Yes	Yes	0.024	0.0032	No	Yes	0.1	No	Yes	OR	TRUE	No	Yes	1.2	Yes	Yes	<0.001	0.094	0.084
2014 UCR Upland Soil Study	ADA-090	Ba,Mn	NA	Ba,Cr,Mn,Ag,Zn	OR	0.084	No	Yes	0.47	Yes	Yes	0.015	0.0028	No	Yes	0.11	No	Yes	OR	TRUE	No	Yes	1.5	Yes	Yes	<0.001	0.066	0.066
2014 UCR Upland Soil Study	ADA-091	Mn	NA	Cr,Ag,Zn	OR	0.13	No	Yes	0.63	Yes	Yes	0.020	0.0029	No	Yes	0.11	No	Yes	OR	TRUE	No	Yes	0.94	No	Yes	<0.001	0.086	0.076
2014 UCR Upland Soil Study	ADA-092	Ba,Mn	NA	As,Ba,Cr,Mn,Mo,Ag,Zn	OR	0.15	Yes	Yes	0.43	Yes	Yes	0.062	0.0087	Yes	Yes	0.094	No	Yes	OR	TRUE	No	Yes	1.3	Yes	Yes	<0.001	0.060	0.066
2014 UCR Upland Soil Study	ADA-093	Ba,Mn	NA	Ba,Mn,Ag,Zn	OR	0.12	No	Yes	0.32	No	Yes	0.011	0.0033	No	Yes	0.10	No	Yes	OR	TRUE	No	Yes	1.3	Yes	Yes	<0.001	0.068	0.063
2014 UCR Upland Soil Study	ADA-094	Ba,Mn	NA	Ag,Zn	0	0.082	No	Yes	0.40	No	Yes	0.017	0.0029	No	Yes	0.10	No	Yes	2	TRUE	No	Yes	1.1	No	Yes	<0.001	0.077	0.061
2014 UCR Upland Soil Study	ADA-095	Ba,Mn	NA	Cr,Ag,Zn	OR	0.11	No	Yes	0.53	Yes	Yes	0.017	0.0029	No	Yes	0.10	No	Yes	OR	TRUE	No	Yes	1.1	No	Yes	<0.001	0.067	0.078
2014 UCR Upland Soil Study	ADA-096	Ba,Mn	NA	Ba,Mn,Ag,Zn	OR	0.096	No	Yes	0.25	No	Yes	0.020	0.0030	No	Yes	0.071	No	Yes	OR	TRUE	No	Yes	1.4	Yes	Yes	<0.001	0.052	0.053
2014 UCR Upland Soil Study	ADA-097	Ba,Mn	NA	Cr,Ag,Zn	OR	0.13	No	Yes	0.51	Yes	Yes	0.062	0.0049	No	Yes	0.087	No	Yes	OR	TRUE	No	Yes	1.0	No	Yes	<0.001	0.053	0.064
2014 UCR Upland Soil Study	ADA-099	Ba,Mn	NA	Cr,Mn,Ag,Zn	OR	0.14	No	Yes	0.45	Yes	Yes	0.026	0.0032	No	Yes	0.1	No	Yes	OR	TRUE	No	Yes	1.2	No	Yes	<0.001	0.071	0.072
2014 UCR Upland Soil Study	ADA-101	Mn	NA	Ag,Zn	OR	0.11	No	Yes	0.38	No	Yes	0.026	0.0042	No	Yes	0.13	No	Yes	OR	TRUE	No	Yes	0.72	No	Yes	<0.001	0.055	0.063
2014 UCR Upland Soil Study	ADA-102	Ba,Mn	NA	Ba,Ag,Zn	1	0.088	No	Yes	0.38	No	Yes	0.014	0.0028	No	Yes	0.13	No	Yes	1	TRUE	No	Yes	1.2	Yes	Yes	<0.001	0.084	0.069
2014 UCR Upland Soil Study	ADA-103	Ba,Mn	NA	Ba,Cr,Mn,Ag,Zn	1	0.10	No	Yes	0.55	Yes	Yes	0.022	0.0049	No	Yes	0.11	No	Yes	1	TRUE	No	Yes	1.6	Yes	Yes	<0.001	0.13	0.12
2014 UCR Upland Soil Study	ADA-104	Ba,Mn	NA	Ba,Mo,Ag,Zn	OR	0.072	No	Yes	0.22	No	Yes	0.056	0.012	Yes	Yes	0.11	No	Yes	OR	TRUE	No	Yes	1.3	Yes	Yes	<0.001	0.057	0.053
2014 UCR Upland Soil Study	ADA-105	Ba,Mn	Zn	Ba,Ag,Zn	OR	0.10	No	Yes	0.41	No	Yes	0.020	0.0022	No	Yes	0.14	No	Yes	OR	TRUE	No	Yes	1.3	Yes	Yes	<0.001	0.078	0.070
2014 UCR Upland Soil Study	ADA-106	Al,Ba,Mn	NA	Ba,Mn,Mo,Ag,Zn	OR	0.076	No	Yes	0.35	No	Yes	0.082	0.011	Yes	Yes	0.12	No	Yes	OR	FALSE	No	Yes	2.7	Yes	Yes	<0.001	0.10	0.084
2014 UCR Upland Soil Study	ADA-107	Ba,Mn	NA	Ba,Cr,Mn,Mo,Ag,V,Zn	OR	0.11	No	Yes	0.88	Yes	Yes	0.067	0.0096	Yes	Yes	0.17	Yes	Yes	OR	TRUE	No	Yes	1.7	Yes	Yes	<0.001	0.13	0.11
2014 UCR Upland Soil Study	ADA-108	Mn	NA	Cr,Ag,Zn	OR	0.086	No	Yes	0.89	Yes	Yes	0.022	0.0022	No	Yes	0.12	No	Yes	OR	TRUE	No	Yes	0.83	No	Yes	<0.001	0.077	0.074
2014 UCR Upland Soil Study	ADA-109	Mn	NA	Ag,Zn	OR	0.099	No	Yes	0.37	No	Yes	0.047	0.0032	No	Yes	0.071	No	Yes	OR	TRUE	No	Yes	0.66	No	Yes	<0.001	0.042	0.045
2014 UCR Upland Soil Study	ADA-110	Mn	NA	Ag,Zn	0	0.082	No	Yes	0.35	No	Yes	0.015	0.0017	No	Yes	0.097	No	Yes	2	TRUE	No	Yes	0.55	No	Yes	<0.001	0.060	0.046
2014 UCR Upland Soil Study	ADA-111	Ba,Mn	NA	Cr,Ag,Zn	1	0.074	No	Yes	0.58	Yes	Yes	0.014	0.0021	No	Yes	0.16	No	Yes	1	TRUE	No	Yes	1.1	No	Yes	<0.001	0.095	0.078
2014 UCR Upland Soil Study	ADA-112	Ba,Mn	NA	Ba,Mn,Ag,Zn	OR	0.076	No	Yes	0.36	No	Yes	0.010	0.0025	No	Yes	0.13	No	Yes	OR	TRUE	No	Yes	1.4	Yes	Yes	<0.001	0.061	0.064
2014 UCR Upland Soil Study	ADA-113	Ba,Mn	NA	Ba,Cr,Mn,Ag,Zn	OR	0.085	No	Yes	0.45	Yes	Yes	0.019	0.0026	No	Yes	0.12	No	Yes	OR	TRUE	No	Yes	1.7	Yes	Yes	<0.001	0.069	0.066
2014 UCR Upland Soil Study	ADA-114	Al,Ba,Fe,Mn	NA	Ba,Mn,Ag,Zn	OR	0.11	No	Yes	0.35	No	Yes	0.018	0.0036	No	Yes	0.091	No	Yes	OR	FALSE	No	Yes	1.2	Yes	Yes	<0.001	0.059	0.055
2014 UCR Upland Soil Study	ADA-115	Mn	NA	Ag,Zn	OR	0.092	No	Yes	0.31	No	Yes	0.012	0.0022	No	Yes	0.084	No	Yes	OR	TRUE	No	Yes	0.97	No	Yes	<0.001	0.050	0.046
2014 UCR Upland Soil Study	ADA-116	Mn	NA	Ag,Zn	0	0.099	No	Yes	0.34	No	Yes	0.015	0.0025	No	Yes	0.11	No	Yes	2	TRUE	No	Yes	0.81	No	Yes	<0.001	0.076	0.055
2014 UCR Upland Soil Study	ADA-117	Mn	NA	Mn,Ag,Zn	0	0.10	No	Yes	0.32	No	Yes	0.030	0.0028	No	Yes	0.11	No	Yes	2	TRUE	No	Yes	0.88	No	Yes	<0.001	0.083	0.055
2014 UCR Upland Soil Study	ADA-118	Ba,Mn	NA	Ba,Cr,Mn,Ag,Zn	1	0.086	No	Yes	0.77	Yes	Yes	0.039	0.0028	No	Yes	0.11	No	Yes	1	TRUE	No	Yes	1.2	Yes	Yes	<0.001	0.080	0.068
2014 UCR Upland Soil Study	ADA-119	Mn	NA	Cr,Ag,Zn	OR	0.087	No	Yes	0.43	Yes	Yes	0.014	0.0022	No	Yes	0.084	No	Yes	OR	TRUE	No	Yes	0.81	No	Yes	<0.001	0.066	0.062
2014 UCR Upland Soil Study	ADA-121	Ba,Mn	NA	Cr,Ag,Zn	OR	0.11	No	Yes	0.45	Yes	Yes	0.021	0.0038	No	Yes	0.15	No	Yes	OR	TRUE	No	Yes	1.2	No	Yes	<0.001	0.081	0.076
2014 UCR Upland Soil Study	ADA-122	Ba,Mn	NA	Ba,Mn,Ag,Zn	OR	0.068	No	Yes	0.34	No	Yes	0.025	0.0045	No	Yes	0.091	No	Yes	OR	TRUE	No	Yes	1.3	Yes	Yes	<0.001	0.066	0.062
2014 UCR Upland Soil Study	ADA-124	Al,Fe,Mn	NA	Ag,Zn	1	0.080	No	Yes	0.20	No	Yes	0.067	0.0038	No	Yes	0.053	No	Yes	3	FALSE	No	Yes	0.5	No	Yes	<0.001	0.053	0.031
2014 UCR Upland Soil Study	ADA-125	Mn	NA	Ag,Zn	1	0.086	No	Yes	0.17	No	Yes	0.037	0.0035	No	Yes	0.050	No	Yes	3	TRUE	No	Yes	0.44	No	Yes	<0.001	0.046	0.027
2014 UCR Upland Soil Study	ADA-126	Mn	Zn	Cu,Ag,Zn	1	0.14	No	Yes	0.21	No	Yes	0.021	0.0033	No	Yes	0.067	No	Yes	1	TRUE	No	Yes	0.85	No	Yes	<0.001	0.050	0.037
2014 UCR Upland Soil Study	ADA-127	Ba,Mn	Zn	Ba,Ag,Zn	1	0.12	No	Yes	0.31	No	Yes	0.041	0.0043	No	Yes	0.10	No	Yes	1	TRUE	No	Yes	1.5	Yes	Yes	<0.001	0.098	0.080
2014 UCR Upland Soil Study	ADA-128	NA	Zn	Ag,Zn	2	0.069	No	Yes	0.15	No	Yes	0.019	0.0016	No	Yes	0.047	No	Yes	2	TRUE	No	Yes	0.26	No	Yes	<0.001	0.036	0.022
2014 UCR Upland Soil Study	ADA-131	Al,Ba,Mn	Zn	As,Ba,Ag,Zn	OR	0.19	Yes	Yes	0.31	No	Yes	0.055	0.0042	No	Yes	0.091	No	Yes	OR	FALSE	No	Yes	1.3	Yes	Yes	<0.001	0.071	0.056
2014 UCR Upland Soil Study	ADA-132	Al,Fe	NA	Ag,Zn	0	0.078	No	Yes	0.28	No	Yes	0.011	0.0031	No	Yes	0.073	No	Yes	2	FALSE	No	Yes	0.49	No	Yes	<0.001	0.053	0.038
2014 UCR Upland Soil Study	ADA-133	Mn	NA	Ag,Zn	0	0.10	No	Yes	0.27	No	Yes	0.041	0.0042	No	Yes	0.083	No	Yes	2	TRUE	No	Yes	0.64	No	Yes	<0.001	0.059	0.044
2014 UCR Upland Soil Study	ADA-135	NA	Zn	Ag,Zn	2	0.057	No	Yes	0.35	No	Yes	0.038	0.0022	No	Yes	0.096	No	Yes	3	TRUE	No	Yes	0.31	No	Yes	<0.001	0.087	0.046
2014 UCR Upland Soil Study	ADA-136	Mn	Zn	Ag,Zn	1	0.069	No	Yes	0.24	No	Yes	0.017	0.0023	No	Yes	0.065	No	Yes	1	TRUE	No	Yes	0.41	No	Yes	<0.001	0.053	0.036
2014 UCR Upland Soil Study	ADA-139	Mn	NA	Ag,Zn	0	0.12	No	Yes	0.39	No	Yes	0.024	0.004	No	Yes	0.11	No	Yes	2	TRUE	No	Yes	0.95	No	Yes	<0.001	0.078	0.061
2014 UCR Upland Soil Study	ADA-141	Mn	NA	Ag,Zn	0	0.078	No	Yes	0.29	No	Yes	0.016	0.0029	No	Yes	0.075	No	Yes	2	TRUE	No	Yes	0.62	No	Yes	<0.001	0.057	0.041
2014 UCR Upland Soil Study	ADA-142	Mn	NA	Ag,Zn	1	0.071	No	Yes	0.21	No	Yes	0.019	0.0021	No	Yes	0.071	No	Yes	1	TRUE	No	Yes	0.38	No	Yes	<0.001	0.038	0.026

Table 7-2. Hazard Quotients for Invertebrates for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, and Potentially Affected Fraction at Each Sampling Location for Each Study

					Anionic metals																							
						Arsenic			Chromium			Molybdenum				Vanadium				Aluminum[b]			Barium			Cobalt		
Study	Location ID	Summary COPCs with SSL HQ ≥ 1 (COPCs with BABs Not included)	Summary COPCs with BAB HQ ≥ 1	Summary COPCs with concentration > BTV	Anionic metal bioavailability score [a]	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	BAB HQ	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	Cationic metal bioavailability score[a]	pH >= 5.5	>BTV	Detect	SSL HQ	>BTV	Detect	PAF (%)	BAB HQ	SSL HQ
2014 UCR Upland Soil Study	ADA-143	NA	NA	Ag,Zn	1	0.064	No	Yes	0.22	No	Yes	0.018	0.0021	No	Yes	0.071	No	Yes	3	TRUE	No	Yes	0.33	No	Yes	<0.001	0.054	0.031
2014 UCR Upland Soil Study	ADA-144	NA	NA	Ag,Zn	0	0.12	No	Yes	0.13	No	Yes	0.022	0.0019	No	Yes	0.054	No	Yes	2	TRUE	No	Yes	0.27	No	Yes	<0.001	0.030	0.022
2014 UCR Upland Soil Study	ADA-145	Mn	NA	Ag,Zn	1	0.11	No	Yes	0.29	No	Yes	0.016	0.0028	No	Yes	0.083	No	Yes	1	TRUE	No	Yes	0.71	No	Yes	<0.001	0.062	0.054
2014 UCR Upland Soil Study	ADA-146	Mn	Zn	Ag,Zn	0	0.11	No	Yes	0.23	No	Yes	0.018	0.0026	No	Yes	0.063	No	Yes	2	TRUE	No	Yes	0.55	No	Yes	<0.001	0.050	0.036
2014 UCR Upland Soil Study	ADA-147	NA	NA	Ag,Zn	0	0.11	No	Yes	0.13	No	Yes	0.027	0.0017	No	Yes	0.046	No	Yes	2	TRUE	No	Yes	0.27	No	Yes	<0.001	0.024	0.017
2014 UCR Upland Soil Study	ADA-148	Al	Zn	Ag,Zn	1	0.11	No	Yes	0.22	No	Yes	0.017	0.0019	No	Yes	0.062	No	Yes	3	FALSE	No	Yes	0.27	No	Yes	<0.001	0.059	0.032
2014 UCR Upland Soil Study	ADA-150	NA	Zn	Ag,Zn	1	0.12	No	Yes	0.18	No	Yes	0.021	0.0017	No	Yes	0.056	No	Yes	3	TRUE	No	Yes	0.25	No	Yes	<0.001	0.059	0.032
2014 UCR Upland Soil Study	ADA-151	Al	Zn	Ag,Zn	1	0.089	No	Yes	0.22	No	Yes	0.022	0.0014	No	Yes	0.071	No	Yes	3	FALSE	No	Yes	0.17	No	Yes	<0.001	0.052	0.029
2014 UCR Upland Soil Study	ADA-152	Ba,Mn	Zn	As,Cr,Ag,Zn	0	0.17	Yes	Yes	0.49	Yes	Yes	0.019	0.0025	No	Yes	0.13	No	Yes	2	TRUE	No	Yes	1.1	No	Yes	<0.001	0.087	0.072
2014 UCR Upland Soil Study	ADA-153	Mn	NA	Ag,Zn	OR	0.14	No	Yes	0.28	No	Yes	0.020	0.0025	No	Yes	0.085	No	Yes	OR	TRUE	No	Yes	0.68	No	Yes	<0.001	0.058	0.055
2014 UCR Upland Soil Study	ADA-154	Mn	Zn	Cr,Ag,Zn	OR	0.13	No	Yes	0.76	Yes	Yes	0.036	0.0030	No	Yes	0.10	No	Yes	OR	TRUE	No	Yes	0.92	No	Yes	<0.001	0.073	0.073
2014 UCR Upland Soil Study	ADA-155	Al,Mn	NA	Ag,Zn	0	0.11	No	Yes	0.17	No	Yes	0.020	0.0027	No	Yes	0.049	No	Yes	2	FALSE	No	Yes	0.56	No	Yes	<0.001	0.037	0.026
2014 UCR Upland Soil Study	ADA-156	Mn	Zn	Ag,Zn	OR	0.12	No	Yes	0.35	No	Yes	0.023	0.0046	No	Yes	0.081	No	Yes	OR	TRUE	No	Yes	0.99	No	Yes	<0.001	0.055	0.052
2014 UCR Upland Soil Study	ADA-158	Mn	Zn	As,Ag,Zn	1	0.15	Yes	Yes	0.34	No	Yes	0.021	0.0027	No	Yes	0.094	No	Yes	3	TRUE	No	Yes	0.38	No	Yes	<0.001	0.069	0.043
2014 UCR Upland Soil Study	ADA-159	Mn	Zn	Cr,Ag,Zn	OR	0.12	No	Yes	0.43	Yes	Yes	0.029	0.0028	No	Yes	0.087	No	Yes	OR	TRUE	No	Yes	0.62	No	Yes	<0.001	0.075	0.066
2014 UCR Upland Soil Study	ADA-160	NA	NA	Ag,Zn	1	0.091	No	Yes	0.17	No	Yes	0.016	0.0019	No	Yes	0.049	No	Yes	3	TRUE	No	Yes	0.32	No	Yes	<0.001	0.037	0.024
2014 UCR Upland Soil Study	ADA-161	Al,Fe,Mn	Zn	Ag,Zn	0	0.11	No	Yes	0.33	No	Yes	0.015	0.0028	No	Yes	0.083	No	Yes	2	FALSE	No	Yes	0.74	No	Yes	<0.001	0.063	0.046
2014 UCR Upland Soil Study	ADA-162	NA	Zn	Ag,Zn	0	0.13	No	Yes	0.18	No	Yes	0.027	0.0018	No	Yes	0.053	No	Yes	2	TRUE	No	Yes	0.36	No	Yes	<0.001	0.029	0.023
2014 UCR Upland Soil Study	ADA-164	Mn	Zn	Ag,Zn	OR	0.13	No	Yes	0.25	No	Yes	0.047	0.0029	No	Yes	0.082	No	Yes	OR	TRUE	No	Yes	0.62	No	Yes	<0.001	0.044	0.040
2014 UCR Upland Soil Study	ADA-165	Mn	Zn	Ag,Zn	0	0.15	No	Yes	0.31	No	Yes	0.025	0.0027	No	Yes	0.071	No	Yes	2	TRUE	No	Yes	0.63	No	Yes	<0.001	0.059	0.044
2014 UCR Upland Soil Study	ADA-168	Mn	Zn	As,Ag,Zn	2	0.17	Yes	Yes	0.29	No	Yes	0.035	0.0027	No	Yes	0.083	No	Yes	2	TRUE	No	Yes	0.57	No	Yes	<0.001	0.067	0.044
2014 UCR Upland Soil Study	ADA-169	Mn	NA		OR	0.078	No	Yes	0.26	No	Yes	0.0079	0.0024	No	Yes	0.068	No	Yes	OR	TRUE	No	Yes	0.68	No	Yes	<0.001	0.066	0.071
2014 UCR Upland Soil Study	ADA-170	Al,Mn	NA	Mo,Ag,Zn	OR	0.084	No	Yes	0.26	No	Yes	0.026	0.0064	Yes	Yes	0.13	No	Yes	OR	FALSE	No	Yes	0.66	No	Yes	<0.001	0.055	0.057
2014 UCR Upland Soil Study	ADA-171	Mn	Zn	Mo,Ag,Zn	OR	0.072	No	Yes	0.24	No	Yes	0.034	0.0086	Yes	Yes	0.11	No	Yes	OR	TRUE	No	Yes	0.67	No	Yes	<0.001	0.053	0.048
2014 UCR Upland Soil Study	ADA-172	Al,Mn	NA	Ag	OR	0.041	No	Yes	0.19	No	Yes	0.0076	0.0022	No	Yes	0.061	No	Yes	OR	FALSE	No	Yes	0.67	No	Yes	<0.001	0.032	0.041
2014 UCR Upland Soil Study	ADA-173	Al,Ba,Mn	NA	Mn,Mo,Ag,Zn	OR	0.082	No	Yes	0.28	No	Yes	0.039	0.0088	Yes	Yes	0.12	No	Yes	OR	FALSE	No	Yes	1.0	No	Yes	<0.001	0.061	0.054
2014 UCR Upland Soil Study	ADA-174	Al,Ba,Mn	NA	Ba,Mn,Mo,Ag,Zn	OR	0.073	No	Yes	0.24	No	Yes	0.039	0.0091	Yes	Yes	0.092	No	Yes	OR	FALSE	No	Yes	1.3	Yes	Yes	<0.001	0.042	0.043
2014 UCR Upland Soil Study	ADA-175	Al,Mn	NA	Ag,Zn	OR	0.039	No	Yes	0.29	No	Yes	0.013	0.0024	No	Yes	0.076	No	Yes	OR	FALSE	No	Yes	0.87	No	Yes	<0.001	0.071	0.057
2014 UCR Upland Soil Study	ADA-176	Ba,Mn	NA	Cr,Ag	OR	0.037	No	Yes	0.43	Yes	Yes	0.0093	0.0018	No	Yes	0.11	No	Yes	OR	TRUE	No	Yes	1.1	No	Yes	<0.001	0.11	0.092
2014 UCR Upland Soil Study	ADA-177	Al,Fe,Mn	NA	Ag	OR	0.059	No	Yes	0.33	No	Yes	0.022	0.0024	No	Yes	0.086	No	Yes	OR	FALSE	No	Yes	0.57	No	Yes	<0.001	0.071	0.076
2014 UCR Upland Soil Study	ADA-178	Mn	NA	Ag,Zn	OR	0.061	No	Yes	0.31	No	Yes	0.015	0.0039	No	Yes	0.097	No	Yes	OR	TRUE	No	Yes	0.54	No	Yes	<0.001	0.083	0.080
2014 UCR Upland Soil Study	ADA-179	Mn	NA	Mo,Ag,Zn	OR	0.057	No	Yes	0.22	No	Yes	0.048	0.0082	Yes	Yes	0.11	No	Yes	OR	TRUE	No	Yes	0.92	No	Yes	<0.001	0.051	0.046
2014 UCR Upland Soil Study	ADA-180	Ba,Mn	NA	Ba,Mo,Ag,Zn	OR	0.057	No	Yes	0.23	No	Yes	0.046	0.013	Yes	Yes	0.11	No	Yes	OR	TRUE	No	Yes	1.8	Yes	Yes	<0.001	0.046	0.047
2014 UCR Upland Soil Study	ADA-181	Ba,Mn	NA	Ba,Mo,Ag,Zn	OR	0.066	No	Yes	0.24	No	Yes	0.050	0.014	Yes	Yes	0.14	No	Yes	OR	TRUE	No	Yes	1.3	Yes	Yes	<0.001	0.042	0.047
2014 UCR Upland Soil Study	ADA-182	Ba,Mn	NA	Mo,Ag,Zn	OR	0.053	No	Yes	0.26	No	Yes	0.059	0.012	Yes	Yes	0.12	No	Yes	OR	TRUE	No	Yes	1.1	No	Yes	<0.001	0.059	0.052
2014 UCR Upland Soil Study	ADA-183	Ba,Mn	NA	Ba,Mo,Ag,V,Zn	OR	0.11	No	Yes	0.26	No	Yes	0.13	0.034	Yes	Yes	0.16	Yes	Yes	OR	TRUE	No	Yes	1.3	Yes	Yes	<0.001	0.040	0.047
2014 UCR Upland Soil Study	ADA-184	Ba,Mn	NA	Ba,Mo,Ag,Zn	OR	0.063	No	Yes	0.19	No	Yes	0.087	0.017	Yes	Yes	0.089	No	Yes	OR	TRUE	No	Yes	2.3	Yes	Yes	<0.001	0.055	0.058
2015 Bossburg Study	UDU-01-ICS	NA	NA	Ag	2	0.041	No	Yes	0.21	No	Yes	NA	NA	NA	NA	0.075	No	Yes	2	TRUE	No	Yes	0.32	No	Yes	<0.001	0.072	0.032
2015 Bossburg Study	UDU-02-ICS	NA	NA	Ag,Zn	2	0.038	No	Yes	0.24	No	Yes	NA	NA	NA	NA	0.079	No	Yes	2	TRUE	No	Yes	0.51	No	Yes	<0.001	0.071	0.032
2015 Bossburg Study	UDU-03-ICS	NA	Cu,Zn	Cu,Ag,Zn	3	0.042	No	Yes	0.23	No	Yes	NA	NA	NA	NA	0.075	No	Yes	3	TRUE	No	Yes	0.32	No	Yes	<0.001	0.077	0.031
2015 Bossburg Study	UDU-04-ICS	Al	Zn	Ag,Zn	1	0.053	No	Yes	0.22	No	Yes	NA	NA	NA	NA	0.075	No	Yes	3	FALSE	No	Yes	0.48	No	Yes	<0.001	0.076	0.032
2015 Bossburg Study	UDU-05-ICS	NA	NA	Cr,Ag,Zn	2	0.041	No	Yes	0.42	Yes	Yes	NA	NA	NA	NA	0.13	No	Yes	2	TRUE	No	Yes	0.40	No	Yes	<0.001	0.079	0.057
2015 Bossburg Study	UDU-06-ICS	NA	NA	Ag	2	0.070	No	Yes	0.41	No	Yes	NA	NA	NA	NA	0.090	No	Yes	0	TRUE	No	Yes	0.59	No	Yes	<0.001	0.059	0.053

[a] Qualitative bioavailability score: OR = Out of range due to high organic matter, 0 = very low; 1 = low; 2 = medium; 3 = high. Based on EPA 2005b Guidance for Developing Ecological Soil Screening Levels. OSWER Directive 9285.7-55. Office of Solid Waste and Emergency Response. https://www.epa.gov/sites/default/files/2015-09/documents/ecossl_guidance_chapters.pdf.

[b] Screening levels for aluminum and iron are based on pH rather than chemical concentration

Notes:

HQs, PAFs, and BTV comparisons for each sample are presented in Appendix F

> = greater than
≥ = greater than or equal to
< = less than
Ag = silver
Al = aluminum
As = arsenic
Ba = barium
BAB = bioavailability-adjusted benchmark
BTV = background threshold value
Co = cobalt
COPC = chemical of potential concern
Cr = chromium
Cu = copper
Fe = iron
HQ = hazard quotient
ID = identification
Mn = manganese
Mo = molybdenum
NA = not applicable
Ni = nickel
PAF = potentially affected fraction
SSL = soil screening level
Tl = thallium
UCR = Upper Columbia River
V = vanadium
Zn = zinc

Table 7-2. Hazard Quotients for Invertebrates for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, an

Study	Location ID	Summary COPCs with SSL HQ ≥ 1 (COPCs with BABs Not included)	Summary COPCs with BAB HQ ≥ 1	Summary COPCs with concentration > BTV	Cationic Metals																							
								Copper				Iron[b]			Manganese			Silver			Thallium			Zinc				
					>BTV	Detect	PAF (%)	BAB HQ	SSL HQ	>BTV	Detect	pH exceeds SSL	>BTV	Detect	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	PAF (%)	BAB HQ	SSL HQ	>BTV	Detect
2012 Ecology Upland Soil Study	SA1-1C	Ba,Mn	NA	Ba,Cr,Mn,Ag,Zn	No	Yes	0.14	0.26	0.31	No	Yes	TRUE	No	Yes	5.2	Yes	Yes	0.0034	Yes	No	0.010	No	Yes	0.074	0.41	1.4	Yes	Yes
2012 Ecology Upland Soil Study	SA1-2C	Ba,Mn	NA	Ba,Cr,Fe,Mn,Ag,Zn	No	Yes	0.051	0.19	0.23	No	Yes	TRUE	Yes	Yes	5.2	Yes	Yes	0.0034	Yes	No	0.0067	No	Yes	0.33	0.54	1.9	Yes	Yes
2012 Ecology Upland Soil Study	SA1-3C	Ba,Mn	NA	Ba,Cr,Ag,Zn	No	Yes	0.090	0.23	0.27	No	Yes	TRUE	No	Yes	2.3	No	Yes	0.0034	Yes	No	0.0067	No	No	0.017	0.32	1.1	Yes	Yes
2012 Ecology Upland Soil Study	SA1-4C	Ba,Mn	NA	Ba,Ag,Zn	No	Yes	0.026	0.16	0.19	No	Yes	TRUE	No	Yes	2.0	No	Yes	0.0034	Yes	No	0.0067	No	No	0.031	0.35	1.2	Yes	Yes
2012 Ecology Upland Soil Study	SA1-5C	Mn	NA	Ag,Zn	No	Yes	0.065	0.21	0.24	No	Yes	TRUE	No	Yes	2.6	No	Yes	0.0034	Yes	No	0.0067	No	No	0.012	0.30	1.1	Yes	Yes
2012 Ecology Upland Soil Study	SA1-6C	Mn	NA	Mn,Ag,Zn	No	Yes	0.038	0.18	0.21	No	Yes	TRUE	No	Yes	3.7	Yes	Yes	0.0034	Yes	No	0.0067	No	No	0.017	0.32	1.1	Yes	Yes
2012 Ecology Upland Soil Study	SA1-7C	Mn	NA	Ag,Zn	No	Yes	0.032	0.17	0.20	No	Yes	TRUE	No	Yes	2.5	No	Yes	0.0034	Yes	No	0.0067	No	No	0.035	0.36	1.2	Yes	Yes
2012 Ecology Upland Soil Study	SA1-8C	Ba,Mn	NA	Ba,Mn,Ag,Zn	No	Yes	0.022	0.15	0.18	No	Yes	TRUE	No	Yes	3.0	Yes	Yes	0.0034	Yes	No	0.0067	No	No	0.035	0.36	1.2	Yes	Yes
2012 Ecology Upland Soil Study	SA10-1C	Ba,Mn	NA	Ba,Cr,Ag,Zn	No	Yes	0.38	0.35	0.49	No	Yes	TRUE	No	Yes	2.4	No	Yes	0.0034	Yes	No	0.013	No	Yes	1.0	0.68	3.1	Yes	Yes
2012 Ecology Upland Soil Study	SA10-2C	Ba,Mn	Zn	As,Ba,Co,Cu,Fe,Mn,Ag,Tl,Zn	Yes	Yes	1.3	0.56	0.79	Yes	Yes	TRUE	Yes	Yes	12	Yes	Yes	0.010	Yes	Yes	0.040	Yes	Yes	39	2.5	11	Yes	Yes
2012 Ecology Upland Soil Study	SA10-3C	Ba,Mn	Zn	As,Ba,Cu,Mn,Ag,Zn	No	Yes	0.46	0.37	0.52	Yes	Yes	TRUE	No	Yes	6.4	Yes	Yes	0.0069	Yes	Yes	0.013	No	Yes	15	1.5	6.9	Yes	Yes
2012 Ecology Upland Soil Study	SA10-4C	NA	NA	Ag,Zn	No	Yes	0.19	0.28	0.38	No	Yes	TRUE	No	Yes	0.097	No	Yes	0.0052	Yes	Yes	0.0067	No	No	0.016	0.30	1.4	Yes	Yes
2012 Ecology Upland Soil Study	SA10-5C	Mn	NA	Cr,Ag,Zn	No	Yes	0.056	0.18	0.26	No	Yes	TRUE	No	Yes	1.8	No	Yes	0.0034	Yes	Yes	0.010	No	Yes	0.16	0.46	2.1	Yes	Yes
2012 Ecology Upland Soil Study	SA10-6C	Ba,Mn	NA	Ba,Mn,Ag,Zn	No	Yes	0.12	0.24	0.33	No	Yes	TRUE	No	Yes	4.9	Yes	Yes	0.0034	Yes	Yes	0.010	No	Yes	0.23	0.49	2.2	Yes	Yes
2012 Ecology Upland Soil Study	SA10-7C	Ba,Mn	NA	As,Ba,Mn,Ag,Zn	No	Yes	0.38	0.35	0.48	No	Yes	TRUE	No	Yes	8.5	Yes	Yes	0.0052	Yes	Yes	0.013	No	Yes	3.8	0.96	4.3	Yes	Yes
2012 Ecology Upland Soil Study	SA10-8C	Ba,Mn	NA	Mn,Ag,Zn	No	Yes	0.13	0.24	0.34	No	Yes	TRUE	No	Yes	6.3	Yes	Yes	0.0052	Yes	Yes	0.017	No	Yes	1.4	0.74	3.3	Yes	Yes
2012 Ecology Upland Soil Study	SA11-1C	Mn	NA	Cr,Ag,Zn	No	Yes	0.34	0.36	0.40	No	Yes	TRUE	No	Yes	2.0	No	Yes	0.0034	Yes	Yes	0.0067	No	Yes	0.10	0.44	1.4	Yes	Yes
2012 Ecology Upland Soil Study	SA11-2C	Ba,Mn	NA	Ba,Ag,Zn	No	Yes	0.062	0.21	0.23	No	Yes	TRUE	No	Yes	2.7	No	Yes	0.0034	Yes	No	0.0067	No	Yes	0.23	0.51	1.6	Yes	Yes
2012 Ecology Upland Soil Study	SA11-3C	Mn	NA	Ag,Zn	No	Yes	0.12	0.25	0.28	No	Yes	TRUE	No	Yes	1.1	No	Yes	0.0034	Yes	No	0.0067	No	Yes	0.18	0.48	1.6	Yes	Yes
2012 Ecology Upland Soil Study	SA11-4C	Ba,Mn	Zn	Ba,Mn,Ag,Tl,Zn	No	Yes	0.16	0.28	0.31	No	Yes	TRUE	No	Yes	3.0	Yes	Yes	0.0052	Yes	Yes	0.020	Yes	Yes	23	1.8	5.8	Yes	Yes
2012 Ecology Upland Soil Study	SA11-5C	Al,Ba,Mn	Zn	Ba,Mn,Ag,Zn	No	Yes	0.14	0.27	0.30	No	Yes	TRUE	No	Yes	3.6	Yes	Yes	0.0069	Yes	Yes	0.017	No	Yes	5.3	1.1	3.4	Yes	Yes
2012 Ecology Upland Soil Study	SA11-6C	Mn	NA	Cr,Ag,Zn	No	Yes	0.36	0.36	0.41	No	Yes	TRUE	No	Yes	1.5	No	Yes	0.0052	Yes	Yes	0.017	No	Yes	1.9	0.80	2.6	Yes	Yes
2012 Ecology Upland Soil Study	SA11-7C	Al,Ba,Mn	Zn	As,Ba,Cu,Mn,Ag,Tl,Zn	No	Yes	1.3	0.58	0.65	Yes	Yes	TRUE	No	Yes	3.2	Yes	Yes	0.034	Yes	Yes	0.033	Yes	Yes	54	3.0	9.6	Yes	Yes
2012 Ecology Upland Soil Study	SA11-8C	Al,Ba,Mn	Zn	As,Ba,Cr,Cu,Mn,Ag,Tl,Zn	No	Yes	0.74	0.47	0.52	Yes	Yes	TRUE	No	Yes	3.5	Yes	Yes	0.010	Yes	Yes	0.020	Yes	Yes	20	1.7	5.5	Yes	Yes
2012 Ecology Upland Soil Study	SA11-9C	Ba,Mn	Zn	As,Ba,Cr,Cu,Mn,Ag,Tl,Zn	No	Yes	0.82	0.48	0.54	Yes	Yes	TRUE	No	Yes	6.3	Yes	Yes	0.0086	Yes	Yes	0.023	Yes	Yes	27	1.9	6.2	Yes	Yes
2012 Ecology Upland Soil Study	SA12-1C	Mn	Zn	As,Cr,Cu,Fe,Mn,Ag,Zn	No	Yes	1.2	0.56	0.66	Yes	Yes	TRUE	Yes	Yes	3.6	Yes	Yes	0.021	Yes	Yes	0.013	No	Yes	4.8	1.0	3.6	Yes	Yes
2012 Ecology Upland Soil Study	SA12-2C	Al,Mn	NA	Mn,Ag,Zn	No	Yes	0.053	0.20	0.23	No	Yes	TRUE	No	Yes	3.3	Yes	Yes	0.0034	Yes	No	0.010	No	Yes	0.28	0.52	1.8	Yes	Yes
2012 Ecology Upland Soil Study	SA12-3C	Mn	NA	Ag,Zn	No	Yes	0.083	0.22	0.26	No	Yes	TRUE	No	Yes	1.5	No	Yes	0.0052	Yes	Yes	0.0067	No	Yes	0.16	0.47	1.6	Yes	Yes
2012 Ecology Upland Soil Study	SA12-4C	Ba,Mn	NA	Ba,Ag,Zn	No	Yes	0.024	0.16	0.18	No	Yes	TRUE	No	Yes	2.1	No	Yes	0.0034	Yes	No	0.0067	No	Yes	0.54	0.60	2.1	Yes	Yes
2012 Ecology Upland Soil Study	SA12-6C	Ba,Mn	NA	Cu,Mn,Ag,Zn	No	Yes	0.71	0.46	0.54	Yes	Yes	TRUE	No	Yes	2.8	Yes	Yes	0.0034	Yes	No	0.0067	No	Yes	0.56	0.60	2.1	Yes	Yes
2012 Ecology Upland Soil Study	SA12-7C	Ba,Mn	Zn	Ba,Mn,Ag,Zn	No	Yes	0.16	0.28	0.32	No	Yes	TRUE	No	Yes	5.3	Yes	Yes	0.0052	Yes	Yes	0.010	No	Yes	5.3	1.1	3.7	Yes	Yes
2012 Ecology Upland Soil Study	SA12-8C	Ba,Mn	NA	Mn,Ag,Zn	No	Yes	0.027	0.16	0.19	No	Yes	TRUE	No	Yes	3.0	Yes	Yes	0.0034	Yes	No	0.0067	No	Yes	0.44	0.57	2.0	Yes	Yes
2012 Ecology Upland Soil Study	SA12-9C	Ba,Mn	NA	Ba,Mn,Ag,Zn	No	Yes	0.068	0.21	0.25	No	Yes	TRUE	No	Yes	6.1	Yes	Yes	0.0034	Yes	Yes	0.0067	No	No	0.058	0.39	1.4	Yes	Yes
2012 Ecology Upland Soil Study	SA13-1C	Mn	NA	Ag,Zn	No	Yes	0.11	0.22	0.32	No	Yes	TRUE	No	Yes	1.9	No	Yes	0.0034	Yes	No	0.0067	No	Yes	0.017	0.31	1.4	Yes	Yes
2012 Ecology Upland Soil Study	SA13-2C	Mn	NA	Mn,Ag,Zn	No	Yes	0.36	0.34	0.49	No	Yes	TRUE	No	Yes	2.8	Yes	Yes	0.0052	Yes	Yes	0.0067	No	Yes	0.37	0.54	2.5	Yes	Yes
2012 Ecology Upland Soil Study	SA13-3C	Ba,Mn	NA	Mn,Ag,Zn	No	Yes	0.033	0.16	0.22	No	Yes	TRUE	No	Yes	3.3	Yes	Yes	0.0052	Yes	Yes	0.010	No	Yes	0.25	0.50	2.3	Yes	Yes
2012 Ecology Upland Soil Study	SA13-4C	NA	NA	Ag,Zn	No	Yes	0.061	0.19	0.27	No	Yes	TRUE	No	Yes	0.70	No	Yes	0.0052	Yes	Yes	0.0067	No	No	0.011	0.28	1.3	Yes	Yes
2012 Ecology Upland Soil Study	SA13-5C	Ba,Mn	Zn	Ba,Cr,Cu,Mn,Ag,Zn	No	Yes	0.50	0.38	0.55	Yes	Yes	TRUE	No	Yes	3.3	Yes	Yes	0.0069	Yes	Yes	0.017	No	Yes	7.3	1.2	5.5	Yes	Yes
2012 Ecology Upland Soil Study	SA13-6C	Mn	NA	Mn,Ag,Zn	No	Yes	0.027	0.15	0.21	No	Yes	TRUE	No	Yes	5.0	Yes	Yes	0.0052	Yes	Yes	0.013	No	Yes	0.21	0.48	2.3	Yes	Yes
2012 Ecology Upland Soil Study	SA13-7C	Mn	NA	Ag,Zn	No	Yes	0.038	0.16	0.23	No	Yes	TRUE	No	Yes	1.9	No	Yes	0.0052	Yes	Yes	0.010	No	Yes	0.065	0.39	1.8	Yes	Yes
2012 Ecology Upland Soil Study	SA13-8C	Al,Mn	NA	Ag,Zn	No	Yes	0.025	0.14	0.20	No	Yes	TRUE	No	Yes	2.6	No	Yes	0.0034	Yes	No	0.0067	No	Yes	0.027	0.33	1.6	Yes	Yes
2012 Ecology Upland Soil Study	SA2-1C	Ba,Mn	Zn	Ba,Mn,Ag,Zn	No	Yes	0.17	0.31	0.26	No	Yes	TRUE	No	Yes	5.6	Yes	Yes	0.0034	Yes	No	0.010	No	Yes	32	2.1	4.1	Yes	Yes
2012 Ecology Upland Soil Study	SA2-2C	Ba,Mn	Zn	Cr,Ag,Zn	No	Yes	0.10	0.27	0.22	No	Yes	TRUE	No	Yes	2.4	No	Yes	0.0034	Yes	No	0.0067	No	No	5.6	1.1	2.1	Yes	Yes
2012 Ecology Upland Soil Study	SA2-3C	Mn	NA	Ag,Zn	No	Yes	0.024	0.18	0.15	No	Yes	TRUE	No	Yes	1.8	No	Yes	0.0034	Yes	No	0.0067	No	No	0.3	0.55	1.1	Yes	Yes
2012 Ecology Upland Soil Study	SA2-4C	Al,Mn	Zn	Mn,Ag,Zn	No	Yes	0.069	0.24	0.20	No	Yes	TRUE	No	Yes	2.8	Yes	Yes	0.0034	Yes	No	0.010	No	Yes	5.4	1.1	2.1	Yes	Yes
2012 Ecology Upland Soil Study	SA2-5C	NA	NA	Ag	No	Yes	0.15	0.30	0.24	No	Yes	TRUE	No	Yes	0.89	No	Yes	0.0034	Yes	No	0.0067	No	No	0.091	0.44	0.88	No	Yes
2012 Ecology Upland Soil Study	SA2-6C	Mn	Zn	Cr,Ag,Zn	No	Yes	0.62	0.46	0.38	No	Yes	TRUE	No	Yes	1.6	No	Yes	0.0034	Yes	Yes	0.017	No	Yes	36	2.2	4.3	Yes	Yes
2012 Ecology Upland Soil Study	SA2-7C	Mn	NA	Cr,Ag,Zn	No	Yes	0.88	0.52	0.43	No	Yes	TRUE	No	Yes	2.5	No	Yes	0.0034	Yes	No	0.0067	No	Yes	1.7	0.79	1.6	Yes	Yes
2012 Ecology Upland Soil Study	SA2-8C	Ba,Mn	NA	Cr,Ag,Zn	No	Yes	0.10	0.27	0.22	No	Yes	TRUE	No	Yes	2.6	No	Yes	0.0034	Yes	Yes	0.0067	No	No	2.7	0.88	1.8	Yes	Yes
2012 Ecology Upland Soil Study	SA3-1C	Mn	NA	Ag	No	Yes	0.048	0.19	0.22	No	Yes	TRUE	No	Yes	1.9	No	Yes	0.0034	Yes	No	0.0067	No	No	0.00089	0.21	0.69	No	Yes
2012 Ecology Upland Soil Study	SA3-2C	Ba,Mn	NA	Ba,Mn,Ag,Zn	No	Yes	0.0054	0.11	0.12	No	Yes	TRUE	No	Yes	2.9	Yes	Yes	0.0034	Yes	No	0.0067	No	No	0.035	0.36	1.2	Yes	Yes
2012 Ecology Upland Soil Study	SA3-3C	Ba,Cr,Mn	NA	Ba,Cr,Mn,Ag,Zn	No	Yes	0.099	0.24	0.27	No	Yes	TRUE	No	Yes	3.2	Yes	Yes	0.0034	Yes	No	0.0067	No	Yes	0.99	0.69	2.3	Yes	Yes
2012 Ecology Upland Soil Study	SA3-4C	Mn	NA	Ag,Zn	No	Yes	0.0066	0.11	0.13	No	Yes	TRUE	No	Yes	2.2	No	Yes	0.0034	Yes	No	0.0067	No	No	0.018	0.32	1.1	Yes	Yes
2012 Ecology Upland Soil Study	SA3-5C	Mn	NA	Ag,Zn	No	Yes	0.026	0.16	0.18	No	Yes	TRUE	No	Yes	1.4	No	Yes	0.0034	Yes	No	0.0067	No	No	0.036	0.36	1.2	Yes	Yes
2012 Ecology Upland Soil Study	SA3-6C	Ba,Cr,Mn	Zn	Ba,Cr,Co,Cu,Fe,Mn,Ag,Tl,Zn	Yes	Yes	0.98	0.52	0.59	Yes	Yes	TRUE	Yes	Yes	5.4	Yes	Yes	0.0052	Yes	Yes	0.020	Yes	Yes	19	1.7	5.5	Yes	Yes
2012 Ecology Upland Soil Study	SA3-7C	Mn	NA	Ag,Zn	No	Yes	0.24	0.31	0.36	No	Yes	TRUE	No	Yes	2.4	No	Yes	0.0034	Yes	Yes	0.010	No	Yes	4.2	0.99	3.2	Yes	Yes
2012 Ecology Upland Soil Study	SA3-8C	Mn	NA	Ag,Zn	No	Yes	0.020	0.15	0.17	No	Yes	TRUE	No	Yes	2.0	No	Yes	0.0034	Yes	No	0.0067	No	Yes	0.49	0.59	1.9	Yes	Yes
2012 Ecology Upland Soil Study	SA4-1C	Mn	NA	Cr,Ag,Zn	No	Yes	0.16	0.28	0.32	No	Yes	TRUE	No	Yes	1.9	No	Yes	0.0034	Yes	Yes	0.010	No	Yes	1.1	0.71	2.3	Yes	Yes
2012 Ecology Upland Soil Study	SA4-2C	Mn	NA	Ag,Zn	No	Yes	0.10	0.24	0.28	No	Yes	TRUE	No	Yes	1.3	No	Yes	0.0034	Yes	No	0.0067	No	Yes	0.16	0.47	1.6	Yes	Yes
2012 Ecology Upland Soil Study	SA4-3C	Al,Fe,Mn	NA	Cr,Ag,Zn	No	Yes	0.47	0.40	0.45	No	Yes	FALSE	No	Yes	1.5	No	Yes	0.0034	Yes	Yes	0.013	No	Yes	3.4	0.94	3.1	Yes	Yes
2012 Ecology Upland Soil Study	SA4-4C	Al,Mn	NA	Cr,Ag,Zn	No	Yes	0.20	0.30	0.34	No	Yes	TRUE	No	Yes	1.8	No	Yes	0.0034	Yes	No	0.010	No	Yes	2.0	0.81	2.7	Yes	Yes
2012 Ecology Upland Soil Study	SA4-5C	Mn	NA	Ag,Zn	No	Yes	0.13	0.26	0.29	No	Yes	TRUE	No	Yes	1.9	No	Yes	0.0034	Yes	No	0.0067	No	Yes	0.18	0.49	1.6	Yes	Yes
2012 Ecology Upland Soil Study	SA4-6C	Mn	Zn	Cr,Ag,Zn	No	Yes	0.16	0.28	0.32	No	Yes	TRUE	No	Yes	2.3	No	Yes	0.0069	Yes	Yes	0.013	No	Yes	5.8	1.1	3.6	Yes	Yes
2012 Ecology Upland Soil Study	SA4-7C	Ba,Mn	NA	Cr,Ag,Zn	No	Yes	0.18	0.28	0.32	No	Yes	TRUE	No	Yes	2.6	No	Yes	0.0052	Yes	Yes	0.010	No	Yes	0.96	0.68	2.2	Yes	Yes
2012 Ecology Upland Soil Study	SA4-8C	Mn	NA	Ag,Zn	No	Yes	0.049	0.19	0.22	No	Yes	TRUE	No	Yes	1.4	No	Yes	0.0034	Yes	No	0.0067	No	No	0.16	0.47	1.6	Yes	Yes
2012 Ecology Upland Soil Study	SA5-1C	Mn	Zn	Ag,Zn	No	Yes	0.72	0.48	0.44	No	Yes	TRUE	No	Yes	1.9	No	Yes	0.0052	Yes	Yes	0.0067	No	Yes	6.5	1.1	2.7	Yes	Yes
2012 Ecology Upland Soil Study	SA5-2C	Ba,Cr,Mn	NA	Ba,Cr,Fe,Ag,V,Zn	No	Yes	0.19	0.31	0.28	No	Yes	TRUE	Yes	Yes	2.1	No	Yes	0.0034	Yes	No	0.017	No	Yes	2.0	0.82	1.9	Yes	Yes
2012 Ecology Upland Soil Study	SA5-3C	Mn	Zn	Ag,Zn	No	Yes	0.49	0.42	0.39	No	Yes	TRUE	No	Yes	2.4	No	Yes	0.0052	Yes	Yes	0.013	No	Yes	24	1.8	4.2	Yes	Yes
2012 Ecology Upland Soil Study	SA5-4C	Mn	Zn	Ag,Zn	No	Yes	0.13	0.28	0.26	No	Yes	TRUE	No	Yes	1.2	No	Yes	0.0052	Yes	Yes	0.010	No	Yes	9.5	1.3	3.0	Yes	Yes
2012 Ecology Upland Soil Study	SA5-5C	NA	NA	Ag,Zn	No	Yes	0.18	0.30	0.28	No	Yes	TRUE	No	Yes	0.97	No	Yes	0.0034	Yes	Yes	0.0067	No	Yes	0.37	0.57	1.3	Yes	Yes

Table 7-2. Hazard Quotients for Invertebrates for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, an

Study	Location ID	Summary COPCs with SSL HQ ≥ 1 (COPCs with BABs Not included)	Summary COPCs with BAB HQ ≥ 1	Summary COPCs with concentration > BTV	Cationic Metals																							
								Copper				Iron[b]			Manganese			Silver			Thallium			Zinc				
					>BTV	Detect	PAF (%)	BAB HQ	SSL HQ	>BTV	Detect	pH exceeds SSL	>BTV	Detect	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	PAF (%)	BAB HQ	SSL HQ	>BTV	Detect
2012 Ecology Upland Soil Study	SA5-7C	NA	Zn	Ag,Zn	No	Yes	0.16	0.29	0.27	No	Yes	TRUE	No	Yes	0.95	No	Yes	0.0069	Yes	Yes	0.013	No	Yes	19	1.6	3.8	Yes	Yes
2012 Ecology Upland Soil Study	SA5-8C	Mn	NA	As,Cr,Ag,Zn	No	Yes	0.70	0.48	0.44	No	Yes	TRUE	No	Yes	1.2	No	Yes	0.0069	Yes	Yes	0.013	No	Yes	1.8	0.8	1.9	Yes	Yes
2012 Ecology Upland Soil Study	SA6-1C	Ba,Mn	Zn	Mn,Ag,Zn	No	Yes	0.12	0.29	0.23	No	Yes	TRUE	No	Yes	4.5	Yes	Yes	0.0052	Yes	Yes	0.010	No	Yes	33	2.1	3.8	Yes	Yes
2012 Ecology Upland Soil Study	SA6-2C	Mn	Zn	Ag,Zn	No	Yes	0.55	0.45	0.35	No	Yes	TRUE	No	Yes	2.5	No	Yes	0.0052	Yes	Yes	0.013	No	Yes	30	2.0	3.7	Yes	Yes
2012 Ecology Upland Soil Study	SA6-3C	Al,Ba,Mn	Zn	As,Cr,Mn,Ag,Zn	No	Yes	0.94	0.54	0.42	No	Yes	TRUE	No	Yes	2.8	Yes	Yes	0.0069	Yes	Yes	0.013	No	Yes	34	2.1	3.9	Yes	Yes
2012 Ecology Upland Soil Study	SA6-4C	NA	NA	Ag	No	Yes	0.0036	0.12	0.094	No	Yes	TRUE	No	Yes	0.36	No	Yes	0.0034	Yes	No	0.0067	No	No	0.042	0.39	0.72	No	Yes
2012 Ecology Upland Soil Study	SA6-5C	NA	NA	Ag	No	Yes	0.0018	0.10	0.08	No	Yes	TRUE	No	Yes	0.40	No	Yes	0.0034	Yes	No	0.0067	No	No	0.01	0.31	0.58	No	Yes
2012 Ecology Upland Soil Study	SA6-6C	Al,Mn	Zn	Ag,Zn	No	Yes	0.18	0.32	0.25	No	Yes	TRUE	No	Yes	1.5	No	Yes	0.0052	Yes	Yes	0.013	No	Yes	20	1.7	3.1	Yes	Yes
2012 Ecology Upland Soil Study	SA6-7C	Al,Mn	Zn	As,Cr,Mn,Ag,Zn	No	Yes	0.88	0.53	0.41	No	Yes	TRUE	No	Yes	3.1	Yes	Yes	0.0052	Yes	Yes	0.013	No	Yes	43	2.4	4.5	Yes	Yes
2012 Ecology Upland Soil Study	SA6-8C	Mn	NA	Ag,Zn	No	Yes	0.022	0.18	0.14	No	Yes	TRUE	No	Yes	1.0	No	Yes	0.0034	Yes	No	0.0067	No	No	0.38	0.57	1.1	Yes	Yes
2012 Ecology Upland Soil Study	SA7-1C	Mn	Zn	Ag,Zn	No	Yes	0.18	0.33	0.24	No	Yes	TRUE	No	Yes	2.3	No	Yes	0.0034	Yes	Yes	0.010	No	Yes	23	1.7	2.8	Yes	Yes
2012 Ecology Upland Soil Study	SA7-2C	NA	Zn	Ag,Zn	No	Yes	0.18	0.32	0.23	No	Yes	TRUE	No	Yes	0.8	No	Yes	0.0052	Yes	Yes	0.013	No	Yes	33	2.1	3.3	Yes	Yes
2012 Ecology Upland Soil Study	SA7-3C	Al	Zn	As,Ag,Zn	No	Yes	0.83	0.52	0.38	No	Yes	TRUE	No	Yes	0.81	No	Yes	0.0086	Yes	Yes	0.017	No	Yes	15	1.5	2.4	Yes	Yes
2012 Ecology Upland Soil Study	SA7-4C	Al	NA	Ag,Zn	No	Yes	0.042	0.22	0.16	No	Yes	TRUE	No	Yes	0.56	No	Yes	0.0034	Yes	Yes	0.0067	No	Yes	3.9	0.97	1.6	Yes	Yes
2012 Ecology Upland Soil Study	SA7-5C	Al,Mn	Zn	As,Cu,Ag,Tl,Zn	No	Yes	2.3	0.76	0.54	Yes	Yes	TRUE	No	Yes	1.2	No	Yes	0.016	Yes	Yes	0.020	Yes	Yes	46	2.5	4.1	Yes	Yes
2012 Ecology Upland Soil Study	SA7-6C	Mn	Zn	Ag,Zn	No	Yes	0.31	0.38	0.28	No	Yes	TRUE	No	Yes	1.2	No	Yes	0.0069	Yes	Yes	0.017	No	Yes	65	3.3	5.4	Yes	Yes
2012 Ecology Upland Soil Study	SA7-7C	Al,Mn	Zn	As,Ag,Tl,Zn	No	Yes	1.5	0.65	0.47	No	Yes	TRUE	No	Yes	2.1	No	Yes	0.017	Yes	Yes	0.027	Yes	Yes	91	5.8	9.4	Yes	Yes
2012 Ecology Upland Soil Study	SA7-8C	Ba,Cr,Mn	Cu,Zn	As,Ba,Cr,Co,Cu,Fe,Ag,Tl,V,Zn	Yes	Yes	5.4	1.1	0.78	Yes	Yes	TRUE	Yes	Yes	2.3	No	Yes	0.016	Yes	Yes	0.030	Yes	Yes	75	4.0	6.4	Yes	Yes
2012 Ecology Upland Soil Study	SA8-1C	Mn	Zn	Ag,Zn	No	Yes	0.19	0.32	0.26	No	Yes	TRUE	No	Yes	1.6	No	Yes	0.0052	Yes	Yes	0.013	No	Yes	43	2.4	4.7	Yes	Yes
2012 Ecology Upland Soil Study	SA8-2C	Al,Mn	Zn	As,Ag,Zn	No	Yes	0.34	0.38	0.31	No	Yes	TRUE	No	Yes	1.2	No	Yes	0.0069	Yes	Yes	0.010	No	Yes	14	1.4	2.8	Yes	Yes
2012 Ecology Upland Soil Study	SA8-3C	NA	NA	Ag,Zn	No	Yes	0.11	0.28	0.22	No	Yes	TRUE	No	Yes	0.84	No	Yes	0.0034	Yes	No	0.0067	No	No	0.69	0.65	1.2	Yes	Yes
2012 Ecology Upland Soil Study	SA8-4C	Mn	Zn	Ag,Zn	No	Yes	0.06	0.23	0.19	No	Yes	TRUE	No	Yes	1.3	No	Yes	0.0034	Yes	No	0.010	No	Yes	10	1.3	2.5	Yes	Yes
2012 Ecology Upland Soil Study	SA8-5C	Al,Mn	Zn	Ag,Zn	No	Yes	0.57	0.45	0.36	No	Yes	TRUE	No	Yes	1.4	No	Yes	0.010	Yes	Yes	0.017	No	Yes	24	1.8	3.4	Yes	Yes
2012 Ecology Upland Soil Study	SA8-6C	Mn	Zn	Ag,Zn	No	Yes	0.13	0.29	0.23	No	Yes	TRUE	No	Yes	1.9	No	Yes	0.0052	Yes	Yes	0.010	No	Yes	19	1.6	3.1	Yes	Yes
2012 Ecology Upland Soil Study	SA8-7C	Mn	Zn	As,Ag,Tl,Zn	No	Yes	1.5	0.64	0.51	No	Yes	TRUE	No	Yes	1.8	No	Yes	0.010	Yes	Yes	0.030	Yes	Yes	71	3.7	7.2	Yes	Yes
2012 Ecology Upland Soil Study	SA8-8C	Ba,Mn	Zn	As,Ba,Cu,Ag,Tl,Zn	No	Yes	2.5	0.77	0.62	Yes	Yes	TRUE	No	Yes	2.0	No	Yes	0.021	Yes	Yes	0.033	Yes	Yes	88	5.2	10	Yes	Yes
2012 Ecology Upland Soil Study	SA9-10C	Mn	Zn	As,Cr,Ag,Zn	No	Yes	0.16	0.28	0.31	No	Yes	TRUE	No	Yes	1.5	No	Yes	0.0052	Yes	Yes	0.013	No	Yes	6.8	1.1	3.7	Yes	Yes
2012 Ecology Upland Soil Study	SA9-1C	Ba,Mn	Zn	As,Ba,Cr,Mn,Ag,Tl,Zn	No	Yes	0.36	0.36	0.40	No	Yes	TRUE	No	Yes	3.8	Yes	Yes	0.0086	Yes	Yes	0.027	Yes	Yes	29	2.0	6.5	Yes	Yes
2012 Ecology Upland Soil Study	SA9-2C	Ba,Cr,Mn	NA	Ba,Cr,Co,Cu,Fe,Ag,Tl,V,Zn	Yes	Yes	1.2	0.56	0.63	Yes	Yes	TRUE	Yes	Yes	1.9	No	Yes	0.0086	Yes	Yes	0.027	Yes	Yes	3.4	0.93	3.0	Yes	Yes
2012 Ecology Upland Soil Study	SA9-3C	Ba,Cr,Mn	NA	Ba,Cr,Fe,Mn,Ag,V,Zn	No	Yes	0.57	0.42	0.48	No	Yes	TRUE	Yes	Yes	2.8	Yes	Yes	0.0052	Yes	Yes	0.017	No	Yes	1.3	0.73	2.3	Yes	Yes
2012 Ecology Upland Soil Study	SA9-4C	NA	Zn	Ag,Zn	No	Yes	0.18	0.29	0.32	No	Yes	TRUE	No	Yes	0.74	No	Yes	0.010	Yes	Yes	0.013	No	Yes	9.5	1.3	4.1	Yes	Yes
2012 Ecology Upland Soil Study	SA9-5C	Ba,Mn	Zn	As,Ba,Mn,Ag,Zn	No	Yes	0.30	0.34	0.38	No	Yes	TRUE	No	Yes	3.8	Yes	Yes	0.010	Yes	Yes	0.017	No	Yes	25	1.9	6.0	Yes	Yes
2012 Ecology Upland Soil Study	SA9-6C	Ba,Mn	Zn	Cr,Ag,Tl,Zn	No	Yes	0.24	0.32	0.35	No	Yes	TRUE	No	Yes	2.6	No	Yes	0.0086	Yes	Yes	0.020	Yes	Yes	13	1.4	4.6	Yes	Yes
2012 Ecology Upland Soil Study	SA9-7C	Ba,Mn	Zn	As,Cr,Mn,Ag,Tl,Zn	No	Yes	0.31	0.34	0.39	No	Yes	TRUE	No	Yes	2.8	Yes	Yes	0.0069	Yes	Yes	0.020	Yes	Yes	15	1.5	4.8	Yes	Yes
2012 Ecology Upland Soil Study	SA9-8C	Ba,Mn	Zn	As,Ba,Cr,Mn,Ag,Tl,Zn	No	Yes	0.58	0.43	0.48	No	Yes	TRUE	No	Yes	4.5	Yes	Yes	0.0086	Yes	Yes	0.030	Yes	Yes	35	2.2	7.1	Yes	Yes
2012 Ecology Upland Soil Study	SA9-9C	Ba,Mn	Zn	As,Cr,Mn,Ag,Zn	No	Yes	0.38	0.37	0.41	No	Yes	TRUE	No	Yes	3.0	Yes	Yes	0.0052	Yes	Yes	0.010	No	Yes	6.3	1.1	3.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-001	Mn	NA	Ag,Zn	No	Yes	0.13	0.27	0.28	No	Yes	TRUE	No	Yes	1.4	No	Yes	0.0043	Yes	Yes	0.012	No	Yes	2.7	0.88	2.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-002	Mn	Zn	Mo,Ag,V,Zn	No	Yes	0.56	0.44	0.39	No	Yes	TRUE	No	Yes	1.1	No	Yes	0.0058	Yes	Yes	0.0085	No	Yes	5.8	1.1	2.4	Yes	Yes
2014 UCR Upland Soil Study	ADA-004	Ba,Mn	Zn	Ba,Mo,Ag,Zn	No	Yes	0.19	0.32	0.28	No	Yes	TRUE	No	Yes	1.8	No	Yes	0.0056	Yes	Yes	0.0088	No	Yes	11	1.3	2.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-005	Mn	NA	Mo,Ag,V,Zn	No	Yes	0.62	0.45	0.44	No	Yes	TRUE	No	Yes	1.3	No	Yes	0.0069	Yes	Yes	0.011	No	Yes	3.0	0.90	2.4	Yes	Yes
2014 UCR Upland Soil Study	ADA-006	NA	NA	Ag,Zn	No	Yes	0.062	0.24	0.19	No	Yes	TRUE	No	Yes	0.99	No	Yes	0.0026	Yes	Yes	0.0077	No	Yes	2.4	0.86	1.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-008	Mn	NA	Cr,Ag,Zn	No	Yes	0.092	0.24	0.26	No	Yes	TRUE	No	Yes	1.7	No	Yes	0.0055	Yes	Yes	0.012	No	Yes	3.1	0.91	2.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-010	Mn	NA	As,Mn,Ag,Zn	No	Yes	0.25	0.31	0.40	No	Yes	TRUE	No	Yes	3.1	Yes	Yes	0.0075	Yes	Yes	0.014	No	Yes	2.3	0.84	3.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-015	Mn	NA	Ag,Zn	No	Yes	0.013	0.15	0.14	No	Yes	TRUE	No	Yes	1.2	No	Yes	0.0016	Yes	Yes	0.0064	No	Yes	0.20	0.50	1.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-016	NA	NA	Ag,Zn	No	Yes	0.0093	0.16	0.12	No	Yes	TRUE	No	Yes	0.88	No	Yes	0.0016	Yes	Yes	0.0055	No	Yes	0.46	0.60	1.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-017	Mn	Zn	Ag,Zn	No	Yes	0.13	0.28	0.24	No	Yes	TRUE	No	Yes	1.4	No	Yes	0.0037	Yes	Yes	0.010	No	Yes	4.6	1.0	2.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-018	Mn	NA	Ag,Zn	No	Yes	0.20	0.28	0.37	No	Yes	TRUE	No	Yes	2.2	No	Yes	0.0061	Yes	Yes	0.017	No	Yes	3.6	0.94	3.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-019	Mn	NA	Cr,Ag,Zn	No	Yes	0.12	0.26	0.28	No	Yes	TRUE	No	Yes	1.2	No	Yes	0.0028	Yes	Yes	0.0051	No	Yes	0.070	0.41	1.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-020	Mn	NA	Ag,Zn	No	Yes	0.12	0.29	0.21	No	Yes	TRUE	No	Yes	1.0	No	Yes	0.0020	Yes	Yes	0.0059	No	Yes	0.97	0.70	1.1	Yes	Yes
2014 UCR Upland Soil Study	ADA-021	Mn	NA	Cu,Mo,Ag,Zn	No	Yes	0.99	0.51	0.62	Yes	Yes	TRUE	No	Yes	1.5	No	Yes	0.0037	Yes	Yes	0.0041	No	Yes	0.038	0.36	1.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-023	NA	NA	Cr,Mo,Ag,V,Zn	No	Yes	0.50	0.43	0.41	No	Yes	TRUE	No	Yes	0.9	No	Yes	0.0091	Yes	Yes	0.01	No	Yes	4.1	0.98	2.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-024	Mn	Zn	As,Cu,Ag,Zn	No	Yes	0.76	0.47	0.54	Yes	Yes	TRUE	No	Yes	1.8	No	Yes	0.0093	Yes	Yes	0.014	No	Yes	7.5	1.2	3.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-025	Ba,Mn	Zn	Ba,Mn,Mo,Ag,Zn	No	Yes	0.17	0.29	0.30	No	Yes	TRUE	No	Yes	3.3	Yes	Yes	0.0081	Yes	Yes	0.010	No	Yes	14	1.5	4.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-026	Ba,Mn	NA	Ba,Mo,Ag,Zn	No	Yes	0.12	0.24	0.32	No	Yes	TRUE	No	Yes	1.6	No	Yes	0.0076	Yes	Yes	0.0075	No	Yes	2.7	0.87	3.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-028	Mn	NA	Ag,Zn	No	Yes	0.13	0.27	0.27	No	Yes	TRUE	No	Yes	2.0	No	Yes	0.0040	Yes	Yes	0.0089	No	Yes	1.6	0.78	2.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-033	Ba,Mn	Zn	Ba,Mo,Ag,Zn	No	Yes	0.064	0.23	0.20	No	Yes	TRUE	No	Yes	2.6	No	Yes	0.0048	Yes	Yes	0.011	No	Yes	25	1.8	4.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-034	Mn	NA	Mo,Ag,Zn	No	Yes	0.056	0.22	0.20	No	Yes	TRUE	No	Yes	2.1	No	Yes	0.0019	Yes	Yes	0.0081	No	Yes	2.2	0.84	1.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-035	Mn	Zn	Mn,Ag,Zn	No	Yes	0.0088	0.12	0.14	No	Yes	TRUE	No	Yes	2.8	Yes	Yes	0.0027	Yes	Yes	0.0094	No	Yes	5.7	1.1	3.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-039	Ba,Mn	Zn	Ba,Mo,Ag,Zn	No	Yes	0.041	0.21	0.16	No	Yes	TRUE	No	Yes	2.4	No	Yes	0.0057	Yes	Yes	0.0070	No	Yes	10	1.3	2.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-042	Ba,Mn	NA	Ba,Mo,Ag,Zn	No	Yes	0.050	0.22	0.18	No	Yes	TRUE	No	Yes	2.0	No	Yes	0.0030	Yes	Yes	0.0063	No	Yes	1.2	0.72	1.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-043	Ba,Mn	NA	Ba,Mo,Ag,Zn	No	Yes	0.46	0.37	0.51	No	Yes	TRUE	No	Yes	2.1	No	Yes	0.0051	Yes	Yes	0.0073	No	Yes	0.42	0.56	2.4	Yes	Yes
2014 UCR Upland Soil Study	ADA-044	Ba,Mn	Zn	Ba,Cr,Mo,Ag,V,Zn	No	Yes	0.19	0.28	0.35	No	Yes	TRUE	No	Yes	2.1	No	Yes	0.0096	Yes	Yes	0.012	No	Yes	5.8	1.1	4.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-045	Mn	NA	As,Ag,Zn	No	Yes	0.17	0.27	0.34	No	Yes	TRUE	No	Yes	2.5	No	Yes	0.0058	Yes	Yes	0.018	No	Yes	3.3	0.92	3.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-046	Mn	NA	Ag,Zn	No	Yes	0.082	0.24	0.23	No	Yes	TRUE	No	Yes	1.4	No	Yes	0.0034	Yes	Yes	0.0086	No	Yes	1.4	0.75	1.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-047	Mn	Zn	Cr,Ag,Zn	No	Yes	0.21	0.31	0.32	No	Yes	TRUE	No	Yes	1.9	No	Yes	0.0072	Yes	Yes	0.014	No	Yes	12	1.4	4.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-048	Ba,Mn	NA	Ba,Mo,Ag,Zn	No	Yes	0.11	0.22	0.34	No	Yes	TRUE	No	Yes	2.3	No	Yes	0.0052	Yes	Yes	0.0066	No	Yes	0.19	0.47	2.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-049	Ba,Mn	Zn	Ba,Mn,Mo,Ag,Zn	No	Yes	0.17	0.30	0.27	No	Yes	TRUE	No	Yes	3.3	Yes	Yes	0.014	Yes	Yes	0.0072	No	Yes	5.9	1.1	2.4	Yes	Yes
2014 UCR Upland Soil Study	ADA-050	Mn	Zn	Cr,Cu,Ag,V,Zn	No	Yes	0.72	0.45	0.58	Yes	Yes	TRUE	No	Yes	1.3	No	Yes	0.013	Yes	Yes	0.018	No	Yes	6.9	1.2	4.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-051	Ba,Mn	Zn	Ba,Cu,Mo,Ag,Zn	No	Yes	1.3	0.59	0.61	Yes	Yes	TRUE	No	Yes	1.7	No	Yes	0.0070	Yes	Yes	0.0070	No	Yes	8.4	1.2	3.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-052	Ba,Mn	NA	Cr,Ag,Zn	No	Yes	0.14	0.25	0.32	No	Yes	TRUE	No	Yes	1.9	No	Yes	0.0069	Yes	Yes	0.015	No	Yes	4.0	0.97	3.8	Yes	Yes

Table 7-2. Hazard Quotients for Invertebrates for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, an

					Cationic Metals																							
								Copper				Iron[b]			Manganese			Silver			Thallium			Zinc				
Study	Location ID	Summary COPCs with SSL HQ ≥ 1 (COPCs with BABs Not included)	Summary COPCs with BAB HQ ≥ 1	Summary COPCs with concentration > BTV	>BTV	Detect	PAF (%)	BAB HQ	SSL HQ	>BTV	Detect	pH exceeds SSL	>BTV	Detect	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	PAF (%)	BAB HQ	SSL HQ	>BTV	Detect
2014 UCR Upland Soil Study	ADA-053	Ba,Mn	NA	Ba,Cr,Mn,Ag,Zn	No	Yes	0.040	0.17	0.23	No	Yes	TRUE	No	Yes	4.3	Yes	Yes	0.0028	Yes	Yes	0.0079	No	Yes	0.048	0.37	1.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-054	Mn	NA	As,Ag,Zn	No	Yes	0.22	0.29	0.40	No	Yes	TRUE	No	Yes	1.5	No	Yes	0.0067	Yes	Yes	0.013	No	Yes	2.9	0.89	3.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-055	Ba,Mn	Zn	As,Ba,Cu,Mn,Mo,Ag,Zn	No	Yes	0.74	0.47	0.53	Yes	Yes	TRUE	No	Yes	3.7	Yes	Yes	0.0096	Yes	Yes	0.013	No	Yes	16	1.5	4.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-056	Ba,Mn	NA	Ba,Cr,Mn,Ag,Zn	No	Yes	0.055	0.21	0.22	No	Yes	TRUE	No	Yes	4.6	Yes	Yes	0.0028	Yes	Yes	0.0073	No	Yes	0.31	0.54	1.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-057	Mn	NA	Cr,Ag,V,Zn	No	Yes	0.24	0.32	0.33	No	Yes	TRUE	No	Yes	2.0	No	Yes	0.0030	Yes	Yes	0.0085	No	Yes	0.30	0.54	1.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-058	Ba,Mn	NA	Ba,Mn,Mo,Ag,Zn	No	Yes	0.025	0.16	0.18	No	Yes	TRUE	No	Yes	4.3	Yes	Yes	0.0027	Yes	Yes	0.0051	No	Yes	0.28	0.53	1.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-059	Ba,Mn	NA	Ba,Cr,Mn,Mo,Ag,Zn	No	Yes	0.13	0.26	0.29	No	Yes	TRUE	No	Yes	4.2	Yes	Yes	0.0032	Yes	Yes	0.0085	No	Yes	0.67	0.63	2.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-060	Mn	NA	Cr,Ag,Zn	No	Yes	0.34	0.36	0.40	No	Yes	TRUE	No	Yes	1.7	No	Yes	0.0067	Yes	Yes	0.014	No	Yes	4.0	0.97	3.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-061	Ba,Cr,Mn	NA	Ba,Cr,Mn,Ag,Zn	No	Yes	0.053	0.19	0.24	No	Yes	TRUE	No	Yes	5.2	Yes	Yes	0.0021	Yes	Yes	0.0095	No	Yes	0.12	0.44	1.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-062	Mn	NA	Ag,Zn	No	Yes	0.059	0.20	0.25	No	Yes	TRUE	No	Yes	1.6	No	Yes	0.0040	Yes	Yes	0.010	No	Yes	0.89	0.67	2.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-063	Ba,Mn	NA	Ba,Mn,Mo,Ag,Zn	No	Yes	0.048	0.20	0.22	No	Yes	TRUE	No	Yes	3.5	Yes	Yes	0.0060	Yes	Yes	0.0080	No	Yes	1.6	0.77	2.4	Yes	Yes
2014 UCR Upland Soil Study	ADA-064	Al,Ba,Mn	NA	Ba,Cr,Mn,Ag,Zn	No	Yes	0.086	0.23	0.25	No	Yes	TRUE	No	Yes	5.0	Yes	Yes	0.0026	Yes	Yes	0.0081	No	Yes	0.68	0.63	1.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-065	Mn	NA	Ag,Zn	No	Yes	0.042	0.22	0.16	No	Yes	TRUE	No	Yes	1.0	No	Yes	0.0025	Yes	Yes	0.0066	No	Yes	1.5	0.77	1.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-066	Mn	NA	Ag,Zn	No	Yes	0.083	0.24	0.23	No	Yes	TRUE	No	Yes	1.6	No	Yes	0.0033	Yes	Yes	0.0081	No	Yes	1.8	0.80	2.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-067	Ba,Mn	NA	Ba,Cr,Cu,Mn,Mo,Ag,Zn	No	Yes	1.4	0.61	0.57	Yes	Yes	TRUE	No	Yes	3.0	Yes	Yes	0.0060	Yes	Yes	0.0076	No	Yes	3.4	0.94	2.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-070	Ba,Mn	NA	Cr,Ag,Zn	No	Yes	0.099	0.23	0.28	No	Yes	TRUE	No	Yes	2.2	No	Yes	0.0058	Yes	Yes	0.012	No	Yes	1.7	0.78	2.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-071	Mn	NA	Ag,Zn	No	Yes	0.072	0.23	0.22	No	Yes	TRUE	No	Yes	2.1	No	Yes	0.0040	Yes	Yes	0.011	No	Yes	2.3	0.84	2.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-073	Al,Mn	NA	Ag,Zn	No	Yes	0.066	0.22	0.23	No	Yes	TRUE	No	Yes	1.9	No	Yes	0.0044	Yes	Yes	0.0096	No	Yes	1.1	0.71	2.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-076	Al,Ba,Mn	Zn	As,Ba,Mo,Ag,Zn	No	Yes	0.075	0.21	0.26	No	Yes	TRUE	No	Yes	2.3	No	Yes	0.010	Yes	Yes	0.013	No	Yes	6.9	1.1	4.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-078	Ba,Mn	NA	Ba,Cr,Ag,Zn	No	Yes	0.058	0.22	0.20	No	Yes	TRUE	No	Yes	2.7	No	Yes	0.0043	Yes	Yes	0.010	No	Yes	4.3	0.99	2.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-079	Al,Ba,Mn	NA	Ba,Mo,Ag,Zn	No	Yes	0.037	0.16	0.24	No	Yes	TRUE	No	Yes	2.3	No	Yes	0.017	Yes	Yes	0.0075	No	Yes	1.4	0.74	3.7	Yes	Yes
2014 UCR Upland Soil Study	ADA-081	Mn	NA	Cr,Ag,Zn	No	Yes	0.070	0.23	0.22	No	Yes	TRUE	No	Yes	1.8	No	Yes	0.0029	Yes	Yes	0.0071	No	Yes	0.28	0.54	1.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-082	Mn	NA	Cr,Ag,Zn	No	Yes	0.12	0.24	0.30	No	Yes	TRUE	No	Yes	1.5	No	Yes	0.0033	Yes	Yes	0.0073	No	Yes	0.089	0.42	1.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-084	Mn	NA	Mn,Ag,Zn	No	Yes	0.048	0.17	0.25	No	Yes	TRUE	No	Yes	3.5	Yes	Yes	0.0054	Yes	Yes	0.0089	No	Yes	0.22	0.49	2.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-085	Mn	Zn	Ag,Zn	No	Yes	0.023	0.13	0.21	No	Yes	TRUE	No	Yes	2.4	No	Yes	0.0050	Yes	Yes	0.0095	No	Yes	16	1.6	8.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-088	Ba,Mn	NA	Cr,Mn,Ag,Zn	No	Yes	0.14	0.26	0.32	No	Yes	TRUE	No	Yes	2.9	Yes	Yes	0.0047	Yes	Yes	0.0091	No	Yes	0.78	0.65	2.4	Yes	Yes
2014 UCR Upland Soil Study	ADA-089	Ba,Mn	NA	As,Ba,Cr,Mn,Ag,Zn	No	Yes	0.15	0.27	0.31	No	Yes	TRUE	No	Yes	3.4	Yes	Yes	0.0042	Yes	Yes	0.0099	No	Yes	2.0	0.81	2.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-090	Ba,Mn	NA	Ba,Cr,Mn,Ag,Zn	No	Yes	0.055	0.19	0.24	No	Yes	TRUE	No	Yes	2.9	Yes	Yes	0.0042	Yes	Yes	0.0098	No	Yes	0.82	0.65	2.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-091	Mn	NA	Cr,Ag,Zn	No	Yes	0.12	0.25	0.28	No	Yes	TRUE	No	Yes	2.3	No	Yes	0.0050	Yes	Yes	0.012	No	Yes	3.7	0.95	3.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-092	Ba,Mn	NA	As,Ba,Cr,Mn,Mo,Ag,Zn	No	Yes	0.087	0.21	0.30	No	Yes	TRUE	No	Yes	3.4	Yes	Yes	0.0063	Yes	Yes	0.012	No	Yes	1.6	0.76	3.4	Yes	Yes
2014 UCR Upland Soil Study	ADA-093	Ba,Mn	NA	Ba,Mn,Ag,Zn	No	Yes	0.030	0.17	0.19	No	Yes	TRUE	No	Yes	4.3	Yes	Yes	0.0041	Yes	Yes	0.0095	No	Yes	0.85	0.66	2.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-094	Ba,Mn	NA	Ag,Zn	No	Yes	0.052	0.21	0.20	No	Yes	TRUE	No	Yes	2.0	No	Yes	0.0027	Yes	Yes	0.0059	No	Yes	0.16	0.48	1.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-095	Ba,Mn	NA	Cr,Ag,Zn	No	Yes	0.034	0.16	0.23	No	Yes	TRUE	No	Yes	2.8	No	Yes	0.0039	Yes	Yes	0.0077	No	Yes	0.022	0.32	1.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-096	Ba,Mn	NA	Ba,Mn,Ag,Zn	No	Yes	0.043	0.18	0.23	No	Yes	TRUE	No	Yes	2.8	Yes	Yes	0.0045	Yes	Yes	0.0089	No	Yes	0.76	0.64	2.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-097	Ba,Mn	NA	Cr,Ag,Zn	No	Yes	0.13	0.23	0.36	No	Yes	TRUE	No	Yes	2.6	No	Yes	0.0084	Yes	Yes	0.012	No	Yes	1.2	0.71	3.7	Yes	Yes
2014 UCR Upland Soil Study	ADA-099	Ba,Mn	NA	Cr,Mn,Ag,Zn	No	Yes	0.088	0.22	0.28	No	Yes	TRUE	No	Yes	3.5	Yes	Yes	0.0041	Yes	Yes	0.011	No	Yes	1.1	0.69	2.7	Yes	Yes
2014 UCR Upland Soil Study	ADA-101	Mn	NA	Ag,Zn	No	Yes	0.055	0.18	0.26	No	Yes	TRUE	No	Yes	2.5	No	Yes	0.0049	Yes	Yes	0.0094	No	Yes	0.15	0.45	2.1	Yes	Yes
2014 UCR Upland Soil Study	ADA-102	Ba,Mn	NA	Ba,Ag,Zn	No	Yes	0.084	0.24	0.24	No	Yes	TRUE	No	Yes	2.2	No	Yes	0.0033	Yes	Yes	0.0078	No	Yes	0.68	0.64	1.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-103	Ba,Mn	NA	Ba,Cr,Mn,Ag,Zn	No	Yes	0.16	0.28	0.32	No	Yes	TRUE	No	Yes	4.8	Yes	Yes	0.0029	Yes	Yes	0.0067	No	Yes	0.62	0.62	2.1	Yes	Yes
2014 UCR Upland Soil Study	ADA-104	Ba,Mn	NA	Ba,Mo,Ag,Zn	No	Yes	0.021	0.15	0.18	No	Yes	TRUE	No	Yes	2.6	No	Yes	0.0084	Yes	Yes	0.0063	No	Yes	0.38	0.56	1.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-105	Ba,Mn	Zn	Ba,Ag,Zn	No	Yes	0.17	0.28	0.32	No	Yes	TRUE	No	Yes	2.4	No	Yes	0.0072	Yes	Yes	0.011	No	Yes	4.4	1.0	3.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-106	Al,Ba,Mn	NA	Ba,Mn,Mo,Ag,Zn	No	Yes	0.13	0.27	0.28	No	Yes	TRUE	No	Yes	3.5	Yes	Yes	0.0063	Yes	Yes	0.0063	No	Yes	0.72	0.64	2.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-107	Ba,Mn	NA	Ba,Cr,Mn,Mo,Ag,V,Zn	No	Yes	0.43	0.39	0.42	No	Yes	TRUE	No	Yes	4.9	Yes	Yes	0.0044	Yes	Yes	0.011	No	Yes	2.2	0.83	2.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-108	Mn	NA	Cr,Ag,Zn	No	Yes	0.11	0.24	0.29	No	Yes	TRUE	No	Yes	1.8	No	Yes	0.0036	Yes	Yes	0.0071	No	Yes	0.42	0.57	1.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-109	Mn	NA	Ag,Zn	No	Yes	0.056	0.19	0.26	No	Yes	TRUE	No	Yes	1.5	No	Yes	0.0073	Yes	Yes	0.010	No	Yes	1.5	0.75	3.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-110	Mn	NA	Ag,Zn	No	Yes	0.088	0.24	0.24	No	Yes	TRUE	No	Yes	1.1	No	Yes	0.0049	Yes	Yes	0.009	No	Yes	2.3	0.84	2.1	Yes	Yes
2014 UCR Upland Soil Study	ADA-111	Ba,Mn	NA	Cr,Ag,Zn	No	Yes	0.13	0.27	0.28	No	Yes	TRUE	No	Yes	2.4	No	Yes	0.0029	Yes	Yes	0.0076	No	Yes	0.39	0.57	1.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-112	Ba,Mn	NA	Ba,Mn,Ag,Zn	No	Yes	0.052	0.18	0.25	No	Yes	TRUE	No	Yes	3.4	Yes	Yes	0.0046	Yes	Yes	0.0067	No	Yes	0.053	0.38	1.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-113	Ba,Mn	NA	Ba,Cr,Mn,Ag,Zn	No	Yes	0.046	0.19	0.22	No	Yes	TRUE	No	Yes	3.3	Yes	Yes	0.0032	Yes	Yes	0.0068	No	Yes	0.070	0.40	1.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-114	Al,Ba,Fe,Mn	NA	Ba,Mn,Ag,Zn	No	Yes	0.037	0.18	0.21	No	Yes	FALSE	No	Yes	3.3	Yes	Yes	0.0038	Yes	Yes	0.0068	No	Yes	0.18	0.48	1.7	Yes	Yes
2014 UCR Upland Soil Study	ADA-115	Mn	NA	Ag,Zn	No	Yes	0.014	0.14	0.16	No	Yes	TRUE	No	Yes	2.6	No	Yes	0.0029	Yes	Yes	0.0063	No	Yes	0.16	0.47	1.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-116	Mn	NA	Ag,Zn	No	Yes	0.041	0.20	0.18	No	Yes	TRUE	No	Yes	2.5	No	Yes	0.0027	Yes	Yes	0.0069	No	Yes	0.66	0.64	1.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-117	Mn	NA	Mn,Ag,Zn	No	Yes	0.068	0.24	0.20	No	Yes	TRUE	No	Yes	2.8	Yes	Yes	0.0027	Yes	Yes	0.0083	No	Yes	3.0	0.90	1.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-118	Ba,Mn	NA	Ba,Cr,Mn,Ag,Zn	No	Yes	0.059	0.21	0.22	No	Yes	TRUE	No	Yes	3.2	Yes	Yes	0.0035	Yes	Yes	0.007	No	Yes	2.4	0.85	2.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-119	Mn	NA	Cr,Ag,Zn	No	Yes	0.066	0.21	0.25	No	Yes	TRUE	No	Yes	2.1	No	Yes	0.0031	Yes	Yes	0.0073	No	Yes	0.41	0.57	2.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-121	Ba,Mn	NA	Cr,Ag,Zn	No	Yes	0.16	0.27	0.32	No	Yes	TRUE	No	Yes	2.6	No	Yes	0.0050	Yes	Yes	0.011	No	Yes	2.6	0.87	3.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-122	Ba,Mn	NA	Ba,Mn,Ag,Zn	No	Yes	0.015	0.14	0.16	No	Yes	TRUE	No	Yes	3.6	Yes	Yes	0.0041	Yes	Yes	0.0059	No	Yes	0.29	0.53	1.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-124	Al,Fe,Mn	NA	Ag,Zn	No	Yes	0.030	0.20	0.15	No	Yes	FALSE	No	Yes	1.4	No	Yes	0.0026	Yes	Yes	0.0068	No	Yes	0.99	0.70	1.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-125	Mn	NA	Ag,Zn	No	Yes	0.031	0.21	0.15	No	Yes	TRUE	No	Yes	1.1	No	Yes	0.0021	Yes	Yes	0.006	No	Yes	0.61	0.63	1.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-126	Mn	Zn	Cu,Ag,Zn	No	Yes	2.0	0.70	0.65	Yes	Yes	TRUE	No	Yes	1.7	No	Yes	0.0084	Yes	Yes	0.011	No	Yes	6.3	1.1	2.7	Yes	Yes
2014 UCR Upland Soil Study	ADA-127	Ba,Mn	Zn	Ba,Ag,Zn	No	Yes	0.34	0.36	0.37	No	Yes	TRUE	No	Yes	1.7	No	Yes	0.0052	Yes	Yes	0.0079	No	Yes	6.1	1.1	3.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-128	NA	Zn	Ag,Zn	No	Yes	0.12	0.29	0.21	No	Yes	TRUE	No	Yes	0.67	No	Yes	0.0037	Yes	Yes	0.0073	No	Yes	6.4	1.1	1.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-131	Al,Ba,Mn	Zn	As,Ba,Ag,Zn	No	Yes	0.14	0.28	0.28	No	Yes	TRUE	No	Yes	2.2	No	Yes	0.0072	Yes	Yes	0.016	No	Yes	5.4	1.1	3.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-132	Al,Fe	NA	Ag,Zn	No	Yes	0.035	0.19	0.17	No	Yes	FALSE	No	Yes	0.75	No	Yes	0.0044	Yes	Yes	0.0085	No	Yes	1.1	0.71	1.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-133	Mn	NA	Ag,Zn	No	Yes	0.073	0.24	0.22	No	Yes	TRUE	No	Yes	1.6	No	Yes	0.0039	Yes	Yes	0.0092	No	Yes	3.8	0.96	2.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-135	NA	Zn	Ag,Zn	No	Yes	0.20	0.35	0.23	No	Yes	TRUE	No	Yes	0.78	No	Yes	0.0036	Yes	Yes	0.0059	No	Yes	13	1.4	1.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-136	Mn	Zn	Ag,Zn	No	Yes	0.059	0.23	0.20	No	Yes	TRUE	No	Yes	1.1	No	Yes	0.0042	Yes	Yes	0.0076	No	Yes	5.6	1.1	2.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-139	Mn	NA	Ag,Zn	No	Yes	0.084	0.24	0.24	No	Yes	TRUE	No	Yes	1.8	No	Yes	0.0045	Yes	Yes	0.0094	No	Yes	3.7	0.96	2.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-141	Mn	NA	Ag,Zn	No	Yes	0.022	0.17	0.15	No	Yes	TRUE	No	Yes	1.4	No	Yes	0.0028	Yes	Yes	0.0064	No	Yes	1.1	0.70	1.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-142	Mn	NA	Ag,Zn	No	Yes	0.025	0.18	0.15	No	Yes	TRUE	No	Yes	1.1	No	Yes	0.0037	Yes	Yes	0.0083	No	Yes	3.8	0.97	2.0	Yes	Yes

Table 7-2. Hazard Quotients for Invertebrates for Screening Level Benchmarks, Bioavailability-Adjusted Benchmarks, an

Study	Location ID	Summary COPCs with SSL HQ ≥ 1 (COPCs with BABs Not included)	Summary COPCs with BAB HQ ≥ 1	Summary COPCs with concentration > BTV	Cationic Metals																							
								Copper				Iron[b]			Manganese			Silver			Thallium			Zinc				
					>BTV	Detect	PAF (%)	BAB HQ	SSL HQ	>BTV	Detect	pH exceeds SSL	>BTV	Detect	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	SSL HQ	>BTV	Detect	PAF (%)	BAB HQ	SSL HQ	>BTV	Detect
2014 UCR Upland Soil Study	ADA-143	NA	NA	Ag,Zn	No	Yes	0.085	0.27	0.19	No	Yes	TRUE	No	Yes	0.73	No	Yes	0.0036	Yes	Yes	0.0063	No	Yes	2.9	0.90	1.4	Yes	Yes
2014 UCR Upland Soil Study	ADA-144	NA	NA	Ag,Zn	No	Yes	0.090	0.25	0.23	No	Yes	TRUE	No	Yes	0.73	No	Yes	0.0052	Yes	Yes	0.0086	No	Yes	2.2	0.84	1.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-145	Mn	NA	Ag,Zn	No	Yes	0.084	0.23	0.25	No	Yes	TRUE	No	Yes	1.8	No	Yes	0.0062	Yes	Yes	0.0092	No	Yes	3.0	0.90	2.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-146	Mn	Zn	Ag,Zn	No	Yes	0.099	0.26	0.23	No	Yes	TRUE	No	Yes	1.3	No	Yes	0.0042	Yes	Yes	0.011	No	Yes	9.2	1.2	2.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-147	NA	NA	Ag,Zn	No	Yes	0.071	0.24	0.21	No	Yes	TRUE	No	Yes	0.66	No	Yes	0.0058	Yes	Yes	0.0092	No	Yes	2.0	0.82	1.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-148	Al	Zn	Ag,Zn	No	Yes	0.22	0.35	0.24	No	Yes	TRUE	No	Yes	0.97	No	Yes	0.0046	Yes	Yes	0.011	No	Yes	10	1.3	1.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-150	NA	Zn	Ag,Zn	No	Yes	0.26	0.37	0.25	No	Yes	TRUE	No	Yes	0.71	No	Yes	0.0061	Yes	Yes	0.010	No	Yes	11	1.3	1.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-151	Al	Zn	Ag,Zn	No	Yes	0.14	0.31	0.21	No	Yes	TRUE	No	Yes	0.49	No	Yes	0.0066	Yes	Yes	0.011	No	Yes	12	1.3	2.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-152	Ba,Mn	Zn	As,Cr,Ag,Zn	No	Yes	0.16	0.28	0.29	No	Yes	TRUE	No	Yes	2.3	No	Yes	0.0052	Yes	Yes	0.013	No	Yes	9.6	1.3	3.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-153	Mn	NA	Ag,Zn	No	Yes	0.11	0.24	0.30	No	Yes	TRUE	No	Yes	1.5	No	Yes	0.0057	Yes	Yes	0.011	No	Yes	2.6	0.86	3.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-154	Mn	Zn	Cr,Ag,Zn	No	Yes	0.200	0.30	0.36	No	Yes	TRUE	No	Yes	1.9	No	Yes	0.0057	Yes	Yes	0.011	No	Yes	5.5	1.1	2.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-155	Al,Mn	NA	Ag,Zn	No	Yes	0.028	0.19	0.16	No	Yes	TRUE	No	Yes	1.5	No	Yes	0.0043	Yes	Yes	0.0087	No	Yes	3.8	0.96	2.1	Yes	Yes
2014 UCR Upland Soil Study	ADA-156	Mn	Zn	Ag,Zn	No	Yes	0.092	0.23	0.27	No	Yes	TRUE	No	Yes	2.2	No	Yes	0.0094	Yes	Yes	0.013	No	Yes	5.6	1.1	3.7	Yes	Yes
2014 UCR Upland Soil Study	ADA-158	Mn	Zn	As,Ag,Zn	No	Yes	0.40	0.39	0.36	No	Yes	TRUE	No	Yes	1.2	No	Yes	0.0097	Yes	Yes	0.016	No	Yes	23	1.8	4.1	Yes	Yes
2014 UCR Upland Soil Study	ADA-159	Mn	Zn	Cr,Ag,Zn	No	Yes	0.14	0.28	0.29	No	Yes	TRUE	No	Yes	2.0	No	Yes	0.0075	Yes	Yes	0.011	No	Yes	7.0	1.1	3.2	Yes	Yes
2014 UCR Upland Soil Study	ADA-160	NA	NA	Ag,Zn	No	Yes	0.030	0.20	0.16	No	Yes	TRUE	No	Yes	0.74	No	Yes	0.0040	Yes	Yes	0.0081	No	Yes	2.6	0.87	1.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-161	Al,Fe,Mn	Zn	Ag,Zn	No	Yes	0.12	0.27	0.25	No	Yes	FALSE	No	Yes	1.7	No	Yes	0.0061	Yes	Yes	0.012	No	Yes	10	1.3	3.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-162	NA	Zn	Ag,Zn	No	Yes	0.37	0.38	0.37	No	Yes	TRUE	No	Yes	0.96	No	Yes	0.014	Yes	Yes	0.017	No	Yes	21	1.7	4.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-164	Mn	Zn	Ag,Zn	No	Yes	0.11	0.25	0.28	No	Yes	TRUE	No	Yes	1.7	No	Yes	0.0081	Yes	Yes	0.013	No	Yes	5.9	1.1	3.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-165	Mn	Zn	Ag,Zn	No	Yes	0.32	0.36	0.34	No	Yes	TRUE	No	Yes	1.4	No	Yes	0.0093	Yes	Yes	0.016	No	Yes	29	2.0	4.7	Yes	Yes
2014 UCR Upland Soil Study	ADA-168	Mn	Zn	As,Ag,Zn	No	Yes	0.18	0.32	0.26	No	Yes	TRUE	No	Yes	1.4	No	Yes	0.0063	Yes	Yes	0.012	No	Yes	25	1.8	3.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-169	Mn	NA		No	Yes	0.0089	0.11	0.16	No	Yes	TRUE	No	Yes	2.1	No	Yes	0.0012	No	Yes	0.0045	No	Yes	0.0014	0.22	0.90	No	Yes
2014 UCR Upland Soil Study	ADA-170	Al,Mn	NA	Mo,Ag,Zn	No	Yes	0.019	0.14	0.18	No	Yes	TRUE	No	Yes	2.1	No	Yes	0.0052	Yes	Yes	0.0073	No	Yes	1.3	0.73	3.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-171	Mn	Zn	Mo,Ag,Zn	No	Yes	0.046	0.19	0.22	No	Yes	TRUE	No	Yes	1.8	No	Yes	0.010	Yes	Yes	0.0069	No	Yes	5.8	1.1	3.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-172	Al,Mn	NA	Ag	No	Yes	0.0016	0.062	0.10	No	Yes	TRUE	No	Yes	2.4	No	Yes	0.0022	Yes	Yes	0.0041	No	Yes	1.10E-05	0.10	0.60	No	Yes
2014 UCR Upland Soil Study	ADA-173	Al,Ba,Mn	NA	Mn,Mo,Ag,Zn	No	Yes	0.030	0.17	0.19	No	Yes	TRUE	No	Yes	2.9	Yes	Yes	0.0047	Yes	Yes	0.0075	No	Yes	0.26	0.52	1.6	Yes	Yes
2014 UCR Upland Soil Study	ADA-174	Al,Ba,Mn	NA	Ba,Mn,Mo,Ag,Zn	No	Yes	0.0054	0.10	0.13	No	Yes	TRUE	No	Yes	3.1	Yes	Yes	0.0086	Yes	Yes	0.0059	No	Yes	0.16	0.47	1.8	Yes	Yes
2014 UCR Upland Soil Study	ADA-175	Al,Mn	NA	Ag,Zn	No	Yes	0.022	0.16	0.16	No	Yes	TRUE	No	Yes	2.4	No	Yes	0.0016	Yes	Yes	0.0060	No	Yes	0.029	0.36	0.98	Yes	Yes
2014 UCR Upland Soil Study	ADA-176	Ba,Mn	NA	Cr,Ag	No	Yes	0.056	0.21	0.22	No	Yes	TRUE	No	Yes	1.9	No	Yes	0.0014	Yes	Yes	0.0083	No	Yes	0.012	0.31	0.91	No	Yes
2014 UCR Upland Soil Study	ADA-177	Al,Fe,Mn	NA	Ag	No	Yes	0.012	0.12	0.16	No	Yes	FALSE	No	Yes	2.5	No	Yes	0.0016	Yes	Yes	0.0047	No	Yes	0.00094	0.20	0.87	No	Yes
2014 UCR Upland Soil Study	ADA-178	Mn	NA	Ag,Zn	No	Yes	0.015	0.14	0.17	No	Yes	TRUE	No	Yes	1.9	No	Yes	0.0017	Yes	Yes	0.0042	No	Yes	0.035	0.36	1.3	Yes	Yes
2014 UCR Upland Soil Study	ADA-179	Mn	NA	Mo,Ag,Zn	No	Yes	0.011	0.13	0.15	No	Yes	TRUE	No	Yes	2.6	No	Yes	0.0048	Yes	Yes	0.006	No	Yes	0.52	0.60	1.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-180	Ba,Mn	NA	Ba,Mo,Ag,Zn	No	Yes	0.030	0.16	0.20	No	Yes	TRUE	No	Yes	2.0	No	Yes	0.0072	Yes	Yes	0.0067	No	Yes	1.7	0.77	3.1	Yes	Yes
2014 UCR Upland Soil Study	ADA-181	Ba,Mn	NA	Ba,Mo,Ag,Zn	No	Yes	0.033	0.16	0.22	No	Yes	TRUE	No	Yes	2.6	No	Yes	0.012	Yes	Yes	0.011	No	Yes	0.35	0.54	2.5	Yes	Yes
2014 UCR Upland Soil Study	ADA-182	Ba,Mn	NA	Mo,Ag,Zn	No	Yes	0.076	0.22	0.25	No	Yes	TRUE	No	Yes	1.3	No	Yes	0.0083	Yes	Yes	0.0050	No	Yes	0.73	0.64	2.0	Yes	Yes
2014 UCR Upland Soil Study	ADA-183	Ba,Mn	NA	Ba,Mo,Ag,V,Zn	No	Yes	0.19	0.27	0.40	No	Yes	TRUE	No	Yes	1.1	No	Yes	0.019	Yes	Yes	0.0058	No	Yes	3.8	0.96	4.9	Yes	Yes
2014 UCR Upland Soil Study	ADA-184	Ba,Mn	NA	Ba,Mo,Ag,Zn	No	Yes	0.076	0.21	0.28	No	Yes	TRUE	No	Yes	2.6	No	Yes	0.020	Yes	Yes	0.0049	No	Yes	1.1	0.70	2.9	Yes	Yes
2015 Bossburg Study	UDU-01-ICS	NA	NA	Ag	No	Yes	0.11	0.31	0.17	No	Yes	TRUE	No	Yes	0.72	No	Yes	0.0034	Yes	Yes	0.0045	No	Yes	2.0	0.83	0.87	No	Yes
2015 Bossburg Study	UDU-02-ICS	NA	NA	Ag,Zn	No	Yes	0.29	0.40	0.22	No	Yes	TRUE	No	Yes	0.72	No	Yes	0.0056	Yes	Yes	0.0043	No	Yes	3.4	0.94	1.0	Yes	Yes
2015 Bossburg Study	UDU-03-ICS	NA	Cu,Zn	Cu,Ag,Zn	No	Yes	10	1.4	0.69	Yes	Yes	TRUE	No	Yes	0.62	No	Yes	0.0037	Yes	Yes	0.0038	No	Yes	6.1	1.1	0.95	Yes	Yes
2015 Bossburg Study	UDU-04-ICS	Al	Zn	Ag,Zn	No	Yes	0.33	0.42	0.21	No	Yes	TRUE	No	Yes	0.74	No	Yes	0.031	Yes	Yes	0.0061	No	Yes	17	1.5	1.5	Yes	Yes
2015 Bossburg Study	UDU-05-ICS	NA	NA	Cr,Ag,Zn	No	Yes	0.22	0.33	0.29	No	Yes	TRUE	No	Yes	0.88	No	Yes	0.0022	Yes	Yes	0.0063	No	Yes	0.078	0.43	0.97	Yes	Yes
2015 Bossburg Study	UDU-06-ICS	NA	NA	Ag	No	Yes	0.092	0.23	0.26	No	Yes	TRUE	No	Yes	0.77	No	Yes	0.0023	Yes	Yes	0.0045	No	Yes	0.0048	0.27	0.85	No	Yes

[a] Qualitative bioavailability score: OR = Out of range due to high organic matter, 0 = very low; 1 = low; 2 = medium; 3 = high. Based on EPA 2005b Guidance for Developing Ecological Soil Screening Levels. OSWER Directive 9285.7-55. Office of Solid Waste and Emergency Response. https://www.epa.gov/sites/default/files/2015-09/documents/ecossl_guidance_chapters.pdf.

[b] Screening levels for aluminum and iron are based on pH rather than chemical concentration

Notes:

HQs, PAFs, and BTV comparisons for each sample are presented in Appendix F

> = greater than
≥ = greater than or equal to
< = less than
Ag = silver
Al = aluminum
As = arsenic
Ba = barium
BAB = bioavailability-adjusted benchmark
BTV = background threshold value
Co = cobalt
COPC = chemical of potential concern
Cr = chromium
Cu = copper
Fe = iron
HQ = hazard quotient
ID = identification
Mn = manganese
Mo = molybdenum
NA = not applicable
Ni = nickel
PAF = potentially affected fraction
SSL = soil screening level
Tl = thallium
UCR = Upper Columbia River
V = vanadium
Zn = zinc

Table 7-3. Summary of COPC Concentrations Compared to Invertebrate Benchmarks and Background Threshold Values for Each Study

Comparisons for metal concentration-based benchmarks					
COPC	**Study**	**Soil Benchmark[a]**	**Site < Benchmark**	**Site ≥ Benchmark & Site ≤ BTV**	**Site ≥ Benchmark & Site > BTV**
Arsenic	2012 Ecology Upland Soil Study	SSL	106 (100%)	NA	NA
Arsenic	2014 UCR Upland Soil Study	SSL	141 (100%)	NA	NA
Arsenic	2015 Bossburg Study	SSL	6 (100%)	NA	NA
Barium	2012 Ecology Upland Soil Study	SSL	62 (58%)	12 (11%)	32 (30%)
Barium	2014 UCR Upland Soil Study	SSL	82 (58%)	13 (9%)	46 (33%)
Barium	2015 Bossburg Study	SSL	6 (100%)	NA	NA
Chromium	2012 Ecology Upland Soil Study	SSL	100 (94%)	NA	6 (6%)
Chromium	2014 UCR Upland Soil Study	SSL	140 (99%)	NA	1 (1%)
Chromium	2015 Bossburg Study	SSL	6 (100%)	NA	NA
Cobalt	2012 Ecology Upland Soil Study	BAB	106 (100%)	NA	NA
Cobalt	2014 UCR Upland Soil Study	BAB	141 (100%)	NA	NA
Cobalt	2015 Bossburg Study	BAB	6 (100%)	NA	NA
Copper	2012 Ecology Upland Soil Study	BAB	105 (99%)	NA	1 (1%)
Copper	2014 UCR Upland Soil Study	BAB	141 (100%)	NA	NA
Copper	2015 Bossburg Study	BAB	5 (83%)	NA	1 (17%)
Manganese	2012 Ecology Upland Soil Study	SSL	12 (11%)	56 (53%)	38 (36%)
Manganese	2014 UCR Upland Soil Study	SSL	14 (10%)	95 (67%)	32 (23%)
Manganese	2015 Bossburg Study	SSL	6 (100%)	NA	NA
Molybdenum	2014 UCR Upland Soil Study	BAB	141 (100%)	NA	NA
Silver	2012 Ecology Upland Soil Study	SSL	106 (100%)	NA	NA
Silver	2014 UCR Upland Soil Study	SSL	141 (100%)	NA	NA
Silver	2015 Bossburg Study	SSL	6 (100%)	NA	NA
Thallium	2012 Ecology Upland Soil Study	SSL	106 (100%)	NA	NA
Thallium	2014 UCR Upland Soil Study	SSL	141 (100%)	NA	NA
Thallium	2015 Bossburg Study	SSL	6 (100%)	NA	NA
Vanadium	2012 Ecology Upland Soil Study	SSL	106 (100%)	NA	NA
Vanadium	2014 UCR Upland Soil Study	SSL	141 (100%)	NA	NA
Vanadium	2015 Bossburg Study	SSL	6 (100%)	NA	NA
Zinc	2012 Ecology Upland Soil Study	BAB	59 (56%)	NA	47 (44%)
Zinc	2014 UCR Upland Soil Study	BAB	103 (73%)	NA	38 (27%)
Zinc	2015 Bossburg Study	BAB	4 (67%)	NA	2 (33%)
Comparisons for pH-based benchmarks (Screening levels for aluminum and iron are based on pH rather than chemical concentration)					
COPC	**Study**	**Soil Benchmark[a]**	**pH > Benchmark**	**pH ≤ Benchmark & Site ≤ BTV**	
Aluminum	2012 Ecology Upland Soil Study	SSL	89 (84%)	17 (16%)	
Aluminum	2014 UCR Upland Soil Study	SSL	122 (87%)	19 (13%)	
Aluminum	2015 Bossburg Study	SSL	5 (83%)	1 (17%)	
Iron	2012 Ecology Upland Soil Study	SSL	105 (99%)	1 (1%)	
Iron	2014 UCR Upland Soil Study	SSL	136 (96%)	5 (4%)	
Iron	2015 Bossburg Study	SSL	6 (100%)	NA	

Notes:

[a] Comparisons are made to the BAB if applicable, or if a BAB is not applicable, the Eco-SSL or SSL.

HQs and BTV comparisons for each sample are presented in Table 7-2 and in Appendix F

\> = greater than

≥ = greater than or equal to

< = less than

≤ = less than or equal to

BAB = bioavailability-adjusted benchmark

BTV = background threshold value

COPC = chemical of potential concern

Eco-SSL = ecological soil screening level

NA = not applicable

SSL = soil screening level

UCR = Upper Columbia River

Table 7-4. Summary of Invertebrate LOE Uncertainties

Uncertainty		Overestimation or Underestimation of the Potential for Adverse Effects	Specific Areas of Applicability	Notes
Exposure Assessment				
	Detection limits	0	NA	See discussion in Section 6.3.1.1. All soil chemistry results for COPCs and COIs in the 2014 UCR Upland Soil Study are detected.
	Sample density	?	NA	Concentrations of COPCs in soil outside of the sample locations included in the Upland BERA data sets may be inferred based on results from nearby samples. These inferences may potentially overestimate or underestimate exposure and associated effects.
	Replicate samples	↓	NA	DU EPCs may under- or overestimate the true average COPC concentration due to variability and sampling error. The 2015 Bossburg, and 2014 UCR Upland Soil Studies included collection of one and three replicate ICS soil samples, respectively from a subset of DUs. Replicates were used to calculate 95%UCL on the mean COPC concentrations following EPA guidance. Uncertainty analyses shown in Table 7-5 indicate that use of the 95%UCL on the mean increases the number of DUs exceeding the benchmark for multiple COPCs.
Effects Assessment				
Soil Screening Level Benchmarks (Eco-SSLs and SSLs)	General uncertainties	? ↑	NA	Eco-SSLs/SSLs have not been assessed for their predictive ability (i.e., the benchmark's ability to correctly assign a COPC concentration as toxic or not toxic). Therefore, it is not possible to assess their false positive and false negative error rates. In addition, concentration-response information associated with the Eco-SSLs is not available. The soil toxicity tests relied on for Eco-SSL/SSL development are typically conducted in soils that favor higher bioavailability conditions, such as unaged or unleached soils. The soil toxicity studies that underly the Eco-SSLs/SSLs are typically conducted in soils that favor higher bioavailability conditions, and in unaged and/or unleached soils. When such soils are spiked with metal salts, toxicity estimates can be inflated by a factor of 2 to more than an order of magnitude relative to conditions in the field (Appendix D).
	Aluminum Eco-SSL uncertainties	?	NA	Aluminum toxicity to soil invertebrates was evaluated, as per Eco-SSL guidance, using soil pH in lieu of total metal concentrations, based on toxic effects of the soluble form in plants, not soil invertebrates. At a soil pH below 5.5, aluminum is significantly released from clays and minerals resulting in increased concentrations of soluble aluminum. However, the limited research has not demonstrated a relationship of toxicity to soil invertebrates (EPA, 2003c) for aluminum. Thus, there is high uncertainty in correlating adverse effects on plants associated with soil pH measurements to adverse effects on soil invertebrates. However, there are no DUs or sample locations with aluminum concentrations higher than the respective BTV and, thus, any adverse effects from these metals at the site are consistent with background level effects assuming the range of pH levels in regional (background) soils is comparable to that of the Terrestrial Study Area. If the low end of the pH range in regional soils is higher than that of the Terrestrial Study Area, then uncertainty with toxicity remains in those locations when soil pH is less than the benchmark of pH < 5.5 and less than regional background. The degree to which this may overestimate or underestimate the potential for adverse effects is unknown.
	Iron Eco-SSL uncertainties	?	NA	Similar to aluminum, iron toxicity to soil invertebrates was evaluated according to Eco-SSL guidance, using soil pH in lieu of a total iron concentration. For iron, solubility occurs at a soil pH below 5.0, but there is limited research showing a relationship of toxicity to soil invertebrates (EPA, 2003c) for this metal. Because there are no DUs or sample locations with iron concentrations higher than the respective BTV, adverse effects from iron at the site are consistent with background level effects assuming the range of pH levels in regional (background) soils is comparable to that of the Terrestrial Study Area. If the low end of the pH range in regional soils is higher than that of the Terrestrial Study Area, then uncertainty with toxicity remains in those locations when soil pH is less than the benchmark < 5.0 and less than regional background. The degree to which this may overestimate or underestimate the potential for adverse effects is unknown.
	Barium Eco-SSL uncertainties	↑	NA	Derived from tests conducted under high bioavailability conditions, which is applicable to less than 3% of DUs in the 2014 UCR Upland Soil Study (Table D4-1). The benchmark is the geomean of reproduction EC20s for three invertebrate species from three studies.
	Copper Eco-SSL uncertainties	↑	NA	Derived from tests conducted under high bioavailability conditions, which is applicable to less than 3% of DUs in the 2014 UCR Upland Soil Study (Table D4-1). The benchmark relies on a large data set with conservative effect levels, such as EC10 and MATC (geomean of NOAEC and LOAEC).

Table 7-4. Summary of Invertebrate LOE Uncertainties

Uncertainty		Overestimation or Underestimation of the Potential for Adverse Effects	Specific Areas of Applicability	Notes
	Chromium SSL uncertainties	↑	NA	The chromium SSL is based on medium bioavailability conditions, which are applicable to 15% of DUs in the 2014 UCR Upland Soil Study (Table D4-1). The benchmark relies on one oligochaete species from the same research laboratory and the MATC. New Zealand derived a somewhat higher soil quality benchmark protective of soil invertebrates as the 5th percentile of an SSD accounting for leaching and aging of soils (Cavanagh and Munir, 2019).
	Manganese Eco-SSL uncertainties	↑	NA	Derived from tests conducted under high bioavailability conditions, which is applicable to less than 3% of DUs in the 2014 UCR Upland Soil Study (Table D4-1). The benchmark relies on three studies and an EC20.
	Zinc Eco-SSL uncertainties	↑	NA	Derived from tests conducted under high bioavailability conditions, which is applicable to less than 3% of DUs in the 2014 UCR Upland Soil Study (Table D4-1). The benchmark relies on a large data set with conservative effect levels, such as EC10 and MATC (geomean of NOAEC and LOAEC).
Bioavailability-Adjusted Benchmarks	General uncertainties	?	NA	There is no field verification of the predictive ability of the benchmarks, in particular because benchmarks are not based on UCR species-specific data. The SSDs used to derive the benchmarks rely on a small number of common test species, or just one study, as is the case with molybdenum. Thus, there is uncertainty concerning the representativeness of the diversity of invertebrates at the site.
Risk Characterization				
HQ interpretation	Use of HQs	↑	NA	HQs do not give a quantitative prediction of the likelihood or severity of adverse effects, although they are expected to increase as the HQ increases. HQ<1 provide compelling evidence of negligible risk. When HQ is ≥1, additional consideration must be given to the dose-response data underlying the effects data.
Metal interactions and essentiality	Single-chemical HQs	?	NA	As discussed in Section 7.3.3.1, interaction of metal mixtures are complex with uncertain implications on estimates of toxicity. Depending on the type of toxicological interaction (e.g., additivity, antagonism, potentiation, or synergism) and the respective exposures for the metals, the single chemical HQ may under- or overestimate the potential for adverse effects.
	Essential nutrients	?	Chromium, cobalt, copper, manganese, molybdenum, and zinc	Some metals are essential nutrients; EPA identifies chromium, cobalt, copper, manganese, molybdenum, and zinc as essential for animals, and arsenic and vanadium as beneficial for animals (EPA, 2007a). The extent to which these metals are essential to the spectrum of soil invertebrates found within the Terrestrial Study Area is unclear.
Background analysis				
Background analysis	BTV data set	↑	NA	As discussed in Section 2.4.1.2, BTVs are in the same range, but not lower, than other available BTVs.

Sources:
Cavanaugh, J.E., and K Munir. *Updated Development of Soil Guideline Values for the Protection of Ecological Receptors (Eco-SGVs): Technical Document* . Manaaki Whenua – Landcare Research. Prepared for: Regional Waste and Contaminated Land Forum, Land Monitoring Forum and Land Managers Group. June.
U.S. Environmental Protection Agency (EPA). 2003c. *Ecological Soil Screening Level for Iron* . Interim Final. OSWER Directive 9285.7-69. Office of Solid Waste and Emergency Response. https://www.epa.gov/sites/production/files/2015 09/documents/eco ssl_iron.pdf.
U.S. Environmental Protection Agency (EPA). 2007a. *Framework for Metals Risk Assessment* . EPA 120/R 07/001. Office of the Science Advisor Washington, Risk Assessment Forum.

Notes:
↑ = likely to overestimate the potential for adverse effects
↓ = likely to underestimate the potential for adverse effects
? = uncertain and may either overestimate or underestimate the potential for adverse effects
0 = not expected to be a major source of uncertainty
≥ = greater than or equal to
< = less than
95 UCL = 95 percent upper confidence limit of the mean
BERA = baseline ecological risk assessment
BTV = background threshold value
COI = chemical of interest
COPC = chemical of potential concern
DU = decision unit
EC10 = concentration that causes a 10 percent effect
EC20 = concentration that causes a 20 percent effect
EPA = U.S. Environmental Protection Agency
EPC = exposure point concentration
Eco-SSL = ecological soil screening level
HQ = hazard quotient
ICS = incremental composite sample
LOAEC = lowest observed adverse effect concentration
LOE = line of evidence
MATC = maximum acceptable toxicant concentration
NA = not applicable
NOAEC = no observed adverse effect concentration
SSD = species sensitivity distribution
SSL = soil screening level
UCR = Upper Columbia River

Table 7-5. Analysis of Uncertainty in Invertebrate EPCs for Incremental Composite Samples - Comparison of Mean with 95 UCL of Mean

		2015 Bossburg Study				2014 UCR Upland Soils Study			
COPC [a]	UCL95/mean for all triplicate samples [b]	Count HQ≥1 (Mean/Benchmark)	Count HQ≥1 (UCL95/Benchmark) [c]	Count HQ≥5 (Mean/Benchmark)	Count HQ≥5 (UCL95/Benchmark) [c]	Count HQ≥1 (Mean/Benchmark)	Count HQ≥1 (UCL95/Benchmark) [c]	Count HQ≥5 (Mean/Benchmark)	Count HQ≥5 (UCL95/Benchmark) [c]
Aluminum	1.09	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Arsenic	1.16	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Barium	1.13	0 (0%)	0 (0%)	0 (0%)	0 (0%)	59 (42%)	72 (51%)	0 (0%)	0 (0%)
Chromium	1.15	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	1 (1%)	0 (0%)	0 (0%)
Cobalt	1.12	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Copper	1.15	1 (17%)	1 (17%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Iron	1.09	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Manganese	1.13	0 (0%)	1 (17%)	0 (0%)	0 (0%)	127 (90%)	130 (92%)	2 (1%)	5 (4%)
Molybdenum	1.18	NA	NA	NA	NA	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Silver	1.23	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Thallium	1.14	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vanadium	1.10	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Zinc	1.16	2 (33%)	3 (50%)	0 (0%)	0 (0%)	38 (27%)	58 (41%)	0 (0%)	0 (0%)

Notes:

[a] Benchmark basis is Eco-SSL or SSL for those COPCs shown in plain text, and BAB for those shown in italics.

[b] Calculated over all triplicate samples from the 2014 UCR Upland Soil Study (n=16) and the 2015 Bossburg Soil Study (n=1) (Appendix F)

[c] Count includes HQs from all DUs using either 95 UCL (for triplicate locations) or concentration multiplied by 1.15 (for non-triplicate locations) as the EPC.

≥ = greater than or equal to

95 UCL = 95 percent upper confidence limit on the mean

BAB = bioavailability-adjusted benchmark

COPC = chemical of potential concern

DU = decision unit

Eco-SSL = ecological soil screening level

EPC = exposure point concentration

HQ = hazard quotient

NA = not applicable

SSL = soil screening level

UCR = Upper Columbia River

Table 7-6. Analysis of Uncertainty in Invertebrate BABs Using the Lower Confidence Limit on the BAB.

COPC	Soil Study	BAB (range) mg/kg	BAB LCL (range) mg/kg	BAB UCL (range) mg/kg	Count HQ≥1 (EPC/BAB)	Count HQ≥1 (EPC/BAB LCL)
Cobalt	2012 Ecology Upland Soil Study	76.0 - 150	8.10 - 8.80	150 - 380	0 (0%)	***44 (42%)***
Cobalt	2014 UCR Upland Soil Study	17.0 - 150	5.80 - 53.0	30.0 - 290	0 (0%)	***2 (1%)***
Cobalt	2015 Bossburg Study	8.00 - 57.0	2.50 - 20.0	14.0 - 96.0	0 (0%)	***4 (67%)***
Copper	2012 Ecology Upland Soil Study	58.0 - 110	24.0 - 40.0	100 - 220	1 (1%)	***30 (28%)***
Copper	2014 UCR Upland Soil Study	54.0 - 130	22.0 - 44.0	93.0 - 260	0 (0%)	***13 (9%)***
Copper	2015 Bossburg Study	39.0 - 89.0	17.0 - 33.0	64.0 - 160	1 (17%)	***1 (17%)***
Molybdenum	2014 UCR Upland Soil Study	13.0 - 120	0 - 0.100	63.0 - 530	0 (0%)	***43 (30%)***
Zinc	2012 Ecology Upland Soil Study	190 - 560	91.0 - 240	290 - 880	47 (44%)	***85 (80%)***
Zinc	2014 UCR Upland Soil Study	150 - 690	72.0 - 290	230 - 1100	38 (27%)	***127 (90%)***
Zinc	2015 Bossburg Study	100 - 380	49.0 - 170	160 - 590	2 (33%)	***4 (67%)***

Notes:

Bold italic results indicate an increase in HQ count relative to HQ count using median BAB.

≥ = greater than or equal to

BAB = bioavailability-adjusted benchmark; fifth percentile (HC5) of the species sensitivity distribution of plant EC20s

COPC = chemical of potential concern

EPC = exposure point concentration

HQ = hazard quotient

LCL = lower confidence limit

mg/kg = milligram(s) per kilogram

UCL = upper confidence limit

UCR = Upper Columbia River

Table 8-1. Summary of Dietary HQs for Birds for all Data Sets

			California quail [a]			American robin [a]			Tree swallow [a]			American kestrel [a]			Black-capped chickadee [a]		
COPC	Soil Study	Number of Sample Locations	Survival	Growth	Reproduction	Survival	Growth	Reproduction	Survival	Growth	Reproduction	Survival	Growth	Reproduction	Survival	Growth	Reproduction
Aluminum	2012 Ecology Upland Soil Study	106	0 (0%)	0 (0%)	NA	0 (0%)	15 (14%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	2 (2%)	NA	0 (0%)	2 (2%)	NA
Aluminum	2014 UCR Upland Soil Study	141	0 (0%)	0 (0%)	NA	0 (0%)	2 (1%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA
Aluminum	2015 Bossburg Study	6	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA
Barium	2012 Ecology Upland Soil Study	106	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA
Barium	2014 UCR Upland Soil Study	141	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA
Barium	2015 Bossburg Study	6	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA
Cadmium	2012 Ecology Upland Soil Study	106	0 (0%)	0 (0%)	0 (0%)	1 (1%)	60 (57%)	54 (51%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3 (3%)	1 (1%)
Cadmium	2014 UCR Upland Soil Study	141	0 (0%)	0 (0%)	0 (0%)	0 (0%)	80 (57%)	65 (46%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Cadmium	2015 Bossburg Study	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Chromium	2012 Ecology Upland Soil Study	106	NA	0 (0%)	NA	NA	0 (0%)	NA	NA	0 (0%)	NA	NA	0 (0%)	NA	NA	0 (0%)	NA
Chromium	2014 UCR Upland Soil Study	141	NA	0 (0%)	NA	NA	0 (0%)	NA	NA	0 (0%)	NA	NA	0 (0%)	NA	NA	0 (0%)	NA
Chromium	2015 Bossburg Study	6	NA	0 (0%)	NA	NA	0 (0%)	NA	NA	0 (0%)	NA	NA	0 (0%)	NA	NA	0 (0%)	NA
Copper	2012 Ecology Upland Soil Study	106	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Copper	2014 UCR Upland Soil Study	141	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Copper	2015 Bossburg Study	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Iron	2012 Ecology Upland Soil Study	106	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA
Iron	2014 UCR Upland Soil Study	141	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA
Iron	2015 Bossburg Study	6	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA
Lead	2012 Ecology Upland Soil Study	106	0 (0%)	0 (0%)	3 (3%)	30 (28%)	3 (3%)	74 (70%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	20 (19%)	7 (7%)	0 (0%)	43 (41%)
Lead	2014 UCR Upland Soil Study	141	0 (0%)	0 (0%)	0 (0%)	10 (7%)	0 (0%)	82 (58%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	5 (4%)	0 (0%)	0 (0%)	26 (18%)
Lead	2015 Bossburg Study	6	1 (17%)	0 (0%)	1 (17%)	1 (17%)	1 (17%)	4 (67%)	0 (0%)	0 (0%)	1 (17%)	1 (17%)	0 (0%)	1 (17%)	1 (17%)	0 (0%)	2 (33%)
Mercury	2012 Ecology Upland Soil Study	106	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	50 (47%)	1 (1%)	0 (0%)	36 (34%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	49 (46%)
Mercury	2014 UCR Upland Soil Study	141	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	77 (55%)	0 (0%)	0 (0%)	41 (29%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	71 (50%)
Mercury	2015 Bossburg Study	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3 (50%)	0 (0%)	0 (0%)	3 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3 (50%)
Molybdenum	2012 Ecology Upland Soil Study	106	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Molybdenum	2014 UCR Upland Soil Study	141	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Molybdenum	2015 Bossburg Study	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Selenium	2012 Ecology Upland Soil Study	106	0 (0%)	0 (0%)	0 (0%)	1 (1%)	4 (4%)	1 (1%)	3 (3%)	6 (6%)	3 (3%)	1 (1%)	1 (1%)	1 (1%)	3 (3%)	6 (6%)	4 (4%)
Selenium	2014 UCR Upland Soil Study	141	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	1 (1%)	1 (1%)	1 (1%)	0 (0%)	1 (1%)	0 (0%)	1 (1%)	3 (2%)	1 (1%)
Selenium	2015 Bossburg Study	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vanadium	2012 Ecology Upland Soil Study	106	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vanadium	2014 UCR Upland Soil Study	141	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vanadium	2015 Bossburg Study	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Zinc	2012 Ecology Upland Soil Study	106	0 (0%)	0 (0%)	0 (0%)	0 (0%)	35 (33%)	20 (19%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	4 (4%)	1 (1%)	0 (0%)	40 (38%)	32 (30%)
Zinc	2014 UCR Upland Soil Study	141	0 (0%)	0 (0%)	0 (0%)	0 (0%)	25 (18%)	6 (4%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)	34 (24%)	20 (14%)
Zinc	2015 Bossburg Study	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Notes:

[a] Count and percentage of locations in each study with HQ ≥ 1 for the survival, growth, and reproduction TRVs.

HQs for each sample are presented in Appendix F

≥ = greater than or equal to

COPC = chemical of potential concern

HQ = hazard quotient

NA = not applicable, no TRV available

TRV = toxicity reference value

UCR = Upper Columbia River

Table 8-2. Summary of Dietary Effect Levels with HQs ≥ 1 for Birds for Each Data Set

				2012 Ecology Soil Study						2014 UCR Upland Soil Study						2015 Bossburg Study					
						Of Locations with HQ ≥ 1						Of Locations with HQ ≥ 1						Of Locations with HQ ≥ 1			
Receptor	COPC	Endpoint	TRV Type	Number of Locations	Number of Locations with HQ ≥ 1 [a]	Number with EDx ≥ ED20 and < ED50 [b]	Number with EDx ≥ ED50 [b]	Median EDx (or HQ)	Maximum EDx (or HQ)	Number of Locations	Number of Locations with HQ ≥ 1 [a]	Number with EDx ≥ ED20 and < ED50 [b]	Number with EDx ≥ ED50 [b]	Median EDx (or HQ)	Maximum EDx (or HQ)	Number of Locations	Number of Locations with HQ ≥ 1 [a]	Number with EDx ≥ ED20 and < ED50 [b]	Number with EDx ≥ ED50 [b]	Median EDx (or HQ)	Maximum EDx (or HQ)
California quail	Lead	Reproduction	geomean	106	3 (3%)	NA	NA	1.2	1.8	141	NA	NA	NA	NA	NA	6	1 (17%)	NA	NA	2.4	2.4
California quail	Lead	Survival	ED20	106	NA	NA	NA	NA	NA	141	NA	NA	NA	NA	NA	6	1 (17%)	1 (100%)	0 (0%)	20	20
American robin	Aluminum	Growth	ED20	106	15 (14%)	15 (100%)	0 (0%)	23	32	141	2 (1%)	2 (100%)	0 (0%)	21	22	6	NA	NA	NA	NA	NA
American robin	Cadmium	Survival	ED20	106	1 (1%)	1 (100%)	0 (0%)	28	28	141	NA	NA	NA	NA	NA	6	NA	NA	NA	NA	NA
American robin	Cadmium	Growth	ED20	106	60 (57%)	59 (98%)	1 (2%)	29	52	141	80 (57%)	80 (100%)	0 (0%)	26	36	6	NA	NA	NA	NA	NA
American robin	Cadmium	Reproduction	ED20	106	54 (51%)	53 (98%)	1 (2%)	26	50	141	65 (46%)	65 (100%)	0 (0%)	24	33	6	NA	NA	NA	NA	NA
American robin	Lead	Survival	ED20	106	30 (28%)	25 (83%)	5 (17%)	31	72	141	10 (7%)	10 (100%)	0 (0%)	26	35	6	1 (17%)	0 (0%)	1 (100%)	80	80
American robin	Lead	Growth	LOAEL ≥ 20	106	3 (3%)	NA	NA	1.1	1.5	141	NA	NA	NA	NA	NA	6	1 (17%)	NA	NA	2.0	2.0
American robin	Lead	Reproduction	Geomean	106	74 (70%)	NA	NA	2.2	9.5	141	82 (58%)	NA	NA	1.6	3.8	6	4 (67%)	NA	NA	1.8	12
American robin	Mercury	Survival	LOAEL ≥ 20	106	1 (1%)	NA	NA	1.6	1.6	141	NA	NA	NA	NA	NA	6	NA	NA	NA	NA	NA
American robin	Mercury	Reproduction	ED20	106	50 (47%)	50 (100%)	0 (0%)	23	36	141	77 (55%)	77 (100%)	0 (0%)	22	26	6	3 (50%)	3 (100%)	0 (0%)	23	31
American robin	Selenium	Survival	LOAEL ≥ 20	106	1 (1%)	NA	NA	1.4	1.4	141	NA	NA	NA	NA	NA	6	NA	NA	NA	NA	NA
American robin	Selenium	Growth	Eco-SSL	106	4 (4%)	NA	NA	1.2	2.9	141	1 (1%)	NA	NA	1.9	1.9	6	NA	NA	NA	NA	NA
American robin	Selenium	Reproduction	ED20	106	1 (1%)	1 (100%)	0 (0%)	38	38	141	NA	NA	NA	NA	NA	6	NA	NA	NA	NA	NA
American robin	Zinc	Growth	Eco-SSL	106	35 (33%)	NA	NA	1.2	2.2	141	25 (18%)	NA	NA	1.1	1.8	6	NA	NA	NA	NA	NA
American robin	Zinc	Reproduction	ED20	106	20 (19%)	16 (80%)	4 (20%)	35	70	141	6 (4%)	5 (83%)	1 (17%)	22	57	6	NA	NA	NA	NA	NA
Tree swallow	Lead	Reproduction	Geomean	106	NA	NA	NA	NA	NA	141	NA	NA	NA	NA	NA	6	1 (17%)	NA	NA	1.1	1.1
Tree swallow	Mercury	Survival	LOAEL ≥ 20	106	1 (1%)	NA	NA	1.3	1.3	141	NA	NA	NA	NA	NA	6	NA	NA	NA	NA	NA
Tree swallow	Mercury	Reproduction	ED20	106	36 (34%)	36 (100%)	0 (0%)	22	34	141	41 (29%)	41 (100%)	0 (0%)	21	24	6	3 (50%)	3 (100%)	0 (0%)	22	29
Tree swallow	Selenium	Survival	LOAEL ≥ 20	106	3 (3%)	NA	NA	1.1	2.8	141	1 (1%)	NA	NA	1.8	1.8	6	NA	NA	NA	NA	NA
Tree swallow	Selenium	Growth	Eco-SSL	106	6 (6%)	NA	NA	2	5.6	141	1 (1%)	NA	NA	3.6	3.6	6	NA	NA	NA	NA	NA
Tree swallow	Selenium	Reproduction	ED20	106	3 (3%)	2 (67%)	1 (33%)	25	74	141	1 (1%)	0 (0%)	1 (100%)	51	51	6	NA	NA	NA	NA	NA
American kestrel	Aluminum	Growth	ED20	106	2 (2%)	2 (100%)	0 (0%)	23	24	141	NA	NA	NA	NA	NA	6	NA	NA	NA	NA	NA
American kestrel	Lead	Survival	ED20	106	1 (1%)	1 (100%)	0 (0%)	22	22	141	NA	NA	NA	NA	NA	6	1 (17%)	1 (100%)	0 (0%)	29	29
American kestrel	Lead	Reproduction	Geomean	106	20 (19%)	NA	NA	1.3	2.6	141	5 (4%)	NA	NA	1.0	1.2	6	1 (17%)	NA	NA	3.3	3.3
American kestrel	Selenium	Survival	LOAEL ≥ 20	106	1 (1%)	NA	NA	1.0	1.0	141	NA	NA	NA	NA	NA	6	NA	NA	NA	NA	NA
American kestrel	Selenium	Growth	Eco-SSL	106	1 (1%)	NA	NA	2.1	2.1	141	1 (1%)	NA	NA	1.5	1.5	6	NA	NA	NA	NA	NA
American kestrel	Selenium	Reproduction	ED20	106	1 (1%)	1 (100%)	0 (0%)	24	24	141	NA	NA	NA	NA	NA	6	NA	NA	NA	NA	NA
American kestrel	Zinc	Growth	Eco-SSL	106	4 (4%)	NA	NA	1.1	1.2	141	1 (1%)	NA	NA	1.0	1.0	6	NA	NA	NA	NA	NA
American kestrel	Zinc	Reproduction	ED20	106	1 (1%)	1 (100%)	0 (0%)	21	21	141	NA	NA	NA	NA	NA	6	NA	NA	NA	NA	NA
Black-capped chickadee	Aluminum	Growth	ED20	106	2 (2%)	2 (100%)	0 (0%)	25	28	141	NA	NA	NA	NA	NA	6	NA	NA	NA	NA	NA
Black-capped chickadee	Cadmium	Growth	ED20	106	3 (3%)	3 (100%)	0 (0%)	22	26	141	NA	NA	NA	NA	NA	6	NA	NA	NA	NA	NA
Black-capped chickadee	Cadmium	Reproduction	ED20	106	1 (1%)	1 (100%)	0 (0%)	24	24	141	NA	NA	NA	NA	NA	6	NA	NA	NA	NA	NA
Black-capped chickadee	Lead	Survival	ED20	106	7 (7%)	6 (86%)	0 (0%)	27	38	141	NA	NA	NA	NA	NA	6	1 (17%)	1 (100%)	0 (0%)	48	48
Black-capped chickadee	Lead	Reproduction	Geomean	106	43 (41%)	NA	NA	1.4	4.2	141	26 (18%)	NA	NA	1.2	1.8	6	2 (33%)	NA	NA	3.2	5.2
Black-capped chickadee	Mercury	Survival	LOAEL ≥ 20	106	1 (1%)	NA	NA	1.6	1.6	141	NA	NA	NA	NA	NA	6	NA	NA	NA	NA	NA
Black-capped chickadee	Mercury	Reproduction	ED20	106	49 (46%)	49 (100%)	0 (0%)	23	36	141	71 (50%)	71 (100%)	0 (0%)	22	26	6	3 (50%)	3 (100%)	0 (0%)	23	31
Black-capped chickadee	Selenium	Survival	LOAEL ≥ 20	106	3 (3%)	NA	NA	1.2	3.0	141	1 (1%)	NA	NA	1.9	1.9	6	NA	NA	NA	NA	NA
Black-capped chickadee	Selenium	Growth	Eco-SSL	106	6 (6%)	NA	NA	2.2	6.1	141	3 (2%)	NA	NA	1.0	3.9	6	NA	NA	NA	NA	NA
Black-capped chickadee	Selenium	Reproduction	ED20	106	4 (4%)	3 (75%)	1 (25%)	28	77	141	1 (1%)	0 (0%)	1 (100%)	56	56	6	NA	NA	NA	NA	NA
Black-capped chickadee	Zinc	Growth	Eco-SSL	106	40 (38%)	NA	NA	1.4	3.5	141	34 (24%)	NA	NA	1.2	2.8	6	NA	NA	NA	NA	NA
Black-capped chickadee	Zinc	Reproduction	ED20	106	32 (30%)	16 (50%)	16 (50%)	46	96	141	20 (14%)	19 (95%)	1 (5%)	26	87	6	NA	NA	NA	NA	NA

Notes:

[a] Percentage of total number of locations with HQ ≥ 1 for each study is shown in parentheses

[b] Percentage of the subset of locations with HQ ≥ 1 for each study is shown in parentheses

HQs and EDxs for each sample are presented in Appendix F

≥ = greater than or equal to

< = less than

COPC = chemical of potential concern

Eco-SSL = ecological soil screening level

ED20 = dose causing a 20 percent effect

ED50 = dose causing a 50 percent effect

EDx = effective dose

HQ = hazard quotient

LOAEL = lowest observed adverse effect level

NA = not applicable; no TRV or EDx available

TRV = toxicity reference value

UCR = Upper Columbia River

Table 8-3. Summary of Bird HQs and BTV Comparisons for Species and Endpoints with HQ ≥1 for Each Study

			2012 Ecology Upland Soil Study [a]			2014 UCR Upland Soil Study [a]			2015 Bossburg Study [a]		
Receptor	COPC	Endpoint	Number of Locations with HQ ≥ 1	Locations with HQ ≥ 1 and Site ≤ BTV	Locations with HQ ≥ 1 and Site > BTV	Number of Locations with HQ ≥ 1	Locations with HQ ≥ 1 and Site ≤ BTV	Locations with HQ ≥ 1 and Site > BTV	Number of Locations with HQ ≥ 1	Locations with HQ ≥ 1 and Site ≤ BTV	Locations with HQ ≥ 1 and Site > BTV
California quail	Lead	Reproduction	3 (3%)	0 (0%)	3 (3%)	NA	NA	NA	1 (17%)	0 (0%)	1 (17%)
California quail	Lead	Survival	NA	NA	NA	NA	NA	NA	1 (17%)	0 (0%)	1 (17%)
American robin	Aluminum	Growth	15 (14%)	15 (14%)	0 (0%)	2 (1%)	2 (1%)	0 (0%)	NA	NA	NA
American robin	Cadmium	Survival	1 (1%)	0 (0%)	1 (1%)	NA	NA	NA	NA	NA	NA
American robin	Cadmium	Growth	60 (57%)	0 (0%)	60 (57%)	80 (57%)	0 (0%)	80 (57%)	NA	NA	NA
American robin	Cadmium	Reproduction	54 (51%)	0 (0%)	54 (51%)	65 (46%)	0 (0%)	65 (46%)	NA	NA	NA
American robin	Lead	Survival	30 (28%)	0 (0%)	30 (28%)	10 (7%)	0 (0%)	10 (7%)	1 (17%)	0 (0%)	1 (17%)
American robin	Lead	Growth	3 (3%)	0 (0%)	3 (3%)	NA	NA	NA	1 (17%)	0 (0%)	1 (17%)
American robin	Lead	Reproduction	74 (70%)	0 (0%)	74 (70%)	82 (58%)	0 (0%)	82 (58%)	4 (67%)	0 (0%)	4 (67%)
American robin	Mercury	Survival	1 (1%)	0 (0%)	1 (1%)	NA	NA	NA	NA	NA	NA
American robin	Mercury	Reproduction	50 (47%)	29 (27%)	21 (20%)	77 (55%)	62 (44%)	15 (11%)	3 (50%)	2 (33%)	1 (17%)
American robin	Selenium	Survival	1 (1%)	0 (0%)	1 (1%)	NA	NA	NA	NA	NA	NA
American robin	Selenium	Growth	4 (4%)	0 (0%)	4 (4%)	1 (1%)	0 (0%)	1 (1%)	NA	NA	NA
American robin	Selenium	Reproduction	1 (1%)	0 (0%)	1 (1%)	NA	NA	NA	NA	NA	NA
American robin	Zinc	Growth	35 (33%)	0 (0%)	35 (33%)	25 (18%)	0 (0%)	25 (18%)	NA	NA	NA
American robin	Zinc	Reproduction	20 (19%)	0 (0%)	20 (19%)	6 (4%)	0 (0%)	6 (4%)	NA	NA	NA
Tree swallow	Lead	Reproduction	NA	NA	NA	NA	NA	NA	1 (17 %)	0 (0 %)	1 (17 %)
Tree swallow	Mercury	Survival	1 (1 %)	0 (0 %)	1 (1 %)	NA	NA	NA	NA	NA	NA
Tree swallow	Mercury	Reproduction	36 (34 %)	15 (14 %)	21 (20 %)	41 (29 %)	26 (18 %)	15 (11 %)	3 (50 %)	2 (33 %)	1 (17 %)
Tree swallow	Selenium	Survival	3 (3 %)	0 (0 %)	3 (3 %)	1 (1 %)	0 (0 %)	1 (1 %)	NA	NA	NA
Tree swallow	Selenium	Growth	6 (6 %)	0 (0 %)	6 (6 %)	1 (1 %)	0 (0 %)	1 (1 %)	NA	NA	NA
Tree swallow	Selenium	Reproduction	3 (3 %)	0 (0 %)	3 (3 %)	1 (1 %)	0 (0 %)	1 (1 %)	NA	NA	NA
American kestrel	Aluminum	Growth	2 (2 %)	2 (2 %)	0 (0 %)	NA	NA	NA	NA	NA	NA
American kestrel	Lead	Survival	1 (1 %)	0 (0 %)	1 (1 %)	NA	NA	NA	1 (17 %)	0 (0 %)	1 (17 %)
American kestrel	Lead	Reproduction	20 (19 %)	0 (0 %)	20 (19 %)	5 (4 %)	0 (0 %)	5 (4 %)	1 (17 %)	0 (0 %)	1 (17 %)
American kestrel	Selenium	Survival	1 (1 %)	0 (0 %)	1 (1 %)	NA	NA	NA	NA	NA	NA
American kestrel	Selenium	Growth	1 (1 %)	0 (0 %)	1 (1 %)	1 (1 %)	0 (0 %)	1 (1 %)	NA	NA	NA
American kestrel	Selenium	Reproduction	1 (1 %)	0 (0 %)	1 (1 %)	NA	NA	NA	NA	NA	NA
American kestrel	Zinc	Growth	4 (4%)	0 (0%)	4 (4%)	1 (1%)	0 (0%)	1 (1%)	NA	NA	NA
American kestrel	Zinc	Reproduction	1 (1%)	0 (0%)	1 (1%)	NA	NA	NA	NA	NA	NA
Black-capped chickadee	Aluminum	Growth	2 (2 %)	2 (2 %)	0 (0 %)	NA	NA	NA	NA	NA	NA
Black-capped chickadee	Cadmium	Growth	3 (3 %)	0 (0 %)	3 (3 %)	NA	NA	NA	NA	NA	NA
Black-capped chickadee	Cadmium	Reproduction	1 (1 %)	0 (0 %)	1 (1 %)	NA	NA	NA	NA	NA	NA
Black-capped chickadee	Lead	Survival	7 (7 %)	0 (0 %)	7 (7 %)	NA	NA	NA	1 (17 %)	0 (0 %)	1 (17 %)
Black-capped chickadee	Lead	Reproduction	43 (41 %)	0 (0 %)	43 (41 %)	26 (18 %)	0 (0 %)	26 (18 %)	2 (33 %)	0 (0 %)	2 (33 %)
Black-capped chickadee	Mercury	Survival	1 (1 %)	0 (0 %)	1 (1 %)	NA	NA	NA	NA	NA	NA
Black-capped chickadee	Mercury	Reproduction	49 (46 %)	28 (26 %)	21 (20 %)	71 (50 %)	56 (40 %)	15 (11 %)	3 (50 %)	2 (33 %)	1 (17 %)
Black-capped chickadee	Selenium	Survival	3 (3 %)	0 (0 %)	3 (3 %)	1 (1 %)	0 (0 %)	1 (1 %)	NA	NA	NA
Black-capped chickadee	Selenium	Growth	6 (6 %)	0 (0 %)	6 (6 %)	3 (2 %)	0 (0 %)	3 (2 %)	NA	NA	NA
Black-capped chickadee	Selenium	Reproduction	4 (4 %)	0 (0 %)	4 (4 %)	1 (1 %)	0 (0 %)	1 (1 %)	NA	NA	NA
Black-capped chickadee	Zinc	Growth	40 (38%)	0 (0%)	40 (38%)	34 (24%)	0 (0%)	34 (24%)	NA	NA	NA
Black-capped chickadee	Zinc	Reproduction	32 (30%)	0 (0%)	32 (30%)	20 (14%)	0 (0%)	20 (14%)	NA	NA	NA

Notes:

[a] Percentage of total number of locations with HQ ≥ 1 for each study is shown in parentheses

HQs and BTV comparisons for each sample are presented in Appendix F

> = greater than

≥ = greater than or equal to

≤ = less than or equal to

BTV = background threshold value

COPC = chemical of potential concern

HQ = hazard quotient

NA = not applicable; COPC/endpoint not evaluated

UCR = Upper Columbia River

Table 8-4. Summary of Bird LOE Uncertainties

Uncertainty	Overestimation or Underestimation of the Potential for Adverse Effects	Specific Areas of Applicability	Notes
Soil Chemistry EPCs			
Detection limits	0	NA	All soil chemistry results for COPCs and COIs in the 2014 UCR Upland Soil Study are detected values.
Sample density	?	NA	Concentrations of COPCs in soil outside of the sample locations included in the Upland BERA data sets may be inferred based on results from nearby samples. These inferences may potentially overestimate or underestimate exposure and associated effects.
Replicate samples	↓	NA	DU EPCs may under- or overestimate the true average COPC concentration due to variability and sampling error. The 2014 UCR Upland Soil and 2015 Bossburg studies included collection of one and three replicate ICS soil samples, respectively from a subset of DUs. Replicates were used to calculate 95 UCL on the mean COPC concentrations following EPA guidance. Uncertainty analyses shown in Table 8-5 indicate that use of the 95 UCL on the mean increases the number of DUs exceeding the benchmark for multiple COPCs.
Bioaccumulation Models			
Generic models	?	NA	Except for plants, bioaccumulation models used for food chain uptake estimates are derived from studies reported in the scientific literature, which were mostly conducted using North American and European soils. None of these models are site specific nor do they adjust for bioavailability or species-specific differences in uptake.
Characteristics of the data underlying bioaccumulation model data sets.	?	NA	All bioaccumulation models used in the BERA relied on paired co-located soil and tissue data. There are several inherent uncertainties associated with these data: • Quality of bioaccumulation relationships improves as the spatial association between biota and soil samples increases. It is not uncommon for biota samples to be collected at locations that do not immediately correspond with soil locations due to habitat and biota availability issues. This increases uncertainty in the models. • Some data sets have biota and soil data that represent spatially aggregated concentrations. This averaging and the variable spatial extent represented by soil and tissue data impart uncertainty. • Some models are based on mobile biota (i.e., small mammals, arthropods) paired with soils from discrete locations. Tissue concentrations will represent the area over which these biota ranged and may be over- or underrepresented by the discrete sample location.
Robustness of model data sets	?	NA	Bioaccumulation models derived from data sets using only species and conditions found at the site are considered the most relevant. For most prey types, cadmium, copper, lead, and zinc have the greatest amount of available data for modeling. The COPCs with the fewest data are aluminum, molybdenum, selenium (terrestrial arthropods), thallium, and vanadium. None of the data sets used only relevant species and site conditions (Appendix C). Uncertainties may under- or overestimate actual site exposures.
Model types	?	NA	Regression models better account for variable uptake over differing concentrations in soil than BAFs, which are a static ratio, assuming the underlying data set is robust. There are more regression models for small mammals (7 of 13 metals), but a greater reliance on BAFs for plants, terrestrial arthropods, aerial insects, and earthworms. COPCs that have regression models for most biota types are cadmium, lead, and zinc. Uncertainties may under- or overestimate actual site exposures.
Plant bioaccumulation models	?	NA	The uncertainties associated with the site-specific plant bioaccumulation models are discussed in Appendix C. Briefly, the site-specific models have high environmental relevance, but may lack some spatial relevance across the entire Terrestrial Study Area. Development of the models required a correction factor between the fine (< 150 µm) and bulk (< 2 mm) soil fractions in site soils, which increases the uncertainty. The plant species and plant parts that were sampled and analyzed were chosen for human food or cultural purposes so likely provide reasonable estimates of edible species and plant parts that wildlife at the site consume.
Invertebrate bioaccumulation models	?	NA	Uncertainties associated with the specific terrestrial arthropod, earthworm, and aerial insect bioaccumulation models are discussed in Appendix C. The terrestrial arthropod, aerial insect, and earthworm models have high relevance to the prey types consumed by receptors in the Terrestrial Study Area; however, differences in site soil parameters, relevant invertebrate species, and variabilities in models may result in overestimation or underestimation of actual site exposures.
Earthworm bioaccumulation models	?		Uncertainty in the soil to earthworm bioaccumulation models is evaluated in Section 8.3.2 by comparing the number of HQs ≥ 1 using the baseline models to those calculated using soil to earthworm bioaccumulation models reported in a recent synthesis of literature reported data (Richardson et al., 2020). When HQs are calculated using the Richardson et al. (2020) models, the numbers of HQs ≥ 1 increase for mercury, are similar for cadmium and lead, and decrease for zinc (Table 8-7).

Table 8-4. Summary of Bird LOE Uncertainties

Uncertainty	Overestimation or Underestimation of the Potential for Adverse Effects	Specific Areas of Applicability	Notes
Exposure Calculations			
Wildlife exposure factors	↑	NA	There are uncertainties associated with the model used to calculate dietary doses for the various bird species. Food ingestion rates for representative species are estimated from allometric scaling equations reported in Nagy (2001) for broader avian feeding guilds or groups. As the selected receptors are intended to be potentially highly exposed with respect to their feeding guild, uncertainty associated with the estimated food ingestion rates may result in the overestimation of the potential exposure to other species within the feeding guild. The incidental soil ingestion rates for the selected receptors are based on relevant literature, where available, or best professional judgment and may overestimate or underestimate ingestion of soil. In particular, the incidental soil ingestion rate for the American robin is expected to be conservative; this value is based on woodcock, which consume mostly (58-99%) worms, whereas the robin eats a comparatively lower proportion (40%) of worms (Tables 4-4 and 4-5; EPA, 1993) meaning it ingests less soil than a woodcock because the robin is likely spending less time foraging in the soil.
Foraging area and duration assumptions	↑	NA	The AUF for birds in the Terrestrial Study Area is 1, which assumes that all bird receptors in a population forage entirely in a given DU in all seasons of the year. As illustrated by the circles depicting the home range for each respective receptor of concern on Maps 8-1 through 8-20, most samples are located too far apart from one another for more than a single sample to fall within the home range of an individual of a given species. The uncertainty associated with limited sample density may result in the under- or overestimation of exposure for individuals and is a conservative estimate for the assessment population.
Water ingestion	0	NA	Ingestion of surface waters is not considered a significant exposure pathway because surface water is not an exposure medium of concern for the Terrestrial Study Area (Section 2.5.1). The absence of water contribution to the dietary dose is an uncertainty but is not expected to impact the estimation of the dose because water concentrations are assumed to be an insignificant contribution to the total dose (Section 2.5.1).
Air inhalation	0	NA	Inhalation of COPCs in air is not considered a significant exposure pathway. This could potentially underestimate COPC exposure. However, as described in Section 2.5.5, the BERA Work Plan (TAI, 2011a) identified inhalation as a potentially complete but minor route of COPC uptake for wildlife. Thus, the COPC refinement did not evaluate COPC exposure through inhalation and it was not carried forward and evaluated in the Upland BERA. This is not expected to be a major source of uncertainty.
IVBA extrapolation across sample locations	?	NA	RBA estimates vary by COPC and sample as a function of IVBA. IVBA analyses for TAL metals were conducted on a limited number of sample locations. IVBA was analyzed in a subset of 2014 UCR Upland Soil Study DUs for all TAL metals, and for a subset of samples from other studies conducted for the RI/FS (Sections 3.1.2 and 3.2.2). These data were used to extrapolate to the remaining locations within the Upland BERA data sets. For lead and zinc, relationships were developed using soil characteristics (pH or TOC) that predicted metal bioavailability in the available IVBA data set. For all other COPCs, metal-specific means of the IVBA data from the subset of 2014 UCR Upland Soil Study DUs were used as surrogate values for sample locations without IVBA data. This extrapolation may overestimate or underestimate the bioaccessible fraction. Sensitivity of risk estimates to RBA are presented in Table 8-5.
IVBA relevance to avian digestion	↑	NA	The IVBA process is based on the digestive system of a child and does not perfectly parallel conditions in the gastric systems of avian receptors. The IVBA extraction process occurs at a pH of 1.5, which is up to several orders of magnitude more acidic than the gastric pH of avian invertivores and herbivores (see Appendix E for comparisons). For these feeding guilds, therefore, the IVBA is likely a overly conservative estimate of bioaccessibility, especially for pH sensitive metals like lead, resulting in overestimation of the bioaccessible fraction. The IVBA analysis is also conservative with respect to gut retention times. The retention time of songbirds is more than a factor of 10 less than that for humans (see Appendix E for comparisons). The use of a longer digestion time might overestimate bioavailability for all metals.
Bioavailability adjustments for soil ingestion, not food	↑	NA	The above bioavailability adjustments are applied for incidentally ingested soil only. Due to the lack of site-specific wildlife food bioavailability data and the greater uncertainty associated with developing generic literature-based bioavailability factors, the Upland BERA assumes a conservative RBA of 100% for food items. This presents an uncertainty that may result in the overestimation of bioavailability in food.
Methylmercury and inorganic mercury allocations	0	Mercury	LOE 1 used methylmercury TRV and total mercury concentrations in soil and prey items. When mercury is apportioned into inorganic and methylmercury in soil and prey items, then compared to the chemically concordant TRV, HQs are below 1 for worst-case scenarios. This refinement reduces the overestimation of potential adverse effects present in the LOE estimation for HQs using methylmercury TRVs and total mercury EPCs (Table 8-8).

Table 8-4. Summary of Bird LOE Uncertainties

Uncertainty	Overestimation or Underestimation of the Potential for Adverse Effects	Specific Areas of Applicability	Notes
TRVs			
General TRV uncertainties	↑	NA	There is no field verification of the predictive ability of the TRVs, in particular because TRVs are not based on UCR-receptor-specific data, UCR-specific metal forms, and laboratory exposures are often not relevant to field conditions. Uncertainties include individual study considerations such as test species, dose administration, chemical form, growth study exposure, dose calculation, and type of effect level (Appendix E). TRVs are often derived from low numbers of data sets, such as aluminum (survival), chromium (III) (growth), and zinc (survival). Selection of the most sensitive test species for TRV derivation often results in overestimation, particularly in situations where the available data set represents several avian orders.
Antimony TRV uncertainties	?	Antimony	There were no TRVs available to evaluate growth, reproduction, or survival in avian receptors from potential exposure to antimony in soils.
Aluminum TRV uncertainties	↑	Growth	The growth effect is based on a modeled ED20 for body weight in one data set on chicken (Capdevielle and Scanes, 1995a), which is not a relevant population-level effect. TRV studies used a soluble form of the metal (aluminum sulfate) that is not likely representative of the form of metal likely present in prey.
Barium TRV uncertainties	?	Reproduction	No TRV existed to analyze the reproductive effect of exposure of birds to barium in soil. The growth and survival TRVs are only based on two data sets. The TRV for survival is based on two data sets with LOAEL ≥ 20 indicating a possible underestimation of adverse effect.
Beryllium TRV uncertainties	?		There were no TRVs available to evaluate growth, reproduction or survival in avian receptors from potential exposure to beryllium in soils.
Cadmium TRV uncertainties	↓	Growth, reproduction	TRVs based on modeled ED20 for body weight (growth TRV) and modeled ED20 for egg production (reproduction TRV) (Bokori et al., 1995b; Leach et al., 1979). Both TRVs use a soluble form of the metal (cadmium sulfate), which is not representative of the form of metal likely present in prey. There were 11 and 5 data sets for growth and reproduction, respectively reducing the uncertainty. However, over half the data sets for growth (8/11) and reproduction (3/5) were unbounded LOAELs (≥ 20) which may lead to an underestimation of adverse effects.
Chromium TRV uncertainties	?	Reproduction, survival	There were no TRVs available to evaluate reproduction or survival in avian receptors from potential exposure to chromium in soils. The TRV for growth was based on one data set with the LOAEL ≥ 20 indicating a possible underestimation of adverse effects (Chung et al., 1985). The growth TRV used a soluble form of chromium (chromium sulfate) that is likely not the form of the metal present in prey.
Iron TRV uncertainties	?	Reproduction	There was no TRV available to evaluate reproduction in avian receptors. The growth and reproduction TRVs for avian receptors were based on only one and two single dose data sets, respectively - all with an unbounded LOAELs (≥ 20). The lack of TRV for reproduction may result in an underestimation of risk, while the unbounded- single dose LOAELs may result in an underestimation of adverse effects. Additionally, the exposure routes for all studies is gavage which may also result in an overestimation of adverse effects.
Lead TRV uncertainties	?	Growth, reproduction, survival	Survival TRV based on modeled ED20 derived from only two pooled data sets using gavage dose administration on non-UCR species (pigeon) and highly soluble form (lead acetate). Reproduction TRV based on geometric mean of the unbounded LOAEL ≥ 20 from three pooled data sets measuring egg production in Japanese quail. Reproduction TRV associated with high uncertainty due to variability of response. A further evaluation using reproduction TRV based on chickens as reported in Sample et al. (2019) found reduced number of HQs ≥ 1 (Table 8-9). Effect is based on egg production endpoint, which has high variability and uncertainty in Japanese quail (Sample et al., 2019). Further analysis of TRV uncertainties combined with other uncertainties for lead is presented in Table 8-10. The growth TRV based on 12 data sets reducing uncertainty, but alternatively all these have unbounded LOAELs ≥ 20 for 20% reduction in growth of non-UCR species (chicken) increasing uncertainty. The growth and reproduction TRVs may lead to a potential underestimation of adverse effects due to the low number of data sets available, variability in effect dose (reproduction) and unbounded LOAELs.
Mercury TRV uncertainties	↑	Reproduction	The mercury TRV is based on methylmercury, a modeled ED20 value derived from dose-response data on F1 number of offspring using methylmercury (Varian-Ramos et al., 2014). The exposure duration for the number of F1 offspring is unclear. The observed effects were not dose-responsive and result in a modeled ED20 substantially lower than reproduction TRVs selected for other BERAs and recommended in the literature (Section 8.3.2.0). When an alternative literature-recommended reproduction TRV is selected, concentrations in most samples result in HQs <1 (Table 8-8).
Molybdenum TRV uncertainties		Growth, reproduction and survival	Limited data sets (<5) were available to generate all three TRVs.

Table 8-4. Summary of Bird LOE Uncertainties

Uncertainty	Overestimation or Underestimation of the Potential for Adverse Effects	Specific Areas of Applicability	Notes
TRVs (continued)			
Selenium TRV uncertainties	?	Growth, reproduction, survival	The TRV for selenium growth is the Eco-SSL NOAEL, which is likely to overestimate adverse effects relative to the ED20. The TRV for selenium reproduction (Ort and Latshaw, 1978) is based on the ED20 derived from dose-response data on hatchability from a single study. The TRV for selenium survival (Arnold et al., 1973) is based on a lowest LOAEL ≥ 20 based on a single data set for chicken, with an estimated effect level of 35%. All studies used a soluble form of the metal (sodium selenite) that is not representative of the form of metal likely present in prey.
Thallium TRV uncertainties	?		There were no TRVs available to evaluate growth, reproduction, or survival in avian receptors from potential exposure to antimony in soils.
Vanadium TRV uncertainties	?	Reproduction	The TRV for reproduction (Toussant and Latshaw, 1994) is based on a LOAEL ≥ 20, which may result in an underestimation of adverse effects. The growth and survival TRVs are based on modeled ED20 values (Berg and Lawrence, 1971; Blalock and Hill, 1987). These ED20s are not substantially lower than the LOAELs for their respective endpoints.
Zinc TRV uncertainties	?	Growth, reproduction, survival	The TRV for zinc growth is the Eco-SSL NOAEL (66 mg/kg bw/day), which exceeds the ED20 (43 mg/kg bw/day) and therefore underestimates adverse effects relative to the ED20. The TRV for zinc reproduction is based on the ED20 derived from dose-response data on hatchability from a single data set. The TRV for zinc survival is based on a lowest LOAEL ≥ 20, with an estimated effect level of 20.7%. Studies are based on non-UCR species but also used different metal forms (survival and growth TRVs based on insoluble metal, reproduction TRV based on highly soluble metal).
HQ Interpretation			
Use of HQs	↑	NA	As discussed in Section 5.1.1, HQs using conservative assumptions are a tool to rule out risk. The most appropriate interpretation of an HQ ≥ 1 is that potential risk cannot be ruled out; otherwise the dose-response data underlying the TRVs must be considered to determine the likelihood that HQs ≥ 1 result in adverse effects.
Translation of HQs to population level attributes	↑	NA	When HQ < 1, inferring from the organism level to the population level is not expected to be a major source of uncertainty. However, when HQ ≥ 1, potential impacts at the organism level may not manifest as measurable impacts at the population level, leading to an overestimation of the potential for adverse population-level effects. In addition, the effect level most predictive of population-level effects likely varies depending on the endpoint and species.
COIs not quantitatively evaluated in the Upland BERA	0	Antimony	Antimony soil concentrations are above the BTV. However, this metal has not been identified as a priority to study toxic effects on birds, as shown by the lack of toxicity studies described in Appendix E. Therefore, the lack of a quantitative evaluation for antimony is not expected to underestimate the potential for adverse effects on birds. Beryllium and thallium soil concentrations are below the BTV; thus, not expected to be a source of uncertainty.
Background analysis	0	NA	As discussed in Section 6.3.5, the BTVs selected for use in the Terrestrial Study Area are in line with other available regional background values. The BTVs are therefore expected to contribute minimal uncertainty to the risk assessment.

Table 8-4. Summary of Bird LOE Uncertainties

Uncertainty	Overestimation or Underestimation of the Potential for Adverse Effects	Specific Areas of Applicability	Notes
Metal interactions and essentiality			
Single chemical HQs	?	NA	The simultaneous exposure of birds to elevated concentrations of multiple metals results in complex interactions, the effects are difficult to predict, and assumption of independent action may result in underestimates of the combined risks. For the purposes of this risk assessment, it is assumed that locations with multiple COCs exceeding benchmarks pose a greater risk to birds than those locations with fewer exceedances and that risk at a specific location is at least as great as that associated with the COC with the highest HQ.
Essential nutrients	?	Chromium, copper, molybdenum, selenium, and zinc	Of the COPCs for birds, chromium, copper, molybdenum, selenium, and zinc are identified as essential for vertebrate animals (USEPA 2007a, NRC 2005). While essential levels of those metals for birds in the Terrestrial Study Area were not developed in the Upland BERA, the doses from the basal diets, where provided, were accounted for in the derivation of the TRVs. However, the extent to which the nutritional requirements of birds raised in the lab are representative of avian wildlife is uncertain. The implications of this uncertainty on the estimation of risks to birds is unclear but the magnitude of uncertainty is likely small relative to overall uncertainty.

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↑ = likely to overestimate the potential for adverse effects
↓ = likely to underestimate the potential for adverse effects
? = uncertain and may either overestimate or underestimate the potential for adverse effe
0 = not expected to be a major source of uncertainty
≥ = greater than or equal to
< = less than
µm = micrometer(s)
95 UCL = 95 percent upper confidence limit of the mean
AUF = area use factor
BAF = bioaccumulation factor
BERA = baseline ecological risk assessment
BTV = background threshold value
COI = chemical of interest
COPC = chemical of potential concern
DU = decision unit
Eco-SSL = ecological soil screening level
ED20 = effective dose with a 20 percent reduction in the response relative to the control
EPA = U.S. Environmental Protection Agency
EPC = exposure point concentration
HQ = hazard quotient
ICS = incremental composite sample
IVBA = in vitro bioaccessibility
LOAEL ≥ 20 = lowest observed adverse effect level with ≥ 20 percent reduction in the response relative to the control
LOE = line of evidence
mg/kg bw/day = milligram(s) per kilogram of body weight per day
mm = millimeter(s)
NA = not applicable
NOAEL = no observed adverse effect level
RBA = relative bioavailability
RI/FS = remedial investigation and feasibility study
TAL = target analyte list
TOC = total organic carbon
TRV = toxicity reference value
UCR = Upper Columbia River

Table 8-5. Analysis of Uncertainty for Multiple Dietary Exposure Scenarios for each Mammal Receptor for each Study

		Count of HQ ≥ 1 [a]														
		2012 Ecology Upland Soil Study					2014 UCR Upland Soil Study					2015 Bossburg Study				
Receptor	**COPC**	**Sample-Specific RBA**	**Minimum RBA**	**Maximum RBA**	**RBA = 1**	**RBA = 0**	**Sample-Specific RBA**	**Minimum RBA**	**Maximum RBA**	**RBA = 1**	**RBA = 0**	**Sample-Specific RBA**	**Minimum RBA**	**Maximum RBA**	**RBA = 1**	**RBA = 0**
American kestrel	Aluminum	2 (2%)	2 (2%)	3 (3%)	21 (20%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	6 (4%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American kestrel	Barium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American kestrel	Cadmium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American kestrel	Chromium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American kestrel	Copper	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American kestrel	Iron	0 (0%)	0 (0%)	0 (0%)	8 (8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American kestrel	Lead	20 (19%)	14 (13%)	26 (25%)	29 (27%)	10 (9%)	5 (4%)	1 (1%)	8 (6%)	12 (9%)	0 (0%)	1 (17%)	1 (17%)	1 (17%)	2 (33%)	1 (17%)
American kestrel	Mercury	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American kestrel	Selenium	1 (1%)	1 (1%)	1 (1%)	1 (1%)	1 (1%)	1 (1%)	1 (1%)	1 (1%)	1 (1%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American kestrel	Vanadium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American kestrel	Zinc	4 (4%)	4 (4%)	4 (4%)	4 (4%)	4 (4%)	0 (0%)	0 (0%)	1 (1%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American kestrel	Molybdenum	NA	NA	NA	NA	NA	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NA	NA	NA	NA	NA
American robin	Aluminum	15 (14%)	6 (6%)	36 (34%)	99 (93%)	1 (1%)	2 (1%)	0 (0%)	24 (17%)	131 (93%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (100%)	0 (0%)
American robin	Barium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American robin	Cadmium	59 (56%)	59 (56%)	60 (57%)	60 (57%)	59 (56%)	80 (57%)	79 (56%)	80 (57%)	80 (57%)	79 (56%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American robin	Chromium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American robin	Copper	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American robin	Iron	0 (0%)	0 (0%)	6 (6%)	103 (97%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	137 (97%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (100%)	0 (0%)
American robin	Lead	74 (70%)	68 (64%)	75 (71%)	81 (76%)	64 (60%)	82 (58%)	69 (49%)	94 (67%)	108 (77%)	65 (46%)	4 (67%)	3 (50%)	4 (67%)	4 (67%)	3 (50%)
American robin	Mercury	50 (47%)	50 (47%)	50 (47%)	57 (54%)	50 (47%)	77 (55%)	74 (52%)	77 (55%)	86 (61%)	74 (52%)	3 (50%)	3 (50%)	3 (50%)	3 (50%)	3 (50%)
American robin	Selenium	4 (4%)	4 (4%)	4 (4%)	4 (4%)	3 (3%)	1 (1%)	1 (1%)	1 (1%)	1 (1%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American robin	Vanadium	0 (0%)	0 (0%)	0 (0%)	3 (3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American robin	Zinc	35 (33%)	29 (27%)	37 (35%)	40 (38%)	29 (27%)	25 (18%)	19 (13%)	29 (21%)	33 (23%)	18 (13%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American robin	Molybdenum	NA	NA	NA	NA	NA	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NA	NA	NA	NA	NA
Black-capped chickadee	Aluminum	2 (2%)	2 (2%)	2 (2%)	2 (2%)	2 (2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Black-capped chickadee	Barium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Black-capped chickadee	Cadmium	3 (3%)	3 (3%)	3 (3%)	3 (3%)	3 (3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Black-capped chickadee	Chromium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Black-capped chickadee	Copper	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Black-capped chickadee	Iron	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Black-capped chickadee	Lead	43 (41%)	43 (41%)	43 (41%)	43 (41%)	43 (41%)	26 (18%)	26 (18%)	26 (18%)	26 (18%)	26 (18%)	2 (33%)	2 (33%)	2 (33%)	2 (33%)	2 (33%)
Black-capped chickadee	Mercury	49 (46%)	49 (46%)	49 (46%)	49 (46%)	49 (46%)	71 (50%)	71 (50%)	71 (50%)	71 (50%)	71 (50%)	3 (50%)	3 (50%)	3 (50%)	3 (50%)	3 (50%)
Black-capped chickadee	Selenium	6 (6%)	6 (6%)	6 (6%)	6 (6%)	6 (6%)	3 (2%)	3 (2%)	3 (2%)	3 (2%)	3 (2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Black-capped chickadee	Vanadium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Black-capped chickadee	Zinc	40 (38%)	40 (38%)	40 (38%)	40 (38%)	40 (38%)	34 (24%)	34 (24%)	34 (24%)	34 (24%)	34 (24%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Black-capped chickadee	Molybdenum	NA	NA	NA	NA	NA	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NA	NA	NA	NA	NA
California quail	Aluminum	0 (0%)	0 (0%)	0 (0%)	36 (34%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	24 (17%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
California quail	Barium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
California quail	Cadmium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
California quail	Chromium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
California quail	Copper	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
California quail	Iron	0 (0%)	0 (0%)	0 (0%)	58 (55%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	39 (28%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
California quail	Lead	3 (3%)	0 (0%)	6 (6%)	17 (16%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (1%)	0 (0%)	1 (17%)	0 (0%)	1 (17%)	1 (17%)	0 (0%)
California quail	Mercury	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
California quail	Selenium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
California quail	Vanadium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
California quail	Zinc	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
California quail	Molybdenum	NA	NA	NA	NA	NA	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NA	NA	NA	NA	NA
Tree swallow	Aluminum	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Tree swallow	Barium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Tree swallow	Cadmium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Tree swallow	Chromium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 8-5. Analysis of Uncertainty for Multiple Dietary Exposure Scenarios for each Mammal Receptor for each Study

		Count of HQ ≥ 1 [a]														
		2012 Ecology Upland Soil Study					2014 UCR Upland Soil Study					2015 Bossburg Study				
Receptor	COPC	Sample-Specific RBA	Minimum RBA	Maximum RBA	RBA = 1	RBA = 0	Sample-Specific RBA	Minimum RBA	Maximum RBA	RBA = 1	RBA = 0	Sample-Specific RBA	Minimum RBA	Maximum RBA	RBA = 1	RBA = 0
Tree swallow	Copper	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Tree swallow	Iron	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Tree swallow	Lead	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (17%)	1 (17%)	1 (17%)	1 (17%)	1 (17%)
Tree swallow	Mercury	36 (34%)	36 (34%)	36 (34%)	36 (34%)	36 (34%)	41 (29%)	41 (29%)	41 (29%)	41 (29%)	41 (29%)	3 (50%)	3 (50%)	3 (50%)	3 (50%)	3 (50%)
Tree swallow	Selenium	6 (6%)	6 (6%)	6 (6%)	6 (6%)	6 (6%)	1 (1%)	1 (1%)	1 (1%)	1 (1%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Tree swallow	Vanadium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Tree swallow	Zinc	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Tree swallow	Molybdenum	NA	NA	NA	NA	NA	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NA	NA	NA	NA	NA

Notes:

[a] Percentage of total number of locations with HQ ≥ 1 for each study is shown in parentheses

HQs are based on average daily dose estimates calculated using values in Appendix F; a few sample-specific HQ counts differ from those in Tables 8-1 through 8-3 due to rounding of values reported in Appendix F relative to values presented in Table 4-1, 4-2, and 4-4.

COPC = chemical of potential concern

HQ = hazard quotient

NA = not applicable; COPC concentration not reported

RBA = relative bioavailability assessment

UCR = Upper Columbia River

Table 8-6. Analysis of Uncertainty in Receptor EPCs for Incremental Composite Samples - Comparison of Mean with 95 UCL of Mean

				2014 UCR Upland Soil Study				2015 Bossburg Study			
Receptor	COPC	TRV basis (survival, growth or reproduction)	95 UCL/mean for all triplicate samples [a]	Count HQ≥1 (Daily $Dose_{Mean}$/TRV)	Count HQ≥1 (Daily $Dose_{UCL95}$/TRV) [b]	Count HQ≥5 (Daily $Dose_{Mean}$/TRV)	Count HQ≥5 (Daily $Dose_{UCL95}$/TRV) [b]	Count HQ≥1 (Daily $Dose_{Mean}$/TRV)	Count HQ≥1 (Daily $Dose_{UCL95}$/TRV) [b]	Count HQ≥5 (Daily $Dose_{Mean}$/TRV)	Count HQ≥5 (Daily $Dose_{UCL95}$/TRV) [b]
American kestrel	Aluminum	Growth	1.09	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American kestrel	Barium	Growth	1.13	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American kestrel	Cadmium	Growth	1.19	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American kestrel	Chromium	Growth	1.15	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American kestrel	Copper	Reproduction	1.15	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American kestrel	Iron	Growth	1.12	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American kestrel	Lead	Reproduction	1.27	5 (4%)	8 (6%)	0 (0%)	0 (0%)	1 (17%)	1 (17%)	0 (0%)	0 (0%)
American kestrel	Mercury	Survival	1.23	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American kestrel	Selenium	Growth	1.33	1 (1%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American kestrel	Vanadium	Growth	1.10	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American kestrel	Zinc	Growth	1.16	0 (0%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American kestrel	Molybdenum	Reproduction	1.19	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NA	NA	NA	NA
American robin	Aluminum	Growth	1.09	2 (1%)	11 (8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American robin	Barium	Growth	1.13	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American robin	Cadmium	Growth	1.19	80 (57%)	88 (62%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American robin	Chromium	Growth	1.15	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American robin	Copper	Reproduction	1.15	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American robin	Iron	Growth	1.12	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American robin	Lead	Reproduction	1.27	82 (58%)	94 (67%)	0 (0%)	0 (0%)	4 (67%)	4 (67%)	1 (17%)	1 (17%)
American robin	Mercury	Reproduction	1.23	77 (55%)	92 (65%)	0 (0%)	0 (0%)	3 (50%)	3 (50%)	0 (0%)	0 (0%)
American robin	Selenium	Growth	1.33	1 (1%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American robin	Vanadium	Growth	1.10	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American robin	Zinc	Growth	1.16	25 (18%)	36 (26%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
American robin	Molybdenum	Reproduction	1.19	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NA	NA	NA	NA
Black-capped chickadee	Aluminum	Growth	1.09	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Black-capped chickadee	Barium	Growth	1.13	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Black-capped chickadee	Cadmium	Growth	1.19	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Black-capped chickadee	Chromium	Growth	1.15	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Black-capped chickadee	Copper	Reproduction	1.15	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Black-capped chickadee	Iron	Growth	1.12	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Black-capped chickadee	Lead	Reproduction	1.27	26 (18%)	38 (27%)	0 (0%)	0 (0%)	2 (33%)	2 (33%)	1 (17%)	1 (17%)
Black-capped chickadee	Mercury	Reproduction	1.23	71 (50%)	89 (63%)	0 (0%)	0 (0%)	3 (50%)	3 (50%)	0 (0%)	0 (0%)
Black-capped chickadee	Selenium	Growth	1.33	3 (2%)	9 (6%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Black-capped chickadee	Vanadium	Growth	1.10	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Black-capped chickadee	Zinc	Growth	1.16	34 (24%)	47 (33%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Black-capped chickadee	Molybdenum	Reproduction	1.19	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NA	NA	NA	NA
California quail	Aluminum	Growth	1.09	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
California quail	Barium	Growth	1.13	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
California quail	Cadmium	Growth	1.19	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
California quail	Chromium	Growth	1.15	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
California quail	Copper	Reproduction	1.15	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
California quail	Iron	Growth	1.12	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
California quail	Lead	Reproduction	1.27	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (17%)	1 (17%)	0 (0%)	0 (0%)
California quail	Mercury	Reproduction	1.23	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
California quail	Selenium	Growth	1.33	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
California quail	Vanadium	Growth	1.10	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
California quail	Zinc	Growth	1.16	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
California quail	Molybdenum	Reproduction	1.19	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NA	NA	NA	NA
Tree swallow	Aluminum	Growth	1.09	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Tree swallow	Barium	Growth	1.13	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Tree swallow	Cadmium	Growth	1.19	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Tree swallow	Chromium	Growth	1.15	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Tree swallow	Copper	Reproduction	1.15	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Tree swallow	Iron	Growth	1.12	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 8-6. Analysis of Uncertainty in Receptor EPCs for Incremental Composite Samples - Comparison of Mean with 95 UCL of Mean

				2014 UCR Upland Soil Study				2015 Bossburg Study			
Receptor	COPC	TRV basis (survival, growth or reproduction)	95 UCL/mean for all triplicate samples [a]	Count HQ≥1 (Daily $Dose_{Mean}$/TRV)	Count HQ≥1 (Daily $Dose_{UCL95}$/TRV) [b]	Count HQ≥5 (Daily $Dose_{Mean}$/TRV)	Count HQ≥5 (Daily $Dose_{UCL95}$/TRV) [b]	Count HQ≥1 (Daily $Dose_{Mean}$/TRV)	Count HQ≥1 (Daily $Dose_{UCL95}$/TRV) [b]	Count HQ≥5 (Daily $Dose_{Mean}$/TRV)	Count HQ≥5 (Daily $Dose_{UCL95}$/TRV) [b]
Tree swallow	Lead	Reproduction	1.27	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (17%)	1 (17%)	0 (0%)	0 (0%)
Tree swallow	Mercury	Reproduction	1.23	41 (29%)	55 (39%)	0 (0%)	0 (0%)	3 (50%)	3 (50%)	0 (0%)	0 (0%)
Tree swallow	Selenium	Growth	1.33	1 (1%)	4 (3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Tree swallow	Vanadium	Growth	1.10	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Tree swallow	Zinc	Growth	1.16	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Tree swallow	Molybdenum	Reproduction	1.19	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NA	NA	NA	NA

Notes:

HQs are based on average daily dose estimates calculated using values in Appendix F; a few sample-specific HQ counts differ from those in Tables 8-1 through 8-3 due to rounding of values reported in Appendix F relative to values presented in Table 4-1, 4-2, and 4-4.

[a] Calculated over all triplicate samples from the 2014 UCR Upland Soil Study (n=16) and the 2015 Bossburg Study (n=1).

[b] Count includes HQs from all DUs using either 95 UCL (for triplicate locations) or concentration multiplied by 1.15 (arithmetic mean of ratio of UCL95:mean for triplicate sample decision units [Section 6] as the soil concentration.

≥ = greater than or equal to

95 UCL = 95th upper confidence limit on the mean

COPC = chemical of potential concern

DU = decision unit

EPC = exposure point concentration

HQ = hazard quotient

NA = not applicable

TRV = toxicity reference value

UCR = Upper Columbia River

Table 8-7. Soil to Earthworm Bioaccumulation Model Uncertainty Analysis

COPC	Model Source	Number of Observations	Earthworm Bioaccumulation Model	Model Parameter (a)	Model Parameter (b)	Cworm (mg/kg-dw)	Soil RBC [Csoil] (mg/kg-dw)	Count of HQ ≥ 1 (% HQ ≥ 1): 2012 Ecology	Count of HQ ≥ 1 (% HQ ≥ 1): 2014 UCR Upland	Count of HQ ≥ 1 (% HQ ≥ 1): 2015 Bossburg
Cadmium	Sample et al. (1998)	114	Simple linear [exp(a*ln(Csoil)+b)]	0.795	2.11	27.4	5	59 (56%) [a]	79 (56%) [a]	0 (0.0%)
Cadmium	Richardson et al. (2020)	580	Log linear [a*Csoil^b]	11.181	0.5551	27.2	5	55 (52%)	77 (55%)	0 (0.0%)
Chromium	Sample et al. (1998)	48	Simple BAF [a*Csoil]	0.306	NA	5924	19,359	0 (0.0%)	0 (0.0%)	0 (0.0%)
Chromium	Richardson et al. (2020)	96	Log linear BAF [Csoil*(a*Csoil^b)]	4.3495	-0.2482 [b]	6201	15,677	0 (0.0%)	0 (0.0%)	0 (0.0%)
Copper	Sample et al. (1998)	103	Simple BAF [a*Csoil]	0.515	NA	136	264	0 (0.0%)	0 (0.0%)	0 (0.0%)
Copper	Richardson et al. (2020)	608	Log linear BAF [Csoil*(a*Csoil^b)]	11.368	-0.811	45.1	324	0 (0.0%)	0 (0.0%)	0 (0.0%)
Lead	Sample et al. (1998)	119	Simple linear [exp(a*ln(Csoil)+b)]	0.807	-0.218	44.9	146	74 (70%)	85 (60%) [a]	4 (67%)
Lead	Richardson et al. (2020)	593	Simple BAF [a*Csoil]	0.4	NA	47.4	119	80 (75%)	104 (74%)	4 (67%)
Mercury	Sample et al. (1998)	15	Simple BAF [a*Csoil]	1.69	NA	0.129	0.076	50 (47%)	74 (52%) [a]	3 (50%)
Mercury	Richardson et al. (2020)	200	Log linear [a*Csoil^b]	2.3814	0.7324	0.174	0.028	101 (95%)	137 (97%)	6 (100%)
Zinc	Sample et al. (1998)	123	Simple linear [exp(a*ln(Csoil)+b)]	0.328	4.45	618	414	35 (33%)	28 (20%) [a]	0 (0.0%)
Zinc	Richardson et al. (2020)	601	Log linear BAF [Csoil*(a*Csoil^b)]	107.86	-0.779	437	564	17 (16%)	2 (1.4%)	0 (0.0%)

Sources:

Richardson, J.B., J.H. Görres, and Tom Sizmur. "Synthesis of earthworm trace metal uptake and bioaccumulation data: Role of soil concentration, earthworm ecophysiology, and experimental design." *Environmental Pollution*. Volume 262. https://doi.org/10.1016/j.envpol.2020.114126.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, and G.W. Suter. 1998. *Development and Validation of Bioaccumulation Models for Small Mammals*. Lockheed Martin Report No. ES/ER/TM 219. Oak Ridge National Laboratory, Oak Ridge, TN.

[a] Baseline (Sample et al., 1998a) counts of HQ ≥ 1 differ slightly from those in Table 8-1 through 8-3 due to differences in rounding between calculation methods and because calculations in this table used the maximum RBA rather than sample-specific RBAs.

[b] Value reported in Richardson et al. (2020) was positive, but was used here as a negative for consistency with figure in Richardson et al. (2020).

≥ = greater than or equal to
BAF = bioaccumulation factor
COPC = chemical of potential concern
Cworm = COPC concentration in worms
Csoil = COPC concentration in soil
HQ = hazard quotient
log = logarithmic
ln = natural logarithm
mg/kg-dw = milligram(s) per kilogram dry weight
NA = not applicable
RBA = relative bioavailability assessment
RBC = risk-based concentration (soil COPC concentration equivalent to a dietary HQ = 1)
UCR = Upper Columbia River

Table 8-8. Soil to Earthworm Bioaccumulation Model Uncertainty Analysis

				Model Parameter		Ratio					Count of HQ≥1 (% HQ ≥ 1)		
COPC	Receptor	Scenario	Earthworm Bioaccumulation Model	(a)	(b)	Earthworm	Terrestrial Arthropod	Flying Insect	Reproduction TRV (mg/kg bw/day)	Soil RBC [Csoil] (mg/kg-dw)	2012 Ecology	2014 UCR	2015 Bossburg
Lead	California quail	Baseline	NA	NA	NA	NA	NA	NA	4.7	948	6 (5.7%)[a]	0 (0.0%)	1 (17%)
Lead	California quail	95 UCL	NA	NA	NA	NA	NA	NA	4.7	948	6 (5.7%)	0 (0.0%)	1 (17%)
Lead	California quail	Alternative TRV	NA	NA	NA	NA	NA	NA	9.8	1991	0 (0.0%)	0 (0.0%)	1 (17%)
Lead	American robin	Baseline	Simple linear [exp(a*ln(Csoil)+b)]	0.807	-0.218	NA	NA	NA	4.7	146	74 (70%)	85 (60%) [a]	4 (67%)
Lead	American robin	95 UCL	Simple linear [exp(a*ln(Csoil)+b)]	0.807	-0.218	NA	NA	NA	4.7	146	74 (70%)	97 (69%)	4 (67%)
Lead	American robin	Alternative earthworm model	a*Csoil	0.4	NA	NA	NA	NA	4.7	119	80 (75%)	104 (74%)	4 (67%)
Lead	American robin	Alternative TRV	Simple linear [exp(a*ln(Csoil)+b)]	0.807	-0.218	NA	NA	NA	9.8	323	43 (41%)	25 (18%)	2 (33%)
Lead	American robin	95 UCL, alternative earthworm model, alternative TRV	a*Csoil	0.4	NA	NA	NA	NA	9.8	253	60 (57%)	61 (43%)	3 (50%)
Lead	Black capped chickadee	Baseline	NA	NA	NA	NA	NA	NA	4.7	322	43 (41%)	25 (18%) [a]	2 (33%)
Lead	Black capped chickadee	95 UCL	NA	NA	NA	NA	NA	NA	4.7	322	43 (41%)	38 (27%)	2 (33%)
Lead	Black capped chickadee	Alternative TRV	NA	NA	NA	NA	NA	NA	9.8	807	9 (8.5%)	0 (0.0%)	1 (17%)
Lead	Black capped chickadee	95 UCL, alternative TRV	NA	NA	NA	NA	NA	NA	9.8	807	9 (8.5%)	0 (0.0%)	1 (17%)
Lead	Tree swallow	Baseline	NA	NA	NA	NA	NA	NA	4.7	2312	0 (0.0%)	0 (0.0%)	1 (17%)
Lead	Tree swallow	95 UCL	NA	NA	NA	NA	NA	NA	4.7	2312	0 (0.0%)	0 (0.0%)	1 (17%)
Lead	Tree swallow	Alternative TRV	NA	NA	NA	NA	NA	NA	9.8	6733	0 (0.0%)	0 (0.0%)	0 (0.0%)
Lead	Tree swallow	95 UCL, alternative TRV	NA	NA	NA	NA	NA	NA	9.8	6733	0 (0.0%)	0 (0.0%)	0 (0.0%)
Lead	American kestrel	Baseline	NA	NA	NA	NA	NA	NA	4.7	490	26 (25%) [a]	8 (5.7%)	1 (17%)
Lead	American kestrel	95 UCL	NA	NA	NA	NA	NA	NA	4.7	490	26 (25%)	10 (7.1%)	1 (17%)
Lead	American kestrel	Alternative TRV	NA	NA	NA	NA	NA	NA	9.8	1354	2 (1.9%)	0 (0.0%)	1 (17%)
Lead	American kestrel	95 UCL, alternative TRV	NA	NA	NA	NA	NA	NA	9.8	1354	2 (1.9%)	0 (0.0%)	1 (17%)
Mercury	California quail	Baseline	NA	NA	NA	NA	1	NA	0.012	1.01	0 (0.0%)	0 (0.0%)	0 (0.0%)
Mercury	California quail	95 UCL	NA	NA	NA	NA	1	NA	0.012	1.01	0 (0.0%)	0 (0.0%)	0 (0.0%)
Mercury	American robin	Baseline	Simple linear [exp(a*ln(Csoil)+b)]	0.795	2.11	1	1	NA	0.012	0.076	50 (47%)	74 (52%)	3 (50%)
Mercury	American robin	95 UCL	Simple linear [exp(a*ln(Csoil)+b)]	0.795	2.11	1	1	NA	0.012	0.076	50 (47%)	84 (60%)	3 (50%)
Mercury	American robin	Alternative earthworm model	Log linear [a*Csoil^b]	2.3814	0.7324	1	1	NA	0.012	0.028	101 (95%)	137 (97%)	6 (100%)
Mercury	American robin	Alternative TRV	Simple linear [exp(a*ln(Csoil)+b)]	0.795	2.11	1	1	NA	0.02	0.253	19 (18%)	9 (6.4%)	1 (17%)
Mercury	American robin	Methylmercury apportionment	Simple linear [exp(a*ln(Csoil)+b)]	0.795	2.11	0.33	0.581	NA	0.012	0.178	9 (8.5%)	0 (0.0%)	1 (17%)
Mercury	American robin	95 UCL, earthworm model, alternative TRV, methylmercury apportionment	Log linear [a*Csoil^b]	2.3814	0.7324	0.33	0.581	NA	0.02	0.355	9 (8.5%)	0 (0.0%)	1 (17%)
Mercury	Black capped chickadee	Baseline	NA	NA	NA	NA	1	NA	0.012	0.078	49 (46%)	71 (50%)	3 (50%)
Mercury	Black capped chickadee	95 UCL	NA	NA	NA	NA	1	NA	0.012	0.078	49 (46%)	89 (63%)	3 (50%)
Mercury	Black capped chickadee	Alternative TRV	NA	NA	NA	NA	1	NA	0.02	0.258	19 (18%)	8 (5.7%)	1 (17%)
Mercury	Black capped chickadee	Methylmercury apportionment	NA	NA	NA	NA	0.581	NA	0.012	0.131	19 (18%)	8 (5.7%)	1 (17%)
Mercury	Black capped chickadee	95 UCL, alternative TRV, methylmercury apportionment	NA	NA	NA	NA	0.581	NA	0.02	0.438	5 (4.7%)	0 (0.0%)	1 (17%)
Mercury	Tree swallow	Baseline	NA	NA	NA	NA	NA	1	0.012	0.096	35 (33%) [b]	39 (28%) [b]	3 (50%)
Mercury	Tree swallow	95 UCL	NA	NA	NA	NA	NA	1	0.012	0.096	35 (33%)	56 (40%)	3 (50%)
Mercury	Tree swallow	Alternative TRV	NA	NA	NA	NA	NA	1	0.02	0.32	11 (10%)	2 (1.4%)	1 (17%)
Mercury	Tree swallow	Methylmercury apportionment	NA	NA	NA	NA	NA	0.581	0.012	0.165	11 (10%)	0 (0.0%)	1 (17%)
Mercury	Tree swallow	95 UCL, alternative TRV, methylmercury apportionment	NA	NA	NA	NA	NA	0.581	0.02	0.551	3 (2.8%)	0 (0.0%)	1 (17%)
Mercury	American kestrel	Baseline	NA	NA	NA	NA	NA	NA	0.012	5.3	0 (0.0%)	0 (0.0%)	0 (0.0%)
Mercury	American kestrel	95 UCL	NA	NA	NA	NA	NA	NA	0.012	5.3	0 (0.0%)	0 (0.0%)	0 (0.0%)

Notes:

[a] Note that for lead, Baseline RBC counts of HQ ≥ 1 differ from those in Table 8-1 through 8-3 because calculations in this table used the maximum RBA rather than sample-specific RBAs.

[b] Note that for mercury some Baseline RBC counts of tree swallow HQ ≥ 1 for 2012 Ecology and 2014 UCR Upland soil study data sets differ slightly from those in Table 8-1 through 8-3 due to differences in rounding of model parameters between calculation methods.

[c] 95 UCLs estimated as sample concentration multiplied by 1.15 (so those samples where there were triplicates differ from those in Table 8-6).

≥ = greater than or equal to
95 UCL = 95 percent upper confidence limit of the mean
COPC = chemical of potential concern
Csoil = COPC concentration in soil
HQ = hazard quotient
log = logarithmic
ln = natural logarithm
mg/kg bw/day = milligram(s) per kilogram of body weight per day
mg/kg-dw = milligram(s) per kilogram dry weight
NA = not applicable
RBA = relative bioavailability assessment
RBC = risk-based concentration (soil COPC concentration equivalent to a dietary HQ = 1)
TRV = toxicity reference value
UCR = Upper Columbia River

Table 8-9. Summary of Maximum HQs for the Dietary Exposure for the Most Exposed Mammal Receptor at Each Location

			Cadmium		Lead		Mercury			Selenium		Zinc	
Study	Location ID	Summary COPCs with TRV HQ ≥ 1	American Robin Growth TRV HQ	Detect	American Robin Reproduction TRV HQ	Detect	American Robin Reproduction TRV HQ	Detect	Concentration > BTV	Black-capped chickadee Growth TRV HQ	Detect	Black-capped Chickadee Growth TRV HQ	Detect
2012 Ecology Upland Soil Study	SA1-1C	Pb	0.78	Yes	1.0	Yes	0.96	Yes	No	0.70	No	0.61	Yes
2012 Ecology Upland Soil Study	SA1-2C	NA	0.55	Yes	0.61	Yes	0.55	Yes	No	0.58	No	0.70	Yes
2012 Ecology Upland Soil Study	SA1-3C	NA	0.31	Yes	0.48	Yes	0.66	Yes	No	0.58	No	0.57	Yes
2012 Ecology Upland Soil Study	SA1-4C	NA	0.31	Yes	0.31	Yes	0.58	Yes	No	0.58	No	0.59	Yes
2012 Ecology Upland Soil Study	SA1-5C	NA	0.47	Yes	0.54	Yes	0.6	Yes	No	0.58	No	0.57	Yes
2012 Ecology Upland Soil Study	SA1-6C	NA	0.45	Yes	0.66	Yes	0.52	Yes	No	0.58	No	0.57	Yes
2012 Ecology Upland Soil Study	SA1-7C	NA	0.43	Yes	0.5	Yes	0.64	Yes	No	0.58	No	0.59	Yes
2012 Ecology Upland Soil Study	SA1-8C	NA	0.53	Yes	0.6	Yes	0.77	Yes	No	0.58	No	0.59	Yes
2012 Ecology Upland Soil Study	SA10-1C	Cd,Pb,Hg	1.5	Yes	1.9	Yes	1.4	Yes	No	0.58	No	0.98	Yes
2012 Ecology Upland Soil Study	SA10-2C	Cd,Pb,Hg,Se,Zn	5.1	Yes	6.0	Yes	3.0	Yes	Yes	1.5	Yes	3.5	Yes
2012 Ecology Upland Soil Study	SA10-3C	Cd,Pb,Hg,Zn	3.4	Yes	2.3	Yes	1.2	Yes	No	0.58	Yes	2.2	Yes
2012 Ecology Upland Soil Study	SA10-4C	Cd,Pb,Hg,Se	1.3	Yes	1.4	Yes	1.5	Yes	No	6.1	Yes	0.60	Yes
2012 Ecology Upland Soil Study	SA10-5C	Pb,Hg	0.99	Yes	1.2	Yes	1.1	Yes	No	0.58	No	0.73	Yes
2012 Ecology Upland Soil Study	SA10-6C	Pb,Hg	0.92	Yes	1.1	Yes	1.0	Yes	No	0.58	No	0.76	Yes
2012 Ecology Upland Soil Study	SA10-7C	Cd,Pb,Hg,Zn	1.7	Yes	1.5	Yes	1.2	Yes	No	0.58	No	1.4	Yes
2012 Ecology Upland Soil Study	SA10-8C	Cd,Pb,Hg,Zn	1.5	Yes	1.8	Yes	1.6	Yes	Yes	0.58	No	1.1	Yes
2012 Ecology Upland Soil Study	SA11-1C	NA	0.57	Yes	0.59	Yes	0.46	Yes	No	0.58	No	0.60	Yes
2012 Ecology Upland Soil Study	SA11-2C	NA	0.63	Yes	0.66	Yes	0.66	Yes	No	0.58	No	0.64	Yes
2012 Ecology Upland Soil Study	SA11-3C	NA	0.61	Yes	0.75	Yes	0.97	Yes	No	0.82	Yes	0.63	Yes
2012 Ecology Upland Soil Study	SA11-4C	Cd,Pb,Hg,Zn	2.3	Yes	2.7	Yes	1.7	Yes	Yes	0.58	No	1.9	Yes
2012 Ecology Upland Soil Study	SA11-5C	Cd,Pb,Hg,Zn	1.4	Yes	2.2	Yes	2.0	Yes	Yes	0.58	No	1.1	Yes
2012 Ecology Upland Soil Study	SA11-6C	Cd,Pb,Hg	1.3	Yes	3.2	Yes	1.4	Yes	No	0.58	No	0.83	Yes
2012 Ecology Upland Soil Study	SA11-7C	Cd,Pb,Hg,Se,Zn	2.6	Yes	9.5	Yes	6.9	Yes	Yes	2.3	No	3.0	Yes
2012 Ecology Upland Soil Study	SA11-8C	Cd,Pb,Hg,Zn	2.5	Yes	4.4	Yes	2.4	Yes	Yes	0.58	No	1.7	Yes
2012 Ecology Upland Soil Study	SA11-9C	Cd,Pb,Hg,Zn	2.8	Yes	3.8	Yes	2.0	Yes	Yes	0.70	Yes	2.0	Yes
2012 Ecology Upland Soil Study	SA12-1C	Cd,Pb,Hg,Zn	1.3	Yes	1.3	Yes	1.0	Yes	No	0.58	No	1.1	Yes
2012 Ecology Upland Soil Study	SA12-2C	Pb	0.69	Yes	1.5	Yes	0.83	Yes	No	0.58	No	0.68	Yes
2012 Ecology Upland Soil Study	SA12-3C	Pb,Hg	0.92	Yes	1.4	Yes	1.8	Yes	Yes	0.70	Yes	0.64	Yes
2012 Ecology Upland Soil Study	SA12-4C	Pb	0.91	Yes	1.1	Yes	0.59	Yes	No	0.58	No	0.73	Yes
2012 Ecology Upland Soil Study	SA12-6C	NA	0.78	Yes	0.79	Yes	0.96	Yes	No	0.58	No	0.74	Yes
2012 Ecology Upland Soil Study	SA12-7C	Cd,Pb,Zn	1.1	Yes	1.3	Yes	0.85	Yes	No	0.58	No	1.2	Yes
2012 Ecology Upland Soil Study	SA12-8C	Pb	0.65	Yes	1.6	Yes	0.88	Yes	No	0.58	No	0.72	Yes
2012 Ecology Upland Soil Study	SA12-9C	NA	0.53	Yes	0.49	Yes	0.60	Yes	No	0.58	No	0.60	Yes
2012 Ecology Upland Soil Study	SA13-1C	NA	0.61	Yes	0.71	Yes	0.58	Yes	No	0.58	No	0.61	Yes
2012 Ecology Upland Soil Study	SA13-2C	Pb,Hg,Se	0.98	Yes	1.2	Yes	1.3	Yes	No	2.0	Yes	0.81	Yes
2012 Ecology Upland Soil Study	SA13-3C	Pb,Hg	0.89	Yes	1.1	Yes	1.1	Yes	No	0.58	No	0.79	Yes
2012 Ecology Upland Soil Study	SA13-4C	Se	0.38	Yes	0.27	Yes	0.76	Yes	No	2.30	No	0.60	Yes
2012 Ecology Upland Soil Study	SA13-5C	Cd,Pb,Hg,Zn	2.2	Yes	3.3	Yes	1.5	Yes	No	0.58	No	1.7	Yes
2012 Ecology Upland Soil Study	SA13-6C	Pb,Hg	0.84	Yes	1.8	Yes	1.3	Yes	No	0.58	No	0.77	Yes
2012 Ecology Upland Soil Study	SA13-7C	Pb	0.65	Yes	1.7	Yes	0.89	Yes	No	0.58	No	0.68	Yes
2012 Ecology Upland Soil Study	SA13-8C	Pb	0.69	Yes	1.1	Yes	0.90	Yes	No	0.58	No	0.63	Yes
2012 Ecology Upland Soil Study	SA2-1C	Cd,Pb,Zn	1.1	Yes	1.5	Yes	0.81	Yes	No	0.58	No	1.3	Yes
2012 Ecology Upland Soil Study	SA2-2C	NA	0.53	Yes	0.63	Yes	0.52	Yes	No	0.58	No	0.74	Yes
2012 Ecology Upland Soil Study	SA2-3C	NA	0.51	Yes	0.74	Yes	0.39	Yes	No	0.58	No	0.57	Yes
2012 Ecology Upland Soil Study	SA2-4C	Cd,Pb	1.1	Yes	1.5	Yes	0.79	Yes	No	0.58	No	0.74	Yes
2012 Ecology Upland Soil Study	SA2-5C	NA	0.41	Yes	0.53	Yes	0.56	Yes	No	0.58	No	0.54	Yes
2012 Ecology Upland Soil Study	SA2-6C	Cd,Pb,Zn	2.3	Yes	2.3	Yes	0.87	Yes	No	0.58	No	1.4	Yes
2012 Ecology Upland Soil Study	SA2-7C	NA	0.76	Yes	0.74	Yes	0.54	Yes	No	0.58	No	0.63	Yes
2012 Ecology Upland Soil Study	SA2-8C	NA	0.55	Yes	0.44	Yes	0.43	Yes	No	0.58	No	0.67	Yes
2012 Ecology Upland Soil Study	SA3-1C	NA	0.21	Yes	0.26	Yes	0.29	Yes	No	0.58	No	0.51	Yes
2012 Ecology Upland Soil Study	SA3-2C	NA	0.41	Yes	0.49	Yes	0.41	Yes	No	0.58	No	0.58	Yes
2012 Ecology Upland Soil Study	SA3-3C	Pb	0.91	Yes	1.1	Yes	0.47	Yes	No	0.58	No	0.77	Yes
2012 Ecology Upland Soil Study	SA3-4C	NA	0.45	Yes	0.55	Yes	0.35	Yes	No	0.58	No	0.57	Yes
2012 Ecology Upland Soil Study	SA3-5C	NA	0.59	Yes	0.70	Yes	0.33	Yes	No	0.58	No	0.58	Yes

Table 8-9. Summary of Maximum HQs for the Dietary Exposure for the Most Exposed Mammal Receptor at Each Location

			Cadmium		Lead		Mercury			Selenium		Zinc	
Study	Location ID	Summary COPCs with TRV HQ ≥ 1	American Robin Growth TRV HQ	Detect	American Robin Reproduction TRV HQ	Detect	American Robin Reproduction TRV HQ	Detect	Concentration > BTV	Black-capped chickadee Growth TRV HQ	Detect	Black-capped Chickadee Growth TRV HQ	Detect
2012 Ecology Upland Soil Study	SA3-6C	Cd,Pb,Hg,Zn	2.0	Yes	2.9	Yes	1.9	Yes	Yes	0.58	No	1.7	Yes
2012 Ecology Upland Soil Study	SA3-7C	Cd,Pb,Hg,Zn	1.5	Yes	2.5	Yes	1.4	Yes	No	0.58	No	1.0	Yes
2012 Ecology Upland Soil Study	SA3-8C	Pb	0.84	Yes	1.3	Yes	0.67	Yes	No	0.58	No	0.71	Yes
2012 Ecology Upland Soil Study	SA4-1C	Cd,Pb	1.1	Yes	1.3	Yes	0.75	Yes	No	0.58	No	0.78	Yes
2012 Ecology Upland Soil Study	SA4-2C	NA	0.8	Yes	0.86	Yes	0.64	Yes	No	0.58	No	0.62	Yes
2012 Ecology Upland Soil Study	SA4-3C	Cd,Pb,Hg	1.7	Yes	2.5	Yes	1.0	Yes	No	0.58	No	0.98	Yes
2012 Ecology Upland Soil Study	SA4-4C	Cd,Pb	1.2	Yes	1.4	Yes	0.96	Yes	No	0.58	No	0.85	Yes
2012 Ecology Upland Soil Study	SA4-5C	NA	0.67	Yes	0.75	Yes	0.51	Yes	No	0.58	No	0.63	Yes
2012 Ecology Upland Soil Study	SA4-6C	Cd,Pb,Hg,Zn	1.7	Yes	2.9	Yes	1.8	Yes	Yes	0.58	No	1.1	Yes
2012 Ecology Upland Soil Study	SA4-7C	Cd,Pb	1.2	Yes	1.8	Yes	0.98	Yes	No	0.58	No	0.77	Yes
2012 Ecology Upland Soil Study	SA4-8C	NA	0.84	Yes	0.91	Yes	0.67	Yes	No	0.58	No	0.62	Yes
2012 Ecology Upland Soil Study	SA5-1C	Cd,Pb,Hg	1.2	Yes	1.9	Yes	1.2	Yes	No	0.70	No	0.85	Yes
2012 Ecology Upland Soil Study	SA5-2C	NA	0.85	Yes	0.91	Yes	0.66	Yes	No	0.58	No	0.71	Yes
2012 Ecology Upland Soil Study	SA5-3C	Cd,Pb,Hg,Zn	1.6	Yes	1.7	Yes	1.2	Yes	No	0.58	No	1.4	Yes
2012 Ecology Upland Soil Study	SA5-4C	Cd,Pb,Hg	1.5	Yes	2.0	Yes	1.0	Yes	No	0.58	No	0.95	Yes
2012 Ecology Upland Soil Study	SA5-5C	NA	0.71	Yes	0.8	Yes	0.56	Yes	No	0.58	No	0.6	Yes
2012 Ecology Upland Soil Study	SA5-7C	Cd,Pb,Hg,Zn	1.8	Yes	2.2	Yes	1.5	Yes	No	0.58	No	1.2	Yes
2012 Ecology Upland Soil Study	SA5-8C	Cd,Pb	1.2	Yes	1.9	Yes	0.89	Yes	No	0.58	No	0.70	Yes
2012 Ecology Upland Soil Study	SA6-1C	Cd,Pb,Hg,Zn	1.6	Yes	2.3	Yes	1.3	Yes	No	0.58	No	1.2	Yes
2012 Ecology Upland Soil Study	SA6-2C	Cd,Pb,Hg,Zn	1.7	Yes	2.3	Yes	1.1	Yes	No	0.58	No	1.2	Yes
2012 Ecology Upland Soil Study	SA6-3C	Cd,Pb,Hg,Zn	1.9	Yes	3.0	Yes	1.2	Yes	No	0.58	No	1.2	Yes
2012 Ecology Upland Soil Study	SA6-4C	NA	0.43	Yes	0.63	Yes	0.34	Yes	No	0.58	No	0.52	Yes
2012 Ecology Upland Soil Study	SA6-5C	NA	0.34	Yes	0.46	Yes	0.2	Yes	No	0.58	No	0.49	Yes
2012 Ecology Upland Soil Study	SA6-6C	Cd,Pb,Hg	1.6	Yes	3.5	Yes	1.4	Yes	No	0.58	No	0.98	Yes
2012 Ecology Upland Soil Study	SA6-7C	Cd,Pb,Hg,Zn	1.8	Yes	3.5	Yes	1.4	Yes	No	0.58	No	1.4	Yes
2012 Ecology Upland Soil Study	SA6-8C	NA	0.63	Yes	0.82	Yes	0.38	Yes	No	0.58	No	0.57	Yes
2012 Ecology Upland Soil Study	SA7-1C	Cd,Pb	1.2	Yes	1.9	Yes	0.84	Yes	No	0.58	No	0.9	Yes
2012 Ecology Upland Soil Study	SA7-2C	Cd,Pb,Zn	1.2	Yes	1.8	Yes	0.98	Yes	No	0.58	No	1.1	Yes
2012 Ecology Upland Soil Study	SA7-3C	Cd,Pb,Hg	1.4	Yes	3.5	Yes	1.2	Yes	No	0.58	No	0.79	Yes
2012 Ecology Upland Soil Study	SA7-4C	Cd,Pb	1.0	Yes	1.7	Yes	0.72	Yes	No	0.58	No	0.62	Yes
2012 Ecology Upland Soil Study	SA7-5C	Cd,Pb,Hg,Zn	1.7	Yes	4.9	Yes	2.5	Yes	Yes	0.58	No	1.3	Yes
2012 Ecology Upland Soil Study	SA7-6C	Cd,Pb,Hg,Zn	2.0	Yes	2.7	Yes	1.5	Yes	No	0.58	No	1.7	Yes
2012 Ecology Upland Soil Study	SA7-7C	Cd,Pb,Hg,Zn	2.8	Yes	6.5	Yes	3.6	Yes	Yes	0.70	Yes	3.0	Yes
2012 Ecology Upland Soil Study	SA7-8C	Cd,Pb,Hg,Zn	2.4	Yes	4.7	Yes	2.2	Yes	Yes	0.58	No	2.0	Yes
2012 Ecology Upland Soil Study	SA8-1C	Cd,Pb,Hg,Zn	2.0	Yes	2.2	Yes	1.1	Yes	No	0.58	No	1.5	Yes
2012 Ecology Upland Soil Study	SA8-2C	Cd,Pb	1.6	Yes	2.2	Yes	0.94	Yes	No	0.58	No	0.87	Yes
2012 Ecology Upland Soil Study	SA8-3C	NA	0.73	Yes	0.89	Yes	0.43	Yes	No	0.58	No	0.59	Yes
2012 Ecology Upland Soil Study	SA8-4C	Cd,Pb,Hg	1.3	Yes	2.6	Yes	1.3	Yes	No	0.58	No	0.81	Yes
2012 Ecology Upland Soil Study	SA8-5C	Cd,Pb,Hg,Zn	1.7	Yes	4.0	Yes	2.1	Yes	Yes	0.58	No	1.1	Yes
2012 Ecology Upland Soil Study	SA8-6C	Cd,Pb	1.4	Yes	1.9	Yes	0.72	Yes	No	0.58	No	0.98	Yes
2012 Ecology Upland Soil Study	SA8-7C	Cd,Pb,Hg,Zn	3.0	Yes	5.5	Yes	2.2	Yes	Yes	0.58	No	2.3	Yes
2012 Ecology Upland Soil Study	SA8-8C	Cd,Pb,Hg,Zn	3.0	Yes	7.0	Yes	3.8	Yes	Yes	0.82	Yes	3.2	Yes
2012 Ecology Upland Soil Study	SA9-10C	Cd,Pb,Hg,Zn	1.9	Yes	2.4	Yes	1.5	Yes	No	0.58	No	1.2	Yes
2012 Ecology Upland Soil Study	SA9-1C	Cd,Pb,Hg,Zn	3.7	Yes	5.0	Yes	1.8	Yes	Yes	0.58	No	2.1	Yes
2012 Ecology Upland Soil Study	SA9-2C	Cd,Pb	1.1	Yes	1.4	Yes	0.71	Yes	No	0.58	No	0.95	Yes
2012 Ecology Upland Soil Study	SA9-3C	Pb	0.95	Yes	1.1	Yes	0.71	Yes	No	0.58	No	0.78	Yes
2012 Ecology Upland Soil Study	SA9-4C	Cd,Pb,Hg,Se,Zn	1.3	Yes	2.7	Yes	2.1	Yes	Yes	1.2	Yes	1.3	Yes
2012 Ecology Upland Soil Study	SA9-5C	Cd,Pb,Hg,Zn	2.2	Yes	2.9	Yes	2.5	Yes	Yes	0.58	No	1.9	Yes
2012 Ecology Upland Soil Study	SA9-6C	Cd,Pb,Hg,Zn	2.4	Yes	3.3	Yes	2.4	Yes	Yes	0.58	No	1.5	Yes
2012 Ecology Upland Soil Study	SA9-7C	Cd,Pb,Hg,Zn	2.3	Yes	3.0	Yes	1.5	Yes	No	0.58	No	1.5	Yes
2012 Ecology Upland Soil Study	SA9-8C	Cd,Pb,Hg,Zn	2.6	Yes	3.6	Yes	3.4	Yes	Yes	0.58	No	2.3	Yes
2012 Ecology Upland Soil Study	SA9-9C	Cd,Pb,Zn	1.8	Yes	2.1	Yes	0.89	Yes	No	0.58	No	1.1	Yes
2014 UCR Upland Soil Study	ADA-001	Cd,Pb	1.4	Yes	1.9	Yes	0.90	Yes	No	0.32	Yes	0.82	Yes
2014 UCR Upland Soil Study	ADA-002	NA	0.7	Yes	0.37	Yes	0.31	Yes	No	0.88	Yes	0.81	Yes

Table 8-9. Summary of Maximum HQs for the Dietary Exposure for the Most Exposed Mammal Receptor at Each Location

			Cadmium		Lead		Mercury			Selenium		Zinc	
Study	Location ID	Summary COPCs with TRV HQ ≥ 1	American Robin Growth TRV HQ	Detect	American Robin Reproduction TRV HQ	Detect	American Robin Reproduction TRV HQ	Detect	Concentration > BTV	Black-capped chickadee Growth TRV HQ	Detect	Black-capped Chickadee Growth TRV HQ	Detect
2014 UCR Upland Soil Study	ADA-004	Cd,Pb	1.3	Yes	1.0	Yes	0.87	Yes	No	0.60	Yes	0.93	Yes
2014 UCR Upland Soil Study	ADA-005	Se	0.74	Yes	0.52	Yes	0.38	Yes	No	1.1	Yes	0.79	Yes
2014 UCR Upland Soil Study	ADA-006	Pb	0.93	Yes	1.2	Yes	0.55	Yes	No	0.23	Yes	0.65	Yes
2014 UCR Upland Soil Study	ADA-008	Cd,Pb,Hg	1.4	Yes	2.3	Yes	1.4	Yes	No	0.47	Yes	0.87	Yes
2014 UCR Upland Soil Study	ADA-010	Cd,Pb,Hg,Zn	1.8	Yes	2.3	Yes	1.4	Yes	No	0.46	Yes	1.1	Yes
2014 UCR Upland Soil Study	ADA-015	NA	0.67	Yes	0.96	Yes	0.63	Yes	No	0.17	Yes	0.59	Yes
2014 UCR Upland Soil Study	ADA-016	NA	0.68	Yes	0.79	Yes	0.43	Yes	No	0.17	Yes	0.56	Yes
2014 UCR Upland Soil Study	ADA-017	Cd,Pb	1.2	Yes	1.6	Yes	0.77	Yes	No	0.27	Yes	0.77	Yes
2014 UCR Upland Soil Study	ADA-018	Cd,Pb,Hg,Zn	1.9	Yes	3.2	Yes	1.4	Yes	No	0.41	Yes	1.2	Yes
2014 UCR Upland Soil Study	ADA-019	NA	0.53	Yes	0.54	Yes	0.47	Yes	No	0.26	Yes	0.59	Yes
2014 UCR Upland Soil Study	ADA-020	NA	0.5	Yes	0.52	Yes	0.30	Yes	No	0.20	Yes	0.57	Yes
2014 UCR Upland Soil Study	ADA-021	NA	0.56	Yes	0.48	Yes	0.56	Yes	No	0.44	Yes	0.59	Yes
2014 UCR Upland Soil Study	ADA-023	Cd	1.3	Yes	0.90	Yes	0.52	Yes	No	0.97	Yes	0.84	Yes
2014 UCR Upland Soil Study	ADA-024	Cd,Pb,Hg,Zn	1.9	Yes	2.7	Yes	1.8	Yes	Yes	0.43	Yes	1.2	Yes
2014 UCR Upland Soil Study	ADA-025	Cd,Pb,Hg,Zn	2.0	Yes	1.7	Yes	1.0	Yes	No	0.68	Yes	1.4	Yes
2014 UCR Upland Soil Study	ADA-026	Cd,Zn	1.4	Yes	0.72	Yes	0.90	Yes	No	0.67	Yes	1.1	Yes
2014 UCR Upland Soil Study	ADA-028	Cd,Pb	1.2	Yes	1.6	Yes	0.79	Yes	No	0.23	Yes	0.73	Yes
2014 UCR Upland Soil Study	ADA-033	Cd,Zn	1.1	Yes	0.59	Yes	0.38	Yes	No	0.44	Yes	1.3	Yes
2014 UCR Upland Soil Study	ADA-034	NA	0.46	Yes	0.44	Yes	0.34	Yes	No	0.36	Yes	0.70	Yes
2014 UCR Upland Soil Study	ADA-035	Cd,Pb,Zn	1.2	Yes	1.5	Yes	0.83	Yes	No	0.23	Yes	1.1	Yes
2014 UCR Upland Soil Study	ADA-039	Cd	1.2	Yes	0.37	Yes	0.37	Yes	No	0.39	Yes	0.78	Yes
2014 UCR Upland Soil Study	ADA-042	NA	0.59	Yes	0.81	Yes	0.63	Yes	No	0.34	Yes	0.61	Yes
2014 UCR Upland Soil Study	ADA-043	Cd	1.1	Yes	0.8	Yes	0.88	Yes	No	0.74	Yes	0.8	Yes
2014 UCR Upland Soil Study	ADA-044	Cd,Pb,Hg,Zn	2.2	Yes	1.0	Yes	1.0	Yes	No	0.79	Yes	1.3	Yes
2014 UCR Upland Soil Study	ADA-045	Cd,Pb,Hg,Zn	1.9	Yes	2.7	Yes	1.5	Yes	No	0.46	Yes	1.1	Yes
2014 UCR Upland Soil Study	ADA-046	Cd,Pb	1.1	Yes	1.6	Yes	0.98	Yes	No	0.29	Yes	0.69	Yes
2014 UCR Upland Soil Study	ADA-047	Cd,Pb,Hg,Zn	1.5	Yes	1.9	Yes	1.1	Yes	No	0.43	Yes	1.3	Yes
2014 UCR Upland Soil Study	ADA-048	Cd,Hg	1.1	Yes	0.87	Yes	1.1	Yes	No	0.91	Yes	0.80	Yes
2014 UCR Upland Soil Study	ADA-049	Cd	1.4	Yes	0.44	Yes	0.60	Yes	No	0.56	Yes	0.80	Yes
2014 UCR Upland Soil Study	ADA-050	Cd,Pb,Hg,Zn	1.9	Yes	2.2	Yes	1.4	Yes	No	0.77	Yes	1.4	Yes
2014 UCR Upland Soil Study	ADA-051	Cd,Se,Zn	1.6	Yes	0.78	Yes	0.51	Yes	No	1.0	Yes	1.1	Yes
2014 UCR Upland Soil Study	ADA-052	Cd,Pb,Hg,Zn	1.8	Yes	2.2	Yes	1.6	Yes	Yes	0.46	Yes	1.2	Yes
2014 UCR Upland Soil Study	ADA-053	Hg	0.61	Yes	0.84	Yes	1.0	Yes	No	0.4	Yes	0.63	Yes
2014 UCR Upland Soil Study	ADA-054	Cd,Pb,Hg,Zn	1.8	Yes	2.3	Yes	1.6	Yes	Yes	0.48	Yes	1.2	Yes
2014 UCR Upland Soil Study	ADA-055	Cd,Pb,Zn	1.9	Yes	1.3	Yes	0.52	Yes	No	0.98	Yes	1.5	Yes
2014 UCR Upland Soil Study	ADA-056	NA	0.59	Yes	0.66	Yes	0.54	Yes	No	0.25	Yes	0.64	Yes
2014 UCR Upland Soil Study	ADA-057	NA	0.71	Yes	0.82	Yes	0.68	Yes	No	0.28	Yes	0.61	Yes
2014 UCR Upland Soil Study	ADA-058	NA	0.60	Yes	0.66	Yes	0.79	Yes	No	0.21	Yes	0.67	Yes
2014 UCR Upland Soil Study	ADA-059	Hg	0.81	Yes	0.91	Yes	1.0	Yes	No	0.34	Yes	0.70	Yes
2014 UCR Upland Soil Study	ADA-060	Cd,Pb,Hg	1.5	Yes	1.8	Yes	1.3	Yes	No	0.37	Yes	0.97	Yes
2014 UCR Upland Soil Study	ADA-061	NA	0.70	Yes	0.87	Yes	0.59	Yes	No	0.25	Yes	0.66	Yes
2014 UCR Upland Soil Study	ADA-062	Cd,Pb,Hg	1.3	Yes	1.6	Yes	1.1	Yes	No	0.28	Yes	0.82	Yes
2014 UCR Upland Soil Study	ADA-063	Cd,Pb,Hg	1.4	Yes	1.1	Yes	1.2	Yes	No	0.44	Yes	0.80	Yes
2014 UCR Upland Soil Study	ADA-064	NA	0.67	Yes	0.88	Yes	0.56	Yes	No	0.44	Yes	0.70	Yes
2014 UCR Upland Soil Study	ADA-065	NA	0.76	Yes	0.95	Yes	0.56	Yes	No	0.20	Yes	0.60	Yes
2014 UCR Upland Soil Study	ADA-066	Cd,Pb	1.0	Yes	1.2	Yes	0.72	Yes	No	0.25	Yes	0.72	Yes
2014 UCR Upland Soil Study	ADA-067	Cd	1.6	Yes	0.73	Yes	0.77	Yes	No	0.44	Yes	0.78	Yes
2014 UCR Upland Soil Study	ADA-070	Cd,Pb,Hg	1.3	Yes	1.8	Yes	1.5	Yes	No	0.48	Yes	0.90	Yes
2014 UCR Upland Soil Study	ADA-071	Cd,Pb	1.2	Yes	1.8	Yes	0.94	Yes	No	0.32	Yes	0.76	Yes
2014 UCR Upland Soil Study	ADA-073	Cd,Pb,Hg	1.1	Yes	1.7	Yes	1.3	Yes	No	0.36	Yes	0.72	Yes
2014 UCR Upland Soil Study	ADA-076	Cd,Pb,Hg,Zn	2.2	Yes	2.4	Yes	2.2	Yes	Yes	0.81	Yes	1.4	Yes
2014 UCR Upland Soil Study	ADA-078	Cd,Pb,Hg	1.3	Yes	1.7	Yes	1.1	Yes	No	0.37	Yes	0.79	Yes
2014 UCR Upland Soil Study	ADA-079	Cd,Pb,Hg,Zn	2.1	Yes	1.2	Yes	1.4	Yes	No	0.53	Yes	1.2	Yes
2014 UCR Upland Soil Study	ADA-081	Pb	0.71	Yes	1.0	Yes	0.79	Yes	No	0.27	Yes	0.59	Yes

Table 8-9. Summary of Maximum HQs for the Dietary Exposure for the Most Exposed Mammal Receptor at Each Location

			Cadmium		Lead		Mercury			Selenium		Zinc	
Study	Location ID	Summary COPCs with TRV HQ ≥ 1	American Robin Growth TRV HQ	Detect	American Robin Reproduction TRV HQ	Detect	American Robin Reproduction TRV HQ	Detect	Concentration > BTV	Black-capped chickadee Growth TRV HQ	Detect	Black-capped Chickadee Growth TRV HQ	Detect
2014 UCR Upland Soil Study	ADA-082	Pb,Hg	0.76	Yes	1.0	Yes	1.0	Yes	No	0.42	Yes	0.63	Yes
2014 UCR Upland Soil Study	ADA-084	Pb,Hg	0.91	Yes	1.1	Yes	1.3	Yes	No	0.36	Yes	0.77	Yes
2014 UCR Upland Soil Study	ADA-085	Hg,Zn	0.94	Yes	0.91	Yes	1.4	Yes	No	0.56	Yes	2.8	Yes
2014 UCR Upland Soil Study	ADA-088	Cd,Pb,Hg	1.2	Yes	1.5	Yes	1.3	Yes	No	0.48	Yes	0.80	Yes
2014 UCR Upland Soil Study	ADA-089	Cd,Pb,Hg	1.2	Yes	1.6	Yes	1.1	Yes	No	0.39	Yes	0.83	Yes
2014 UCR Upland Soil Study	ADA-090	Cd,Pb,Hg	1.2	Yes	1.4	Yes	1.6	Yes	Yes	0.35	Yes	0.82	Yes
2014 UCR Upland Soil Study	ADA-091	Cd,Pb,Hg	1.5	Yes	1.6	Yes	1.2	Yes	No	0.39	Yes	0.95	Yes
2014 UCR Upland Soil Study	ADA-092	Cd,Pb,Hg,Zn	1.6	Yes	1.6	Yes	1.2	Yes	No	0.65	Yes	1.1	Yes
2014 UCR Upland Soil Study	ADA-093	Pb,Hg	0.99	Yes	1.3	Yes	1.1	Yes	No	0.39	Yes	0.76	Yes
2014 UCR Upland Soil Study	ADA-094	NA	0.52	Yes	0.7	Yes	0.75	Yes	No	0.21	Yes	0.59	Yes
2014 UCR Upland Soil Study	ADA-095	Pb,Hg	0.70	Yes	1.0	Yes	1.1	Yes	No	0.34	Yes	0.62	Yes
2014 UCR Upland Soil Study	ADA-096	Cd,Pb,Hg	1.3	Yes	1.8	Yes	1.3	Yes	No	0.44	Yes	0.83	Yes
2014 UCR Upland Soil Study	ADA-097	Cd,Pb,Hg,Zn	1.8	Yes	2.3	Yes	1.7	Yes	Yes	0.55	Yes	1.2	Yes
2014 UCR Upland Soil Study	ADA-099	Cd,Pb,Hg	1.2	Yes	1.6	Yes	1.6	Yes	Yes	0.34	Yes	0.86	Yes
2014 UCR Upland Soil Study	ADA-101	Pb,Hg	0.89	Yes	1.2	Yes	1.2	Yes	No	0.47	Yes	0.74	Yes
2014 UCR Upland Soil Study	ADA-102	NA	0.70	Yes	0.97	Yes	0.68	Yes	No	0.32	Yes	0.67	Yes
2014 UCR Upland Soil Study	ADA-103	NA	0.85	Yes	0.84	Yes	0.92	Yes	No	0.40	Yes	0.75	Yes
2014 UCR Upland Soil Study	ADA-104	Hg	0.64	Yes	0.67	Yes	1.0	Yes	No	0.55	Yes	0.70	Yes
2014 UCR Upland Soil Study	ADA-105	Cd,Pb,Hg,Zn	1.4	Yes	1.6	Yes	1.4	Yes	No	0.33	Yes	1.0	Yes
2014 UCR Upland Soil Study	ADA-106	Hg	0.74	Yes	0.67	Yes	1.0	Yes	No	0.91	Yes	0.72	Yes
2014 UCR Upland Soil Study	ADA-107	Cd,Pb,Hg	1.2	Yes	1.1	Yes	1.2	Yes	No	0.39	Yes	0.88	Yes
2014 UCR Upland Soil Study	ADA-108	Pb	0.88	Yes	1.0	Yes	0.96	Yes	No	0.25	Yes	0.69	Yes
2014 UCR Upland Soil Study	ADA-109	Cd,Pb,Hg,Zn	1.5	Yes	1.9	Yes	1.7	Yes	Yes	0.54	Yes	1.0	Yes
2014 UCR Upland Soil Study	ADA-110	Cd,Pb	1.1	Yes	1.3	Yes	0.88	Yes	No	0.26	Yes	0.75	Yes
2014 UCR Upland Soil Study	ADA-111	NA	0.67	Yes	0.73	Yes	0.94	Yes	No	0.23	Yes	0.63	Yes
2014 UCR Upland Soil Study	ADA-112	Hg	0.78	Yes	0.73	Yes	1.2	Yes	No	0.35	Yes	0.63	Yes
2014 UCR Upland Soil Study	ADA-113	Hg	0.68	Yes	0.96	Yes	1.4	Yes	No	0.30	Yes	0.61	Yes
2014 UCR Upland Soil Study	ADA-114	Hg	0.70	Yes	0.95	Yes	1.3	Yes	No	0.25	Yes	0.65	Yes
2014 UCR Upland Soil Study	ADA-115	NA	0.66	Yes	0.97	Yes	0.97	Yes	No	0.21	Yes	0.63	Yes
2014 UCR Upland Soil Study	ADA-116	NA	0.65	Yes	0.90	Yes	0.85	Yes	No	0.23	Yes	0.61	Yes
2014 UCR Upland Soil Study	ADA-117	Pb	0.86	Yes	1.1	Yes	0.73	Yes	No	0.19	Yes	0.67	Yes
2014 UCR Upland Soil Study	ADA-118	Cd,Hg	1.1	Yes	0.99	Yes	1.0	Yes	No	0.26	Yes	0.82	Yes
2014 UCR Upland Soil Study	ADA-119	Pb,Hg	0.88	Yes	1.1	Yes	1.0	Yes	No	0.22	Yes	0.71	Yes
2014 UCR Upland Soil Study	ADA-121	Cd,Pb,Hg	1.2	Yes	1.4	Yes	1.2	Yes	No	0.36	Yes	0.95	Yes
2014 UCR Upland Soil Study	ADA-122	Hg	0.71	Yes	0.71	Yes	1.1	Yes	No	0.42	Yes	0.68	Yes
2014 UCR Upland Soil Study	ADA-124	Pb	0.76	Yes	1.5	Yes	0.92	Yes	No	0.29	Yes	0.59	Yes
2014 UCR Upland Soil Study	ADA-125	Pb	0.6	Yes	1.1	Yes	0.70	Yes	No	0.22	Yes	0.56	Yes
2014 UCR Upland Soil Study	ADA-126	Cd,Pb,Hg	1.5	Yes	2.3	Yes	1.4	Yes	No	0.39	Yes	0.86	Yes
2014 UCR Upland Soil Study	ADA-127	Cd,Pb	1.3	Yes	1.2	Yes	0.51	Yes	No	0.44	Yes	0.97	Yes
2014 UCR Upland Soil Study	ADA-128	Cd,Pb	1.1	Yes	1.4	Yes	0.51	Yes	No	0.21	Yes	0.71	Yes
2014 UCR Upland Soil Study	ADA-131	Cd,Pb,Hg,Zn	1.8	Yes	3.1	Yes	1.8	Yes	Yes	0.64	Yes	1.1	Yes
2014 UCR Upland Soil Study	ADA-132	Pb	0.77	Yes	1.5	Yes	0.90	Yes	No	0.26	Yes	0.64	Yes
2014 UCR Upland Soil Study	ADA-133	Cd,Pb	1.1	Yes	1.6	Yes	0.80	Yes	No	0.30	Yes	0.77	Yes
2014 UCR Upland Soil Study	ADA-135	NA	0.65	Yes	0.79	Yes	0.45	Yes	No	0.29	Yes	0.67	Yes
2014 UCR Upland Soil Study	ADA-136	Cd,Pb	1.2	Yes	1.3	Yes	0.81	Yes	No	0.26	Yes	0.78	Yes
2014 UCR Upland Soil Study	ADA-139	Cd,Pb,Hg	1.1	Yes	1.4	Yes	1.0	Yes	No	0.43	Yes	0.82	Yes
2014 UCR Upland Soil Study	ADA-141	Hg	0.74	Yes	0.94	Yes	1.1	Yes	No	0.22	Yes	0.64	Yes
2014 UCR Upland Soil Study	ADA-142	Cd,Pb	1.1	Yes	1.5	Yes	0.73	Yes	No	0.23	Yes	0.73	Yes
2014 UCR Upland Soil Study	ADA-143	NA	0.72	Yes	0.95	Yes	0.58	Yes	No	0.25	Yes	0.60	Yes
2014 UCR Upland Soil Study	ADA-144	Cd,Pb	1.2	Yes	1.6	Yes	0.81	Yes	No	0.30	Yes	0.71	Yes
2014 UCR Upland Soil Study	ADA-145	Cd,Pb,Hg	1.4	Yes	1.9	Yes	1.3	Yes	No	0.34	Yes	0.88	Yes
2014 UCR Upland Soil Study	ADA-146	Cd,Pb	1.3	Yes	1.7	Yes	0.83	Yes	No	0.29	Yes	0.88	Yes
2014 UCR Upland Soil Study	ADA-147	Cd,Pb,Hg	1.2	Yes	2.1	Yes	1.1	Yes	No	0.34	Yes	0.69	Yes
2014 UCR Upland Soil Study	ADA-148	Cd,Pb,Hg	1.2	Yes	2.1	Yes	1.0	Yes	No	0.28	Yes	0.69	Yes

Table 8-9. Summary of Maximum HQs for the Dietary Exposure for the Most Exposed Mammal Receptor at Each Location

			Cadmium		Lead		Mercury			Selenium		Zinc	
Study	**Location ID**	**Summary COPCs with TRV HQ ≥ 1**	**American Robin Growth TRV HQ**	**Detect**	**American Robin Reproduction TRV HQ**	**Detect**	**American Robin Reproduction TRV HQ**	**Detect**	**Concentration > BTV**	**Black-capped chickadee Growth TRV HQ**	**Detect**	**Black-capped Chickadee Growth TRV HQ**	**Detect**
2014 UCR Upland Soil Study	ADA-150	Cd,Pb	1.1	Yes	1.9	Yes	0.96	Yes	No	0.29	Yes	0.70	Yes
2014 UCR Upland Soil Study	ADA-151	Pb,Hg	0.80	Yes	2.1	Yes	1.3	Yes	No	0.32	Yes	0.73	Yes
2014 UCR Upland Soil Study	ADA-152	Cd,Pb,Hg,Zn	1.5	Yes	1.9	Yes	1.3	Yes	No	0.37	Yes	1.2	Yes
2014 UCR Upland Soil Study	ADA-153	Cd,Pb,Hg,Zn	1.5	Yes	1.9	Yes	1.1	Yes	No	0.36	Yes	1.0	Yes
2014 UCR Upland Soil Study	ADA-154	Cd,Pb,Hg	1.4	Yes	2.1	Yes	1.3	Yes	No	0.37	Yes	0.92	Yes
2014 UCR Upland Soil Study	ADA-155	Cd,Pb,Hg	1.1	Yes	1.6	Yes	1.0	Yes	No	0.29	Yes	0.74	Yes
2014 UCR Upland Soil Study	ADA-156	Cd,Pb,Hg,Zn	1.6	Yes	3.0	Yes	1.8	Yes	Yes	0.43	Yes	1.2	Yes
2014 UCR Upland Soil Study	ADA-158	Cd,Pb,Hg,Zn	1.6	Yes	3.1	Yes	1.6	Yes	Yes	0.53	Yes	1.3	Yes
2014 UCR Upland Soil Study	ADA-159	Cd,Pb,Hg,Zn	1.6	Yes	2.3	Yes	1.5	Yes	No	0.39	Yes	1.0	Yes
2014 UCR Upland Soil Study	ADA-160	Pb	0.96	Yes	1.4	Yes	0.79	Yes	No	0.21	Yes	0.64	Yes
2014 UCR Upland Soil Study	ADA-161	Cd,Pb,Hg	1.4	Yes	2.2	Yes	1.3	Yes	No	0.30	Yes	0.96	Yes
2014 UCR Upland Soil Study	ADA-162	Cd,Pb,Hg,Zn	2.0	Yes	3.8	Yes	2.0	Yes	Yes	0.49	Yes	1.4	Yes
2014 UCR Upland Soil Study	ADA-164	Cd,Pb,Hg,Zn	1.7	Yes	2.5	Yes	1.6	Yes	Yes	0.92	Yes	1.1	Yes
2014 UCR Upland Soil Study	ADA-165	Cd,Pb,Hg,Zn	2.0	Yes	2.8	Yes	1.9	Yes	Yes	0.44	Yes	1.5	Yes
2014 UCR Upland Soil Study	ADA-168	Cd,Pb,Hg,Zn	1.5	Yes	1.8	Yes	1.0	Yes	No	0.34	Yes	1.1	Yes
2014 UCR Upland Soil Study	ADA-169	NA	0.30	Yes	0.60	Yes	0.85	Yes	No	0.19	Yes	0.54	Yes
2014 UCR Upland Soil Study	ADA-170	Hg	0.61	Yes	0.86	Yes	1.2	Yes	No	0.36	Yes	0.94	Yes
2014 UCR Upland Soil Study	ADA-171	Hg,Zn	0.68	Yes	0.71	Yes	1.1	Yes	No	0.35	Yes	1.1	Yes
2014 UCR Upland Soil Study	ADA-172	Hg	0.29	Yes	0.62	Yes	1.3	Yes	No	0.30	Yes	0.50	Yes
2014 UCR Upland Soil Study	ADA-173	Hg	0.57	Yes	0.80	Yes	1.1	Yes	No	0.36	Yes	0.64	Yes
2014 UCR Upland Soil Study	ADA-174	Hg	0.80	Yes	0.70	Yes	1.5	Yes	No	0.40	Yes	0.68	Yes
2014 UCR Upland Soil Study	ADA-175	NA	0.30	Yes	0.59	Yes	0.66	Yes	No	0.20	Yes	0.56	Yes
2014 UCR Upland Soil Study	ADA-176	NA	0.28	Yes	0.49	Yes	0.72	Yes	No	0.19	Yes	0.55	Yes
2014 UCR Upland Soil Study	ADA-177	NA	0.24	Yes	0.56	Yes	0.93	Yes	No	0.21	Yes	0.54	Yes
2014 UCR Upland Soil Study	ADA-178	NA	0.25	Yes	0.46	Yes	0.77	Yes	No	0.20	Yes	0.60	Yes
2014 UCR Upland Soil Study	ADA-179	Hg	0.53	Yes	0.63	Yes	1.0	Yes	No	0.35	Yes	0.69	Yes
2014 UCR Upland Soil Study	ADA-180	Hg	0.93	Yes	0.82	Yes	1.1	Yes	No	0.63	Yes	0.97	Yes
2014 UCR Upland Soil Study	ADA-181	Hg	0.95	Yes	0.72	Yes	1.4	Yes	No	0.70	Yes	0.81	Yes
2014 UCR Upland Soil Study	ADA-182	Cd	1.1	Yes	0.36	Yes	0.85	Yes	No	0.72	Yes	0.72	Yes
2014 UCR Upland Soil Study	ADA-183	Cd,Hg,Se,Zn	2.4	Yes	0.39	Yes	2.1	Yes	Yes	3.9	Yes	1.5	Yes
2014 UCR Upland Soil Study	ADA-184	Cd	1.8	Yes	0.55	Yes	0.81	Yes	No	0.70	Yes	0.93	Yes
2015 Bossburg Study	UDU-01-ICS	Pb	0.36	Yes	1.1	Yes	0.58	Yes	No	0.16	Yes	0.54	Yes
2015 Bossburg Study	UDU-02-ICS	Pb,Hg	0.31	Yes	1.5	Yes	1.5	Yes	No	0.15	Yes	0.56	Yes
2015 Bossburg Study	UDU-03-ICS	Pb,Hg	0.29	Yes	2.1	Yes	1.6	Yes	No	0.15	Yes	0.55	Yes
2015 Bossburg Study	UDU-04-ICS	Pb,Hg	0.52	Yes	12	Yes	3.8	Yes	Yes	0.22	Yes	0.61	Yes
2015 Bossburg Study	UDU-05-ICS	NA	0.32	Yes	0.36	Yes	0.41	Yes	No	0.19	Yes	0.55	Yes
2015 Bossburg Study	UDU-06-ICS	NA	0.37	Yes	0.29	Yes	0.46	Yes	No	0.77	Yes	0.54	Yes

Notes:

HQs are based on average daily dose estimates calculated using values in Appendix F; a few HQs differ from those in Tables 8-1 through 8-3 due to rounding of values reported in Appendix F relative to values presented in Table 4-1, 4-2, and 4-4.

≥ = greater than or equal to
Cd = cadmium
COPC = chemical of potential concern
Hg = mercury
HQ = hazard quotient
ID = identification
NA = not applicable; no HQs ≥ 1
Pb = lead
Se = selenium
TRV = toxicity reference value
UCR = Upper Columbia River
Zn = zinc

Table 9-1. Summary of Dietary HQs for all Data Sets

			Meadow vole[a]			Masked shrew[a]			Little brown bat[a]			Short-tailed weasel[a]			Gray wolf[a]			Deer mouse[a]		
COPC	Soil Study	Number of Sample Locations	Survival	Growth	Reproduction	Survival	Growth	Reproduction	Survival	Growth	Reproduction	Survival	Growth	Reproduction	Survival	Growth	Reproduction	Survival	Growth	Reproduction
Aluminum	2012 Ecology Upland Soil Study	106	0 (0%)	0 (0%)	94 (89%)	1 (1%)	1 (1%)	95 (90%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	88 (83%)	0 (0%)	0 (0%)	2 (2%)	0 (0%)	0 (0%)	45 (42%)
Aluminum	2014 UCR Upland Soil Study	141	0 (0%)	0 (0%)	119 (84%)	0 (0%)	0 (0%)	120 (85%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	110 (78%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	31 (22%)
Aluminum	2015 Bossburg Study	6	0 (0%)	0 (0%)	3 (50%)	0 (0%)	0 (0%)	4 (67%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (33%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Cadmium	2012 Ecology Upland Soil Study	106	0 (0%)	0 (0%)	0 (0%)	67 (63%)	3 (3%)	22 (21%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)
Cadmium	2014 UCR Upland Soil Study	141	0 (0%)	0 (0%)	0 (0%)	90 (64%)	0 (0%)	14 (10%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Cadmium	2015 Bossburg Study	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Chromium	2012 Ecology Upland Soil Study	106	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)
Chromium	2014 UCR Upland Soil Study	141	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)
Chromium	2015 Bossburg Study	6	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)
Copper	2012 Ecology Upland Soil Study	106	0 (0%)	0 (0%)	0 (0%)	57 (54%)	30 (28%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Copper	2014 UCR Upland Soil Study	141	0 (0%)	0 (0%)	0 (0%)	45 (32%)	16 (11%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Copper	2015 Bossburg Study	6	0 (0%)	0 (0%)	0 (0%)	2 (33%)	1 (17%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Iron	2012 Ecology Upland Soil Study	106	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA
Iron	2014 UCR Upland Soil Study	141	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA
Iron	2015 Bossburg Study	6	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA
Lead	2012 Ecology Upland Soil Study	106	7 (7%)	0 (0%)	17 (16%)	67 (63%)	17 (16%)	82 (77%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	8 (8%)	0 (0%)	25 (24%)
Lead	2014 UCR Upland Soil Study	141	0 (0%)	0 (0%)	1 (1%)	66 (47%)	1 (1%)	109 (77%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	8 (6%)
Lead	2015 Bossburg Study	6	1 (17%)	1 (17%)	1 (17%)	3 (50%)	1 (17%)	4 (67%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (17%)	0 (0%)	0 (0%)	0 (0%)	1 (17%)	1 (17%)	1 (17%)
Mercury	2012 Ecology Upland Soil Study	106	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mercury	2014 UCR Upland Soil Study	141	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mercury	2015 Bossburg Study	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Molybdenum	2012 Ecology Upland Soil Study	106	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)
Molybdenum	2014 UCR Upland Soil Study	141	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)
Molybdenum	2015 Bossburg Study	6	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)
Selenium	2012 Ecology Upland Soil Study	106	0 (0%)	0 (0%)	0 (0%)	6 (6%)	13 (12%)	0 (0%)	1 (1%)	5 (5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	3 (3%)	0 (0%)
Selenium	2014 UCR Upland Soil Study	141	0 (0%)	0 (0%)	0 (0%)	1 (1%)	22 (16%)	0 (0%)	1 (1%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)
Selenium	2015 Bossburg Study	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (17%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Thallium	2012 Ecology Upland Soil Study	106	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA
Thallium	2014 UCR Upland Soil Study	141	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA
Thallium	2015 Bossburg Study	6	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA	0 (0%)	0 (0%)	NA
Zinc	2012 Ecology Upland Soil Study	106	0 (0%)	0 (0%)	0 (0%)	18 (17%)	71 (67%)	71 (67%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	8 (8%)	8 (8%)
Zinc	2014 UCR Upland Soil Study	141	0 (0%)	0 (0%)	0 (0%)	3 (2%)	101 (72%)	101 (72%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	1 (1%)
Zinc	2015 Bossburg Study	6	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Notes:

[a] Count and percentage of locations in each study with HQ ≥ 1 for the survival, growth, and reproduction TRVs.

HQs for each sample are presented in Appendix F

≥ = greater than or equal to

COPC = chemical of potential concern

HQ = hazard quotient

NA = not applicable, no TRV available

TRV = toxicity reference value

UCR = Upper Columbia River

Table 9-2. Summary of Dietary Effect Levels for HQs ≥ 1

			2012 Ecology Upland Soil Study						2014 UCR Upland Soil Study						2015 Bossburg Study					
					Of Locations with HQ ≥ 1						Of Locations with HQ ≥ 1						Of Locations with HQ ≥ 1			
Receptor	COPC	Endpoint	Number of Locations	Number of Locations with HQ ≥ 1 [a]	Number with EDx ≥ ED20 and < ED50 [b]	Number with EDx ≥ ED50 [b]	Median EDx (or HQ)	Maximum EDx (or HQ)	Number of Locations	Number of Locations with HQ ≥ 1 [a]	Number with EDx ≥ ED20 and < ED50 [b]	Number with EDx ≥ ED50 [b]	Median EDx (or HQ)	Maximum EDx (or HQ)	Number of Locations	Number of Locations with HQ ≥ 1 [a]	Number with EDx ≥ ED20 and < ED50 [b]	Number with EDx ≥ ED50 [b]	Median EDx (or HQ)	Maximum EDx (or HQ)
Meadow vole	Aluminum	Reproduction	106	94 (89%)	94 (100%)	0 (0%)	31	48	141	119 (84%)	119 (100%)	0 (0%)	28	40	6	3 (50%)	3 (100%)	0 (0%)	22	23
Meadow vole	Lead	Survival	106	7 (7%)	6 (86%)	1 (14%)	34	73	NA	NA	NA	NA	NA	NA	6	1 (17%)	0 (0%)	1 (100%)	88	88
Meadow vole	Lead	Reproduction	106	17 (16%)	NA	NA	1.4	3.4	141	1 (1%)	NA	NA	1.2	1.2	6	1 (17%)	NA	NA	4.5	4.5
Meadow vole	Lead	Growth	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	1 (17%)	NA	NA	1	1
Masked shrew	Aluminum	Survival	106	1 (1%)	NA	NA	1.3	1.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Masked shrew	Aluminum	Growth	106	1 (1%)	NA	NA	1.3	1.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Masked shrew	Aluminum	Reproduction	106	95 (90%)	62 (65%)	33 (35%)	41	84	141	120 (85%)	106 (88%)	14 (12%)	35	67	6	4 (67%)	4 (100%)	0 (0%)	23	25
Masked shrew	Cadmium	Survival	106	67 (63%)	67 (100%)	0 (0%)	26	40	141	90 (64%)	90 (100%)	0 (0%)	24	31	NA	NA	NA	NA	NA	NA
Masked shrew	Cadmium	Growth	106	3 (3%)	3 (100%)	0 (0%)	22	26	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Masked shrew	Cadmium	Reproduction	106	22 (21%)	22 (100%)	0 (0%)	24	36	141	14 (10%)	14 (100%)	0 (0%)	21	24	NA	NA	NA	NA	NA	NA
Masked shrew	Copper	Survival	106	57 (54%)	NA	NA	1.4	2.8	141	45 (32%)	NA	NA	1.2	2.3	6	2 (33%)	NA	NA	1.7	2.4
Masked shrew	Copper	Growth	106	30 (28%)	12 (40%)	18 (60%)	53	97	141	16 (11%)	8 (50%)	8 (50%)	49	85	6	1 (17%)	0 (0%)	1 (100%)	90	90
Masked shrew	Lead	Survival	106	67 (63%)	24 (36%)	43 (64%)	63	99	141	66 (47%)	42 (64%)	24 (36%)	44	90	6	3 (50%)	1 (33%)	2 (67%)	61	99
Masked shrew	Lead	Growth	106	17 (16%)	NA	NA	1.3	2.7	141	1 (1%)	NA	NA	1.1	1.1	6	1 (17%)	NA	NA	3.5	3.5
Masked shrew	Lead	Reproduction	106	82 (77%)	NA	NA	2.5	12	141	109 (77%)	NA	NA	1.9	4.7	6	4 (67%)	NA	NA	2.45	15
Masked shrew	Selenium	Survival	106	6 (6%)	NA	NA	2	5.6	141	1 (1%)	NA	NA	3.6	3.6	NA	NA	NA	NA	NA	NA
Masked shrew	Selenium	Growth	106	13 (12%)	8 (62%)	5 (38%)	29	91	141	22 (16%)	21 (95%)	1 (5%)	28	81	6	1 (17%)	1 (100%)	0 (0%)	27	27
Masked shrew	Zinc	Survival	106	18 (17%)	NA	NA	1.4	2.4	141	3 (2%)	NA	NA	1	1.9	NA	NA	NA	NA	NA	NA
Masked shrew	Zinc	Growth	106	71 (67%)	NA	NA	1.9	6	141	101 (72%)	NA	NA	1.5	4.8	NA	NA	NA	NA	NA	NA
Masked shrew	Zinc	Reproduction	106	71 (67%)	NA	NA	1.9	6	141	101 (72%)	NA	NA	1.5	4.8	NA	NA	NA	NA	NA	NA
Little brown bat	Selenium	Survival	106	1 (1%)	NA	NA	2.2	2.2	141	1 (1%)	NA	NA	1.4	1.4	NA	NA	NA	NA	NA	NA
Little brown bat	Selenium	Growth	106	5 (5%)	4 (80%)	1 (20%)	33	68	141	1 (1%)	0 (0%)	1 (100%)	52	52	NA	NA	NA	NA	NA	NA
Short-tailed weasel	Aluminum	Reproduction	106	88 (83%)	88 (100%)	0 (0%)	29	43	141	110 (78%)	110 (100%)	0 (0%)	26	36	6	2 (33%)	2 (100%)	0 (0%)	21	21
Short-tailed weasel	Lead	Reproduction	106	1 (1%)	NA	NA	1.1	1.1	NA	NA	NA	NA	NA	NA	6	1 (17%)	NA	NA	1.3	1.3
Gray wolf	Aluminum	Reproduction	106	2 (2%)	2 (100%)	0 (0%)	22	22	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Deer mouse	Aluminum	Reproduction	106	45 (42%)	43 (96%)	2 (4%)	26	59	141	31 (22%)	31 (100%)	0 (0%)	23	37	NA	NA	NA	NA	NA	NA
Deer mouse	Cadmium	Survival	106	1 (1%)	1 (100%)	0 (0%)	21	21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Deer mouse	Lead	Survival	106	8 (8%)	6 (75%)	2 (25%)	37	73	NA	NA	NA	NA	NA	NA	6	1 (17%)	0 (0%)	1 (100%)	86	86
Deer mouse	Lead	Reproduction	106	25 (24%)	NA	NA	1.3	3.4	141	8 (6%)	NA	NA	1.1	1.4	6	1 (17%)	NA	NA	4.3	4.3
Deer mouse	Lead	Growth	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	1 (17%)	NA	NA	1	1
Deer mouse	Selenium	Survival	106	1 (1%)	NA	NA	1.6	1.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Deer mouse	Selenium	Growth	106	3 (3%)	2 (67%)	1 (33%)	22	55	141	1 (1%)	1 (100%)	0 (0%)	38	38	NA	NA	NA	NA	NA	NA
Deer mouse	Zinc	Growth	106	8 (8%)	NA	NA	1.3	1.7	141	1 (1%)	NA	NA	1.4	1.4	NA	NA	NA	NA	NA	NA
Deer mouse	Zinc	Reproduction	106	8 (8%)	NA	NA	1.3	1.7	141	1 (1%)	NA	NA	1.4	1.4	NA	NA	NA	NA	NA	NA

Notes:

[a] Percentage of total number of locations with HQ ≥ 1 for each study is shown in parentheses

[b] Percentage of the subset of locations with HQ ≥ 1 for each study is shown in parentheses

HQs and EDxs for each sample are presented in Appendix F

≥ = greater than or equal to

< = less than

COPC = chemical of potential concern

ED20 = effective dose with 20 percent reduction in the response relative to the control

ED50 = effective dose with 50 percent reduction in the response relative to the control

EDx = effective dose with an x percent reduction in the response relative to the control

HQ = hazard quotient

NA = not applicable

UCR = Upper Columbia River

Table 9-3. Summary of Mammal HQs and BTV comparisons for Each Study (for species and endpoints with HQ ≥1)

			2012 Ecology Upland Soil Study			2014 UCR Upland Soil Study			2015 Bossburg Study		
Receptor	COPC	Endpoint	Number of Locations with HQ ≥ 1	Locations with HQ ≥ 1 and Site ≤ BTV	Locations with HQ ≥ 1 and Site > BTV	Number of Locations with HQ ≥ 1	Locations with HQ ≥ 1 and Site ≤ BTV	Locations with HQ ≥ 1 and Site > BTV	Number of Locations with HQ ≥ 1	Locations with HQ ≥ 1 and Site ≤ BTV	Locations with HQ ≥ 1 and Site > BTV
Meadow vole	Aluminum	Reproduction	94 (89%)	94 (89%)	0 (0%)	119 (84%)	119 (84%)	0 (0%)	3 (50%)	3 (50%)	0 (0%)
Meadow vole	Lead	Survival	7 (7%)	0 (0%)	7 (7%)	NA	NA	NA	1 (17%)	0 (0%)	1 (17%)
Meadow vole	Lead	Reproduction	17 (16%)	0 (0%)	17 (16%)	1 (1%)	0 (0%)	1 (1%)	1 (17%)	0 (0%)	1 (17%)
Meadow vole	Lead	Growth	NA	NA	NA	NA	NA	NA	1 (17%)	0 (0%)	1 (17%)
Masked shrew	Aluminum	Survival	1 (1%)	1 (1%)	0 (0%)	NA	NA	NA	NA	NA	NA
Masked shrew	Aluminum	Growth	1 (1%)	1 (1%)	0 (0%)	NA	NA	NA	NA	NA	NA
Masked shrew	Aluminum	Reproduction	95 (90%)	95 (90%)	0 (0%)	120 (85%)	120 (85%)	0 (0%)	4 (67%)	4 (67%)	0 (0%)
Masked shrew	Cadmium	Survival	67 (63%)	0 (0%)	67 (63%)	90 (64%)	0 (0%)	90 (64%)	NA	NA	NA
Masked shrew	Cadmium	Growth	3 (3%)	0 (0%)	3 (3%)	NA	NA	NA	NA	NA	NA
Masked shrew	Cadmium	Reproduction	22 (21%)	0 (0%)	22 (21%)	14 (10%)	0 (0%)	14 (10%)	NA	NA	NA
Masked shrew	Copper	Survival	57 (54%)	44 (42%)	13 (12%)	45 (32%)	38 (27%)	7 (5%)	2 (33%)	1 (17%)	1 (17%)
Masked shrew	Copper	Growth	30 (28%)	17 (16%)	13 (12%)	16 (11%)	9 (6%)	7 (5%)	1 (17%)	0 (0%)	1 (17%)
Masked shrew	Lead	Survival	67 (63%)	0 (0%)	67 (63%)	66 (47%)	0 (0%)	66 (47%)	3 (50%)	0 (0%)	3 (50%)
Masked shrew	Lead	Growth	17 (16%)	0 (0%)	17 (16%)	1 (1%)	0 (0%)	1 (1%)	1 (17%)	0 (0%)	1 (17%)
Masked shrew	Lead	Reproduction	82 (77%)	0 (0%)	82 (77%)	109 (77%)	0 (0%)	109 (77%)	4 (67%)	0 (0%)	4 (67%)
Masked shrew	Selenium	Survival	6 (6%)	0 (0%)	6 (6%)	1 (1%)	0 (0%)	1 (1%)	NA	NA	NA
Masked shrew	Selenium	Growth	13 (12%)	0 (0%)	13 (12%)	22 (16%)	0 (0%)	22 (16%)	1 (17%)	0 (0%)	1 (17%)
Masked shrew	Zinc	Survival	18 (17%)	0 (0%)	18 (17%)	3 (2%)	0 (0%)	3 (2%)	NA	NA	NA
Masked shrew	Zinc	Growth	71 (67%)	0 (0%)	71 (67%)	101 (72%)	0 (0%)	101 (72%)	NA	NA	NA
Masked shrew	Zinc	Reproduction	71 (67%)	0 (0%)	71 (67%)	101 (72%)	0 (0%)	101 (72%)	NA	NA	NA
Little brown bat	Selenium	Survival	1 (1%)	0 (0%)	1 (1%)	1 (1%)	0 (0%)	1 (1%)	NA	NA	NA
Little brown bat	Selenium	Growth	5 (5%)	0 (0%)	5 (5%)	1 (1%)	0 (0%)	1 (1%)	NA	NA	NA
Short-tailed weasel	Aluminum	Reproduction	88 (83%)	88 (83%)	0 (0%)	110 (78%)	110 (78%)	0 (0%)	2 (33%)	2 (33%)	0 (0%)
Short-tailed weasel	Lead	Reproduction	1 (1%)	0 (0%)	1 (1%)	NA	NA	NA	1 (17%)	0 (0%)	1 (17%)
Gray wolf	Aluminum	Reproduction	2 (2%)	2 (2%)	0 (0%)	NA	NA	NA	NA	NA	NA
Deer mouse	Aluminum	Reproduction	45 (42%)	45 (42%)	0 (0%)	31 (22%)	31 (22%)	0 (0%)	NA	NA	NA
Deer mouse	Cadmium	Survival	1 (1%)	0 (0%)	1 (1%)	NA	NA	NA	NA	NA	NA
Deer mouse	Lead	Survival	8 (8%)	0 (0%)	8 (8%)	NA	NA	NA	1 (17%)	0 (0%)	1 (17%)
Deer mouse	Lead	Reproduction	25 (24%)	0 (0%)	25 (24%)	8 (6%)	0 (0%)	8 (6%)	1 (17%)	0 (0%)	1 (17%)
Deer mouse	Lead	Growth	NA	NA	NA	NA	NA	NA	1 (17%)	0 (0%)	1 (17%)
Deer mouse	Selenium	Survival	1 (1%)	0 (0%)	1 (1%)	NA	NA	NA	NA	NA	NA
Deer mouse	Selenium	Growth	3 (3%)	0 (0%)	3 (3%)	1 (1%)	0 (0%)	1 (1%)	NA	NA	NA
Deer mouse	Zinc	Growth	8 (8%)	0 (0%)	8 (8%)	1 (1%)	0 (0%)	1 (1%)	NA	NA	NA
Deer mouse	Zinc	Reproduction	8 (8%)	0 (0%)	8 (8%)	1 (1%)	0 (0%)	1 (1%)	NA	NA	NA

Notes:

[a] Percentage of total number of locations with HQ ≥ 1 for each study is shown in parentheses

HQs and BTV comparisons for each sample are presented in Appendix F

> = greater than

≥ = greater than or equal to

≤ = less than or equal to

BTV = background threshold value

COPC = chemical of potential concern

HQ = hazard quotient

NA = not applicable; COPC/endpoint not evaluated

UCR = Upper Columbia River

Table 9-4. Summary of Mammal LOE Uncertainties

Uncertainty	Overestimation or Underestimation of the Potential for Adverse Effects	Specific Areas of Applicability	Notes
Soil Chemistry EPCs			
Detection limits	0	NA	All soil chemistry results for COPCs and COIs in the 2014 UCR Upland Soil Study are detected values.
Sample density	?	NA	Concentrations of COPCs in soil outside of the sample locations included in the Upland BERA data sets may be inferred based on results from nearby samples. These inferences may potentially overestimate or underestimate exposure and associated effects.
Replicate samples	↓	NA	DU EPCs may under- or overestimate the true average COPC concentration due to variability and sampling error. The 2014 UCR Upland Soil and 2015 Bossburg studies included collection of one and three replicate ICS soil samples, respectively from a subset of DUs. Replicates were used to calculate 95 UCL on the mean COPC concentrations (UCL95) following EPA guidance. Uncertainty analyses shown in Table 9-5 indicate that use of the 95 UCL on the mean increases the number of DUs exceeding the benchmark for multiple COPCs.
Inconsistencies in the analyte form between benchmark and field chemistry	↑	mercury	While the TRVs for mercury are based on studies where organisms were exposed to methylmercury, the EPCs derived from the soil data from the three soil studies are for total mercury. Methylmercury concentrations at the site are expected to be composed of a small fraction of total mercury for most dietary items.
Bioaccumulation Models			
Generic models	?	NA	Except for plants, bioaccumulation models used for food chain uptake estimates are derived from studies reported in the scientific literature, which were mostly conducted using North American and European soils. None of these models are site specific nor do they adjust for bioavailability or species-specific differences in uptake.
Characteristics of the data underlying bioaccumulation model datasets.	?	NA	All bioaccumulation models used in the BERA relied on paired co-located soil and tissue data. There are several inherent uncertainties associated with these data: • Quality of bioaccumulation relationships improves as the spatial association between biota and soil samples increases. It is not uncommon for biota samples to be collected at locations that do not immediately correspond with soil locations due to habitat and biota availability issues. This increases uncertainty in the models. • Some data sets have biota and soil data that represent spatially aggregated concentrations. This averaging and the variable spatial extent represented by soil and tissue data impart uncertainty. • Some models are based on mobile biota (i.e., small mammals, arthropods) paired with soils from discrete locations. Tissue concentrations will represent the area over which these biota ranged and may be over- or under represented by the discrete sample location.
Robustness of model data sets	?	NA	Bioaccumulation models derived from data sets using only species and conditions found at the site are considered the most relevant. For most prey types, cadmium, copper, lead, and zinc have the greatest amount of available data for modeling. The COPCs with the fewest data are aluminum, molybdenum, selenium (terrestrial arthropods), thallium, and vanadium. None of the data sets used only relevant species and site conditions (Appendix C). Uncertainties may under- or overestimate actual site exposures.
Model types	?	NA	Regression models better account for variable uptake over differing concentrations in soil than BAFs, which are a static ratio, assuming the underlying data set is robust. There are more regression models for small mammals (7 of 13 metals), but a greater reliance on BAFs for plants, terrestrial arthropods, aerial insects, and earthworms. COPCs that have regression models for most biota types are cadmium, lead, and zinc. Uncertainties may under- or overestimate actual site exposures.
Plant bioaccumulation models	?	NA	The uncertainties associated with the site-specific plant bioaccumulation models are discussed in Appendix C. Briefly, the site-specific models have high environmental relevance, but may lack some spatial relevance across the entire Terrestrial Study Area. Development of the models required a correction factor between the fine (< 150 µm) and bulk (< 2 mm) soil fractions in site soils, which increases the uncertainty. The plant species and plant parts that were sampled and analyzed were chosen for human food or cultural purposes so likely provide reasonable estimates of edible species and plant parts that wildlife at the site consume.
Invertebrate bioaccumulation models	?	NA	Uncertainties associated with the specific terrestrial arthropod and aerial insect bioaccumulation models are discussed in Appendix C. The terrestrial arthropod and aerial insect models have high relevance to the prey types consumed by receptors in the Terrestrial Study Area; however, differences in site soil parameters, relevant invertebrate species, and variabilities in models may result in overestimation or underestimation of actual site exposures.

Table 9-4. Summary of Mammal LOE Uncertainties

Uncertainty	Overestimation or Underestimation of the Potential for Adverse Effects	Specific Areas of Applicability	Notes
Exposure Calculations			
Wildlife exposure factors	↑	NA	There are uncertainties associated with the model used to calculate dietary doses for the various mammal species. Food ingestion rates for representative species are estimated from allometric scaling equations reported in Nagy (2001) for broader mammalian feeding guilds or groups. As the selected receptors are intended to be potentially highly exposed with respect to their feeding guild, uncertainty associated with the estimated food ingestion rates may result in the overestimation of the potential exposure to other species within the feeding guild.
Foraging area and duration assumptions	↑	NA	The AUF for mammals in the Terrestrial Study Area is 1, which assumes that all mammal receptors in a population forage entirely in a given DU in all seasons of the year. As illustrated by the circles depicting the home range for each respective receptor of concern on Maps 9-1 through 9-20, most samples are located too far apart from one another for more than a single sample to fall within the home range of an individual of a given species, except little brown bat. The uncertainty associated with limited sample density may result in the under- or overestimation of exposure for individuals and is a conservative estimate for the assessment population.
Water ingestion	0	NA	Ingestion of surface waters is not considered a significant exposure pathway because surface water is not an exposure medium of concern for the Terrestrial Study Area (Section 2.5.1). The absence of water contribution to the dietary dose is an uncertainty but is not expected to impact the estimation of the dose because water concentrations are assumed to be an insignificant contribution to the total dose (Section 2.5.1).
Air inhalation	0	NA	Inhalation of COPCs in air is not considered a significant exposure pathway. This could potentially underestimate COPC exposure. However, as described in Section 2.5.5, the BERA Work Plan (TAI, 2011a) identified inhalation as a potentially complete but minor route of COPC uptake for wildlife. Thus, the COPC refinement did not evaluate COPC exposure through inhalation and it was not carried forward and evaluated in the Upland BERA. This is not expected to be a major source of uncertainty.
IVBA extrapolation across sample locations	?	NA	RBA estimates vary by COPC and sample as a function of IVBA. IVBA analyses for TAL metals were conducted on a limited number of sample locations. IVBA was analyzed in a subset of 2014 UCR Upland Soil Study DUs for all TAL metals, and for a subset of samples from other studies conducted for the RI/FS (Sections 3.1.2 and 3.2.2). These data were used to extrapolate to the remaining locations within the Upland BERA data sets. For lead and zinc, relationships were developed using soil characteristics (pH or TOC) that predicted metal bioavailability in the available IVBA data set. For all other COPCs, metal-specific means of the IVBA data from the subset of 2014 UCR Upland Soil Study DUs were used as surrogate values for sample locations without IVBA data. This extrapolation may overestimate or underestimate the bioaccessible fraction of incidentally ingested metals from soil. Sensitivity of risk estimates to RBA are presented in Table 9-5.
IVBA relevance to mammalian digestion	↑	NA	The IVBA process is based on the digestive system of a child and does not perfectly parallel conditions in the gastric systems of mammal receptors. The IVBA may overestimate the bioavailability of pH sensitive metals (e.g., lead) for mammals that are not carnivores. In addition, the IVBA may overestimate digestion time for small mammalian receptors and, thus, overestimate bioaccessibility for all metals for those receptors.
Bioavailability adjustments for soil ingestion, not food	↑	NA	The above bioavailability adjustments are applied for incidentally ingested soil only. Due to the lack of site-specific wildlife food bioavailability data and the greater uncertainty associated with developing generic literature-based bioavailability factors, the Upland BERA assumes a conservative RBA of 100% for food items. This presents an uncertainty that may result in the overestimation of bioavailability in food.
TRVs			
General TRV uncertainties	?	NA	There is no field verification of the predictive ability of the TRVs, in particular because TRVs are not based on UCR-receptor-specific data, UCR-specific metal forms, and laboratory exposures are often not relevant to field conditions. Uncertainties include individual study considerations such as test species, dose administration, chemical form, growth study exposure, dose calculation, and type of effect level (Appendix E). TRVs are often derived from low numbers of data sets, such as aluminum (growth, survival), chromium (III) (growth and reproduction), iron (survival), methylmercury (growth, reproduction), molybdenum (reproduction), selenium (reproduction), and thallium (survival and growth). Selection of the most sensitive test species for TRV derivation often results in overestimation, particularly in situations where the available data set represents several mammalian orders.
Antimony TRV uncertainties	?	Antimony	There were no TRVs available to evaluate growth, reproduction or survival in mammalian receptors from potential exposure to antimony in soils.

Table 9-4. Summary of Mammal LOE Uncertainties

Uncertainty	Overestimation or Underestimation of the Potential for Adverse Effects	Specific Areas of Applicability	Notes
TRVs continued			
Aluminum TRV uncertainties	↑	Survival, growth	Only one data set is available to develop the survival TRV (LOAEL ≥20), which may lead to an under- or overestimation of adverse effects and increases uncertainty in the TRV. The reproduction TRV is based on a modeled ED20 value derived from a dose-response model of fetal body weight in rodents. The TRV study used a soluble form of the metal (aluminum nitrate nonahydrate) that is not representative of form of metal likely in prey. The growth TRV is developed on mice during a non-critical lifestage and < 10% of the lifespan. Dose administration for all three TRVs was gavage, which may lead to an overestimation of adverse effects due to increased bioaccessibility.
Cadmium TRV uncertainties	↑	Survival, growth, reproduction	All three TRVs are based on modeled ED20 values derived from dose-response models. The growth TRV test species was tested at a critical lifestage. The TRV studies used a soluble form of the metal (cadmium chloride) that may not be representative of the metal form in prey. The dose administration method was gavage resulting in a potential overestimation of toxicity due to increased bioaccessibility of the soluble form of cadmium. The shrew cadmium growth TRV (Dodds-Smith et al., 1992) is 25 times greater than the growth TRV for mammals, via the same exposure route (diet) and testing at a critical lifestage. The shrew-specific TRV results in a 22 percent growth reduction relative to control as opposed to the ED20 for rat (Attachment E1 Table 4-8). It should be noted that the shrew LOAEL of 104 mg/kg/bw/day was the only dose tested in the study therefore, this is an unbounded LOAEL, which may result in an underestimation of adverse effects in growth of shrews from exposure to lead in soils.
Chromium TRV Uncertainties	↑	Growth, reproduction, survival	Very few data sets are available to assess chromium toxicity in mammalian receptors, which results in significant uncertainty regarding the toxicity. One data set was available for growth and two for reproduction. All three Tier 2 data sets reported LOAELs≥20, which may result in an underestimation of toxicity. Exposure in all studies was via drinking water, which may result in an overestimation of toxicity. Ingestion rates are obtained from secondary sources, which may result in an under- or overestimation of toxicity. Chemical form is Cr +3 (the more toxic form of chromium), which may be not represent the form of Cr in UCR soils leading to an overestimation of toxicity.
Copper TRV uncertainties	?	Growth, reproduction, survival	The growth TRV (Allcroft et al.,1961) is based on an ED20 derived from a dose-response model of juvenile pig body weight gain. The reproduction TRV is based on the lowest LOAEL ≥ 20 for mink kit (young) survival with an estimated effect level of 29.5 percent. The survival TRV is based on the geomean of two pooled data sets (Ritchie et al., 1963; Allcroft et al., 1961) of pig LOAEL ≥ 20 values with estimated effects between 25% and 100%, which may lead to an underestimate of effects. The TRV studies used soluble forms of the metal (copper sulfate) that is not representative of form of metal likely in prey. The BW and FIR for all TRVs are based on secondary sources, which could lead to an under- or overestimation of the dose and therefore toxicity.
Iron TRV Uncertainties	?	Growth and survival	No TRV is available for reproduction. The survival TRV (870 mg/kg bw/day [Whittaker et al., 1996]) is based on an ED20 using carbonyl iron and dietary exposure for rat. The second study (Whittaker et al., 2002) using carbonyl iron and gavage (single dose) exposure in rats resulted in a no effect level of 50,000 mg/kg bw/day, a significant difference that may likely be the result of the exposure route. The three data sets for the mammal survival TRV span significant effect levels. Two of the data sets with the highest effective doses used an exposure duration and route of single-dose gavage, which may result in an underestimation of toxicity. The form of iron in these two single dose gavage studies was different, which also influences the toxicity. The duration (single dose) is relevant because toxicity is expected to be chronic because iron is an essential mineral in mammals for cellular and tissue viability and is regulated through homeostatic mechanisms to control the amount of intestinal dietary and cellular iron uptake, distribution, and export. So, the single dose effects levels were at least in part regulated by mechanisms that influence the dose that results in toxicity. The single dose gavage study (Whittaker et al., 2002) considered for the growth TRV also resulted in the highest effective doses with a no effect at 1,200 mg/kg bw/day and 40,000 mg/kg bw/day LOAEL ≥ 20.
Lead TRV uncertainties	?	Growth, reproduction, survival	The growth TRV (Lorenzo et al., 1978) is based on the lowest LOAEL ≥ 20 for body weight gain in 1-day old rabbits with an estimated effect level of 41.2%. The exposure route is gavage, which may under- or overestimate toxicity. The reproduction TRV is the Eco-SSL NOAEL though a lower LOAEL ≥ 20 for 22% reduced reproduction in mouse was identified (Gupta et al., 1995; Appendix E1, Table 4-3). The survival TRV is based on the ED20, derived from a dose-response model. The survival TRV is based on exposure via gavage. The test species (rabbit) was tested during a critical lifestage. The survival and growth TRV studies used a soluble form of the metal (lead nitrate), which is not representative of form of metal likely in prey.

Table 9-4. Summary of Mammal LOE Uncertainties

Uncertainty	Overestimation or Underestimation of the Potential for Adverse Effects	Specific Areas of Applicability	Notes
Methylmercury TRV uncertainties	?	Growth, reproduction and survival	The methylmercury TRV is a conservative estimate of dietary toxicity of inorganic mercury to mammals. Methylmercury was not measured in UCR soils and the fraction of methylmercury relative to total mercury is likely small, which may lead to an overestimation of adverse effects. The growth TRV (Mitsumori et al., 1983) is based on a LOAEL ≥20, which may result in an underestimation of adverse effects. The survival and growth TRVs are based on dietary exposure of juvenile rats for between 104 and 130 weeks. The reproduction TRV (Verschuuren et al., 1976a) was selected from a limited number of data sets all reporting LOAELs and two using gavage as the exposure route potentially underestimating toxicity; one of the three studies reported a variable exposure rate, which leads to uncertainty with regard to the reliability of the study.
Molybdenum TRV uncertainties	?	Growth and reproduction	No TRV was available to assess the adverse effects on survival. Only one data set was available to generate the reproduction TRV (Fungwe et al., 1990) which may under- or overestimate the potential for adverse effects. The reproduction TRV is based on drinking water exposure leading to a potential overestimation of adverse effects due to potential for increased bioavailability of molybdenum. The growth TRV (Brinkman and Miller, 1961) is based on a LOAEL ≥ 20, which may lead to an underestimation of adverse effects on growth.
Selenium TRV uncertainties	?	Growth, reproduction, survival	The growth TRV is based on an ED20 derived from dose-response data on body weight, while the survival TRV is based on the lowest LOAEL ≥ 20 with an estimated effect level of 62%. The TRV studies used soluble forms of the metal (sodium selenite and D-selenomethionine), which may not be representative of the form of metal likely in prey. A total of six data sets were available upon which to base a TRV for growth, five report LOAELs ≥20 and the sixth was the ED20 (Mahan and Moxon, 1984). Only two data sets are available for the reproduction endpoint, both with reported LOAELs ≥20. For comparison, there were two data sets that reported no effect at 4.6 mg/kg bw/day dose, which is close to the 5.0 mg/kg bw/day dose selected as the reproduction TRV (Seidenberg et al., 1986). The exposure route for the reproduction studies was gavage and the exposure duration short (0.71 and 1.1 weeks). The lack of data leads to uncertainty in the reproduction TRV, the reliance on the LOAEL ≥20, and the short exposure period may lead to an underestimation of adverse effect, while the use of gavage may lead to an overestimation. There are nine studies from which to select a survival TRV, all based on dietary exposure. The number of data sets reduces uncertainty in the TRV, but all nine report LOAELS ≥20, which may underestimate the potential for adverse effects.
Thallium TRV uncertainties	?	Growth and survival	Both the growth and survival TRVs are based on the same source (Downs et al., 1960) and are modeled ED20s (2.1 mg/kg bw/day and 2.6 mg/kg bw/day) both from two pooled data sets reporting LOAELs ≥20. The limited data result in significant uncertainty and potential under- or overestimation of adverse effects.
Zinc TRV uncertainties	↓	Growth, reproduction, survival	The Eco-SSL (75.4 mg/kg bw/day) was selected as both the growth and reproduction TRVs. Lower growth and reproduction TRVs are available that were not selected. The lowest TRV for growth is an ED20 of 3.7 mg/kg bw/day (Khan et al., 2007; Table 4-5) resulting in a 36% reduction in body weight relative to control; this ED20 is 20 times lower than the Eco-SSL. The lowest reproduction TRV is a LOAEL of 14 mg/kg bw/day from Khan et al. (2007; Table 4-5) resulting in a 22.5% reduction in offspring survival; this TRV is five times lower than the Eco-SSL. The use of the Eco-SSL likely underestimates the potential for adverse effect on growth and reproduction. The survival TRV is based on a geomean of LOAEL ≥ 20 values from three pooled data sets with estimated effects between 25% and 37.5%. The TRV studies used zinc carbonate an insoluble form, which may not be representative of the form of metal likely in prey.
HQ Interpretation			
Use of HQs	↑	NA	As discussed in Section 5.1.1, HQs using conservative assumptions are a tool to rule out risk. The most appropriate interpretation of an HQ ≥ 1 is that potential risk cannot be ruled out. Otherwise the dose-response data underlying the TRVs must be considered to determine the likelihood that HQs ≥ 1 result in adverse effects.
Translation of HQs to population level attributes	↑	NA	When HQ < 1, inferring from the organism level to the population level is not expected to be a major source of uncertainty. However, when HQ ≥ 1, potential impacts at the organism level may not manifest as measurable impacts at the population level, leading to an overestimation of the potential for adverse population-level effects. In addition, the effect level most predictive of population-level effects likely varies depending on the endpoint and species.
COIs not quantitatively evaluated in the Upland BERA	0	Antimony	Antimony soil concentrations exceed the BTV. However, this metal has not been identified as a priority to study toxic effects on mammals, as shown by the lack of toxicity studies described in Appendix E. Therefore, the lack of a quantitative evaluation for antimony is not expected to underestimate the potential for adverse effects on mammals.
Background analysis	0	NA	As discussed in Section 6.3.5, the BTVs selected for use in the Terrestrial Study Area are in line with other available regional background values. The BTVs are therefore expected to contribute minimal uncertainty to the risk assessment.

Table 9-4. Summary of Mammal LOE Uncertainties

Uncertainty	Overestimation or Underestimation of the Potential for Adverse Effects	Specific Areas of Applicability	Notes
Metal interactions and essentiality			
Single chemical HQs	?	NA	The simultaneous exposure of mammals to elevated concentrations of multiple metals results in complex interactions, the effects are difficult to predict, and assumption of independent action may result in underestimates of the combined risks. For the purposes of this risk assessment, it is assumed that locations with multiple COCs exceeding benchmarks pose a greater risk to mammals than those locations with fewer exceedances and that risk at a specific location is at least as great as that associated with the COC with the highest HQ.
Essential nutrients	?	Chromium, copper, molybdenum, selenium, and zinc	Of the COPCs for mammals, chromium, copper, molybdenum, selenium, and zinc are identified as essential for vertebrate animals (EPA, 2007a; NRC, 2005). While essential levels of those metals for mammals in the Terrestrial Study Area were not developed in the Upland BERA, the doses from the basal diets, where provided, were accounted for in the derivation of the TRVs. However, the extent to which the nutritional requirements of mammals raised in the lab are representative of avian wildlife is uncertain. The implications of this uncertainty on the estimation of risks to mammals is unclear but the magnitude of uncertainty is likely small relative to overall uncertainty.

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↑ = likely to overestimate the potential for adverse effects
↓ = likely to underestimate the potential for adverse effects
? = uncertain and may either overestimate or underestimate the potential for adverse effects
0 = not expected to be a major source of uncertainty
≥ = greater than or equal to
< = less than
95 UCL = 95 percent upper confidence limit of the mean
µm = micrometer(s)
AUF = area use factor
BAF = bioaccumulation factor
BERA = baseline ecological risk assessment
BTV = background threshold value
BW = body weight
COI = chemical of interest
COPC = chemical of potential concern
Cr = chromium
DU = decision unit
Eco-SSL = ecological soil screening level
ED20 = effective dose with a 20 percent reduction in the response relative to the control
EPA = U.S. Environmental Protection Agency
EPC = exposure point concentration
FIR = food ingestion rate
HQ = hazard quotient
ICS = incremental composite samples
IVBA = in vitro bioaccessibility
LOAEL ≥ 20 = lowest observed adverse effect level with ≥ 20 percent reduction in the response relative to the control
LOE = line of evidence
mg/kg/bw/day = milligram(s) per kilogram of body weight per day
mm = millimeter(s)
NA = not applicable
NOAEL = no observed adverse effect level
RBA = relative bioavailability
RI/FS = remedial investigation and feasibility study
TAL = target analyte list
TOC = total organic carbon
TRV = toxicity reference value
UCR = Upper Columbia River

Table 9-5. Analysis of Uncertainty for Multiple Dietary Exposure Scenarios for each Mammal Receptor for each Study

		Count of HQ ≥ 1 [a]														
		2012 Ecology Upland Soil Study					2014 UCR Upland Soil Study					2015 Bossburg Study				
		Sample-Specific RBA	**Minimum RBA**	**Maximum RBA**	**RBA = 1**	**RBA = 0**	**Sample-Specific RBA**	**Minimum RBA**	**Maximum RBA**	**RBA = 1**	**RBA = 0**	**Sample-Specific RBA**	**Minimum RBA**	**Maximum RBA**	**RBA = 1**	**RBA = 0**
Deer mouse	Aluminum	45 (42%)	30 (28%)	67 (63%)	102 (96%)	15 (14%)	32 (23%)	13 (9%)	67 (48%)	140 (99%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	6 (100%)	0 (0%)
Deer mouse	Cadmium	1 (1%)	1 (1%)	1 (1%)	1 (1%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Deer mouse	Chromium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Deer mouse	Copper	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Deer mouse	Iron	0 (0%)	0 (0%)	0 (0%)	13 (12%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3 (2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Deer mouse	Lead	25 (24%)	18 (17%)	26 (25%)	29 (27%)	10 (9%)	8 (6%)	4 (3%)	8 (6%)	11 (8%)	0 (0%)	1 (17%)	1 (17%)	1 (17%)	2 (33%)	1 (17%)
Deer mouse	Mercury	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Deer mouse	Selenium	3 (3%)	3 (3%)	3 (3%)	3 (3%)	3 (3%)	1 (1%)	1 (1%)	1 (1%)	1 (1%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Deer mouse	Thallium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Deer mouse	Zinc	8 (8%)	7 (7%)	9 (8%)	9 (8%)	7 (7%)	1 (1%)	1 (1%)	1 (1%)	1 (1%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Deer mouse	Molybdenum	NA	NA	NA	NA	NA	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NA	NA	NA	NA	NA
Gray wolf	Aluminum	2 (2%)	1 (1%)	6 (6%)	48 (45%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	36 (26%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Gray wolf	Cadmium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Gray wolf	Chromium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Gray wolf	Copper	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Gray wolf	Iron	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Gray wolf	Lead	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Gray wolf	Mercury	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Gray wolf	Selenium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Gray wolf	Thallium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Gray wolf	Zinc	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Gray wolf	Molybdenum	NA	NA	NA	NA	NA	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NA	NA	NA	NA	NA
Little brown bat	Aluminum	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Little brown bat	Cadmium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Little brown bat	Chromium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Little brown bat	Copper	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Little brown bat	Iron	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Little brown bat	Lead	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Little brown bat	Mercury	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Little brown bat	Selenium	5 (5%)	5 (5%)	5 (5%)	5 (5%)	5 (5%)	1 (1%)	1 (1%)	1 (1%)	1 (1%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Little brown bat	Thallium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Little brown bat	Zinc	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Little brown bat	Molybdenum	NA	NA	NA	NA	NA	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NA	NA	NA	NA	NA
Masked shrew	Aluminum	95 (90%)	83 (78%)	101 (95%)	106 (100%)	59 (56%)	120 (85%)	94 (67%)	136 (96%)	141 (100%)	50 (35%)	4 (67%)	0 (0%)	6 (100%)	6 (100%)	0 (0%)
Masked shrew	Cadmium	67 (63%)	67 (63%)	67 (63%)	68 (64%)	67 (63%)	90 (64%)	90 (64%)	91 (65%)	91 (65%)	88 (62%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Masked shrew	Chromium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Masked shrew	Copper	57 (54%)	56 (53%)	57 (54%)	59 (56%)	56 (53%)	45 (32%)	44 (31%)	46 (33%)	52 (37%)	44 (31%)	2 (33%)	2 (33%)	2 (33%)	2 (33%)	2 (33%)
Masked shrew	Iron	0 (0%)	0 (0%)	6 (6%)	100 (94%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	135 (96%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (100%)	0 (0%)
Masked shrew	Lead	82 (77%)	80 (75%)	86 (81%)	87 (82%)	75 (71%)	109 (77%)	104 (74%)	111 (79%)	117 (83%)	93 (66%)	4 (67%)	4 (67%)	4 (67%)	4 (67%)	4 (67%)
Masked shrew	Mercury	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Masked shrew	Selenium	13 (12%)	13 (12%)	13 (12%)	106 (100%)	13 (12%)	22 (16%)	22 (16%)	22 (16%)	22 (16%)	22 (16%)	1 (17%)	1 (17%)	1 (17%)	1 (17%)	1 (17%)
Masked shrew	Thallium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Masked shrew	Zinc	71 (67%)	71 (67%)	71 (67%)	73 (69%)	71 (67%)	101 (72%)	98 (70%)	102 (72%)	102 (72%)	98 (70%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Masked shrew	Molybdenum	NA	NA	NA	NA	NA	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NA	NA	NA	NA	NA
Meadow vole	Aluminum	94 (89%)	81 (76%)	100 (94%)	106 (100%)	19 (18%)	119 (84%)	80 (57%)	134 (95%)	141 (100%)	5 (4%)	3 (50%)	0 (0%)	6 (100%)	6 (100%)	0 (0%)
Meadow vole	Cadmium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Meadow vole	Chromium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 9-5. Analysis of Uncertainty for Multiple Dietary Exposure Scenarios for each Mammal Receptor for each Study

		Count of HQ ≥ 1 [a]														
		2012 Ecology Upland Soil Study					**2014 UCR Upland Soil Study**					**2015 Bossburg Study**				
		Sample-Specific RBA	**Minimum RBA**	**Maximum RBA**	**RBA = 1**	**RBA = 0**	**Sample-Specific RBA**	**Minimum RBA**	**Maximum RBA**	**RBA = 1**	**RBA = 0**	**Sample-Specific RBA**	**Minimum RBA**	**Maximum RBA**	**RBA = 1**	**RBA = 0**
Meadow vole	Copper	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Meadow vole	Iron	0 (0%)	0 (0%)	0 (0%)	79 (75%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	86 (61%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (17%)	0 (0%)
Meadow vole	Lead	17 (16%)	9 (8%)	19 (18%)	27 (25%)	1 (1%)	1 (1%)	0 (0%)	5 (4%)	9 (6%)	0 (0%)	1 (17%)	1 (17%)	1 (17%)	1 (17%)	1 (17%)
Meadow vole	Mercury	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Meadow vole	Selenium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Meadow vole	Thallium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Meadow vole	Zinc	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Meadow vole	Molybdenum	NA	NA	NA	NA	NA	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NA	NA	NA	NA	NA
Short-tailed weasel	Aluminum	88 (83%)	86 (81%)	94 (89%)	102 (96%)	83 (78%)	110 (78%)	100 (71%)	117 (83%)	137 (97%)	91 (65%)	2 (33%)	0 (0%)	3 (50%)	6 (100%)	0 (0%)
Short-tailed weasel	Cadmium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Short-tailed weasel	Chromium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Short-tailed weasel	Copper	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Short-tailed weasel	Iron	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Short-tailed weasel	Lead	1 (1%)	0 (0%)	1 (1%)	2 (2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (17%)	1 (17%)	1 (17%)	1 (17%)	0 (0%)
Short-tailed weasel	Mercury	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Short-tailed weasel	Selenium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Short-tailed weasel	Thallium	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Short-tailed weasel	Zinc	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Short-tailed weasel	Molybdenum	NA	NA	NA	NA	NA	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NA	NA	NA	NA	NA

Notes:

[a] Percentage of total number of locations with HQ ≥ 1 for each study is shown in parentheses

HQs are based on average daily dose estimates calculated using values in Appendix F; a few sample-specific HQ counts differ from those in Tables 9-1 through 9-3 due to rounding of values reported in Appendix F relative to values presented in Table 4-1, 4-2, and 4-4.

HQ = hazard quotient

NA = not applicable; COPC concentration not reported

RBA = relative bioavailability

UCR = Upper Columbia River

Table 9-6. Analysis of Uncertainty in Receptor EPCs for Incremental Composite Samples - Comparison of Mean with 95UCL of Mean

				2014 UCR Upland Soil Study				2015 Bossburrg Study			
Receptor	**COPC**	**TRV basis (survival, growth or reproduction)**	**UCL95/mean for all triplicate samples [a]**	**Count HQ≥1 (Daily $Dose_{Mean}$/TRV)**	**Count HQ≥1 (Daily $Dose_{UCL95}$/TRV) [b]**	**Count HQ≥5 (Daily $Dose_{Mean}$/TRV)**	**Count HQ≥5 (Daily $Dose_{UCL95}$/TRV) [b]**	**Count HQ≥1 (Daily $Dose_{Mean}$/TRV)**	**Count HQ≥1 (Daily $Dose_{UCL95}$/TRV) [b]**	**Count HQ≥5 (Daily $Dose_{Mean}$/TRV)**	**Count HQ≥5 (Daily $Dose_{UCL95}$/TRV) [b]**
Deer mouse	Aluminum	Reproduction	1.1	32 (23%)	58 (41%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Deer mouse	Cadmium	Survival	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Deer mouse	Chromium	Reproduction	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Deer mouse	Copper	Survival	1.1	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Deer mouse	Iron	Growth	1.1	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Deer mouse	Lead	Reproduction	1.3	8 (6%)	9 (6%)	0 (0%)	0 (0%)	1 (17%)	1 (17%)	0 (0%)	1 (17%)
Deer mouse	Mercury	Reproduction	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Deer mouse	Selenium	Growth	1.3	1 (1%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Deer mouse	Thallium	Survival	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Deer mouse	Zinc	Growth	1.2	1 (1%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Deer mouse	Molybdenum	Reproduction	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NA	NA	NA	NA
Gray wolf	Aluminum	Reproduction	1.1	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Gray wolf	Cadmium	Survival	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Gray wolf	Chromium	Reproduction	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Gray wolf	Copper	Survival	1.1	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Gray wolf	Iron	Growth	1.1	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Gray wolf	Lead	Reproduction	1.3	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Gray wolf	Mercury	Reproduction	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Gray wolf	Selenium	Growth	1.3	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Gray wolf	Thallium	Survival	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Gray wolf	Zinc	Growth	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Gray wolf	Molybdenum	Reproduction	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NA	NA	NA	NA
Little brown bat	Aluminum	Reproduction	1.1	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Little brown bat	Cadmium	Survival	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Little brown bat	Chromium	Reproduction	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Little brown bat	Copper	Survival	1.1	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Little brown bat	Iron	Growth	1.1	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Little brown bat	Lead	Reproduction	1.3	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (17%)	0 (0%)	0 (0%)
Little brown bat	Mercury	Reproduction	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Little brown bat	Selenium	Growth	1.3	1 (1%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Little brown bat	Thallium	Survival	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Little brown bat	Zinc	Growth	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Little brown bat	Molybdenum	Reproduction	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NA	NA	NA	NA
Masked shrew	Aluminum	Reproduction	1.1	120 (85%)	127 (90%)	3 (2%)	24 (17%)	4 (67%)	6 (100%)	0 (0%)	0 (0%)
Masked shrew	Cadmium	Survival	1.2	90 (64%)	97 (69%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Masked shrew	Chromium	Reproduction	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Masked shrew	Copper	Survival	1.1	45 (32%)	72 (51%)	0 (0%)	0 (0%)	2 (33%)	3 (50%)	0 (0%)	0 (0%)
Masked shrew	Iron	Growth	1.1	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Masked shrew	Lead	Reproduction	1.3	109 (77%)	118 (84%)	0 (0%)	1 (1%)	4 (67%)	4 (67%)	1 (17%)	1 (17%)
Masked shrew	Mercury	Reproduction	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Masked shrew	Selenium	Growth	1.3	22 (16%)	28 (20%)	1 (1%)	1 (1%)	1 (17%)	1 (17%)	0 (0%)	0 (0%)
Masked shrew	Thallium	Survival	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Masked shrew	Zinc	Growth	1.2	101 (72%)	115 (82%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Masked shrew	Molybdenum	Reproduction	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NA	NA	NA	NA
Meadow vole	Aluminum	Reproduction	1.1	119 (84%)	127 (90%)	0 (0%)	0 (0%)	3 (50%)	6 (100%)	0 (0%)	0 (0%)
Meadow vole	Cadmium	Survival	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Meadow vole	Chromium	Reproduction	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Meadow vole	Copper	Survival	1.1	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Meadow vole	Iron	Growth	1.1	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 9-6. Analysis of Uncertainty in Receptor EPCs for Incremental Composite Samples - Comparison of Mean with 95UCL of Mean

				2014 UCR Upland Soil Study				2015 Bossburrg Study			
Receptor	COPC	TRV basis (survival, growth or reproduction)	UCL95/mean for all triplicate samples [a]	Count HQ≥1 (Daily $Dose_{Mean}$/TRV)	Count HQ≥1 (Daily $Dose_{UCL95}$/TRV) [b]	Count HQ≥5 (Daily $Dose_{Mean}$/TRV)	Count HQ≥5 (Daily $Dose_{UCL95}$/TRV) [b]	Count HQ≥1 (Daily $Dose_{Mean}$/TRV)	Count HQ≥1 (Daily $Dose_{UCL95}$/TRV) [b]	Count HQ≥5 (Daily $Dose_{Mean}$/TRV)	Count HQ≥5 (Daily $Dose_{UCL95}$/TRV) [b]
Meadow vole	Lead	Reproduction	1.3	1 (1%)	5 (4%)	0 (0%)	0 (0%)	1 (17%)	1 (17%)	0 (0%)	1 (17%)
Meadow vole	Mercury	Reproduction	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Meadow vole	Selenium	Growth	1.3	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Meadow vole	Thallium	Survival	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Meadow vole	Zinc	Growth	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Meadow vole	Molybdenum	Reproduction	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NA	NA	NA	NA
Short-tailed weasel	Aluminum	Reproduction	1.1	110 (78%)	119 (84%)	0 (0%)	0 (0%)	2 (33%)	3 (50%)	0 (0%)	0 (0%)
Short-tailed weasel	Cadmium	Survival	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Short-tailed weasel	Chromium	Reproduction	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Short-tailed weasel	Copper	Survival	1.1	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Short-tailed weasel	Iron	Growth	1.1	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Short-tailed weasel	Lead	Reproduction	1.3	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (17%)	1 (17%)	0 (0%)	0 (0%)
Short-tailed weasel	Mercury	Reproduction	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Short-tailed weasel	Selenium	Growth	1.3	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Short-tailed weasel	Thallium	Survival	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Short-tailed weasel	Zinc	Growth	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Short-tailed weasel	Molybdenum	Reproduction	1.2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NA	NA	NA	NA

Notes:

HQs are based on average daily dose estimates calculated using values in Appendix F; a few sample-specific HQ counts differ from those in Tables 8-1 through 8-3 due to rounding of values reported in Appendix F relative to values presented in Table 4-1, 4-2, and 4-4.

[a] Calculated over all triplicate samples from the 2014 UCR Upland Soil Study (n=16) and the 2015 Bossburg Study (n=1).

[b] Count includes HQs from all DUs using either 95 UCL (for triplicate locations) or concentration multiplied by 1.15 (arithmetic mean of ratio of UCL95:mean for triplicate sample decision units [Section 6] as the soil concentration.

≥ = greater than or equal to

95 UCL = 95th upper confidence limit on the mean

COPC = chemical of potential concern

DU = decision unit

EPC = exposure point concentration

HQ = hazard quotient

NA = not applicable

TRV = toxicity reference value

UCR = Upper Columbia River

Table 9-7. Summary of Maximum HQs for the Dietary Exposure for the Most Exposed Mammal Receptor at Each Location.

			Cadmium		Copper [a]			Lead		Selenium		Zinc	
Study	Location ID	Summary COPCs with TRV HQ ≥ 1	Masked Shrew Survival TRV HQ	Detect	Masked Shrew Survival TRV HQ	Detect	BTV	Masked Shrew Reproduction TRV HQ	Detect	Masked Shrew Growth TRV HQ	Detect	Masked Shrew Growth TRV HQ	Detect
2012 Ecology Upland Soil Study	SA1-1C	Cu,Pb,Se	0.92	Yes	1.1	Yes	No	1.4	Yes	1.2	No	0.77	Yes
2012 Ecology Upland Soil Study	SA1-2C	Zn	0.71	Yes	0.8	Yes	No	0.81	Yes	0.99	No	1	Yes
2012 Ecology Upland Soil Study	SA1-3C	NA	0.45	Yes	0.95	Yes	No	0.63	Yes	0.99	No	0.6	Yes
2012 Ecology Upland Soil Study	SA1-4C	NA	0.45	Yes	0.66	Yes	No	0.41	Yes	0.99	No	0.67	Yes
2012 Ecology Upland Soil Study	SA1-5C	NA	0.62	Yes	0.87	Yes	No	0.71	Yes	0.99	No	0.57	Yes
2012 Ecology Upland Soil Study	SA1-6C	NA	0.6	Yes	0.74	Yes	No	0.85	Yes	0.99	No	0.61	Yes
2012 Ecology Upland Soil Study	SA1-7C	NA	0.58	Yes	0.71	Yes	No	0.66	Yes	0.99	No	0.68	Yes
2012 Ecology Upland Soil Study	SA1-8C	NA	0.69	Yes	0.63	Yes	No	0.79	Yes	0.99	No	0.68	Yes
2012 Ecology Upland Soil Study	SA10-1C	Cd,Cu,Pb,Zn	1.5	Yes	1.7	Yes	No	2.5	Yes	0.99	No	1.7	Yes
2012 Ecology Upland Soil Study	SA10-2C	Cd,Cu,Pb,Se,Zn	4	Yes	2.8	Yes	Yes	7.7	Yes	2.6	Yes	6	Yes
2012 Ecology Upland Soil Study	SA10-3C	Cd,Cu,Pb,Zn	2.9	Yes	1.8	Yes	Yes	2.9	Yes	0.99	Yes	3.8	Yes
2012 Ecology Upland Soil Study	SA10-4C	Cd,Cu,Pb,Se	1.4	Yes	1.4	Yes	No	1.8	Yes	10	Yes	0.74	Yes
2012 Ecology Upland Soil Study	SA10-5C	Cd,Pb,Zn	1.1	Yes	0.91	Yes	No	1.6	Yes	0.99	No	1.1	Yes
2012 Ecology Upland Soil Study	SA10-6C	Cd,Cu,Pb,Zn	1.1	Yes	1.2	Yes	No	1.4	Yes	0.99	No	1.2	Yes
2012 Ecology Upland Soil Study	SA10-7C	Cd,Cu,Pb,Zn	1.7	Yes	1.7	Yes	No	1.9	Yes	0.99	No	2.3	Yes
2012 Ecology Upland Soil Study	SA10-8C	Cd,Cu,Pb,Zn	1.5	Yes	1.2	Yes	No	2.4	Yes	0.99	No	1.8	Yes
2012 Ecology Upland Soil Study	SA11-1C	Cu	0.73	Yes	1.4	Yes	No	0.79	Yes	0.99	No	0.77	Yes
2012 Ecology Upland Soil Study	SA11-2C	NA	0.78	Yes	0.83	Yes	No	0.88	Yes	0.99	No	0.89	Yes
2012 Ecology Upland Soil Study	SA11-3C	Cu,Pb,Se	0.76	Yes	1	Yes	No	1	Yes	1.4	Yes	0.85	Yes
2012 Ecology Upland Soil Study	SA11-4C	Cd,Cu,Pb,Zn	2.1	Yes	1.1	Yes	No	3.5	Yes	0.99	No	3.2	Yes
2012 Ecology Upland Soil Study	SA11-5C	Cd,Cu,Pb,Zn	1.4	Yes	1.1	Yes	No	2.8	Yes	0.99	No	1.9	Yes
2012 Ecology Upland Soil Study	SA11-6C	Cd,Cu,Pb,Zn	1.4	Yes	1.4	Yes	No	4	Yes	0.99	No	1.4	Yes
2012 Ecology Upland Soil Study	SA11-7C	Cd,Cu,Pb,Se,Zn	2.4	Yes	2.3	Yes	Yes	12	Yes	4	No	5.1	Yes
2012 Ecology Upland Soil Study	SA11-8C	Cd,Cu,Pb,Zn	2.3	Yes	1.9	Yes	Yes	5.5	Yes	0.99	No	3	Yes
2012 Ecology Upland Soil Study	SA11-9C	Cd,Cu,Pb,Se,Zn	2.5	Yes	1.9	Yes	Yes	4.8	Yes	1.2	Yes	3.4	Yes
2012 Ecology Upland Soil Study	SA12-1C	Cd,Cu,Pb,Zn	1.4	Yes	2.3	Yes	Yes	1.7	Yes	0.99	No	1.9	Yes
2012 Ecology Upland Soil Study	SA12-2C	Pb	0.84	Yes	0.81	Yes	No	1.9	Yes	0.99	No	0.99	Yes
2012 Ecology Upland Soil Study	SA12-3C	Cd,Pb,Se	1.1	Yes	0.93	Yes	No	1.8	Yes	1.2	Yes	0.88	Yes
2012 Ecology Upland Soil Study	SA12-4C	Cd,Pb,Zn	1	Yes	0.65	Yes	No	1.5	Yes	0.99	No	1.1	Yes
2012 Ecology Upland Soil Study	SA12-6C	Cu,Pb,Zn	0.92	Yes	1.9	Yes	Yes	1.1	Yes	0.99	No	1.1	Yes
2012 Ecology Upland Soil Study	SA12-7C	Cd,Cu,Pb,Zn	1.2	Yes	1.1	Yes	No	1.7	Yes	0.99	No	2	Yes
2012 Ecology Upland Soil Study	SA12-8C	Pb,Zn	0.8	Yes	0.67	Yes	No	2	Yes	0.99	No	1.1	Yes
2012 Ecology Upland Soil Study	SA12-9C	NA	0.69	Yes	0.87	Yes	No	0.65	Yes	0.99	No	0.74	Yes
2012 Ecology Upland Soil Study	SA13-1C	Cu	0.76	Yes	1.1	Yes	No	0.95	Yes	0.99	No	0.78	Yes
2012 Ecology Upland Soil Study	SA13-2C	Cd,Cu,Pb,Se,Zn	1.1	Yes	1.7	Yes	No	1.6	Yes	3.4	Yes	1.4	Yes
2012 Ecology Upland Soil Study	SA13-3C	Cd,Pb,Zn	1	Yes	0.79	Yes	No	1.4	Yes	0.99	No	1.3	Yes
2012 Ecology Upland Soil Study	SA13-4C	Se	0.53	Yes	0.95	Yes	No	0.36	Yes	4	No	0.72	Yes
2012 Ecology Upland Soil Study	SA13-5C	Cd,Cu,Pb,Zn	2.1	Yes	1.9	Yes	Yes	4.4	Yes	0.99	No	3	Yes
2012 Ecology Upland Soil Study	SA13-6C	Pb,Zn	0.97	Yes	0.75	Yes	No	2.3	Yes	0.99	No	1.2	Yes
2012 Ecology Upland Soil Study	SA13-7C	Pb	0.8	Yes	0.82	Yes	No	2.2	Yes	0.99	No	0.98	Yes
2012 Ecology Upland Soil Study	SA13-8C	Pb	0.84	Yes	0.72	Yes	No	1.5	Yes	0.99	No	0.84	Yes
2012 Ecology Upland Soil Study	SA2-1C	Cd,Pb,Zn	1.2	Yes	0.9	Yes	No	2	Yes	0.99	No	2.2	Yes
2012 Ecology Upland Soil Study	SA2-2C	Zn	0.69	Yes	0.77	Yes	No	0.82	Yes	0.99	No	1.2	Yes
2012 Ecology Upland Soil Study	SA2-3C	NA	0.67	Yes	0.53	Yes	No	0.97	Yes	0.99	No	0.59	Yes
2012 Ecology Upland Soil Study	SA2-4C	Cd,Pb,Zn	1.2	Yes	0.7	Yes	No	1.9	Yes	0.99	No	1.1	Yes
2012 Ecology Upland Soil Study	SA2-5C	NA	0.55	Yes	0.86	Yes	No	0.69	Yes	0.99	No	0.48	Yes
2012 Ecology Upland Soil Study	SA2-6C	Cd,Cu,Pb,Zn	2.1	Yes	1.3	Yes	No	3	Yes	0.99	No	2.4	Yes
2012 Ecology Upland Soil Study	SA2-7C	Cu	0.91	Yes	1.5	Yes	No	0.97	Yes	0.99	No	0.85	Yes
2012 Ecology Upland Soil Study	SA2-8C	NA	0.71	Yes	0.78	Yes	No	0.59	Yes	0.99	No	0.95	Yes
2012 Ecology Upland Soil Study	SA3-1C	NA	0.34	Yes	0.77	Yes	No	0.35	Yes	0.99	No	0.38	Yes
2012 Ecology Upland Soil Study	SA3-2C	NA	0.55	Yes	0.43	Yes	No	0.64	Yes	0.99	No	0.65	Yes
2012 Ecology Upland Soil Study	SA3-3C	Cd,Pb,Zn	1	Yes	0.96	Yes	No	1.5	Yes	0.99	No	1.2	Yes
2012 Ecology Upland Soil Study	SA3-4C	NA	0.6	Yes	0.45	Yes	No	0.72	Yes	0.99	No	0.58	Yes
2012 Ecology Upland Soil Study	SA3-5C	NA	0.75	Yes	0.65	Yes	No	0.94	Yes	0.99	No	0.65	Yes
2012 Ecology Upland Soil Study	SA3-6C	Cd,Cu,Pb,Zn	1.9	Yes	2.1	Yes	Yes	3.7	Yes	0.99	No	3	Yes
2012 Ecology Upland Soil Study	SA3-7C	Cd,Cu,Pb,Zn	1.5	Yes	1.3	Yes	No	3.2	Yes	0.99	No	1.8	Yes
2012 Ecology Upland Soil Study	SA3-8C	Pb,Zn	0.97	Yes	0.61	Yes	No	1.6	Yes	0.99	No	1.1	Yes
2012 Ecology Upland Soil Study	SA4-1C	Cd,Cu,Pb,Zn	1.2	Yes	1.1	Yes	No	1.7	Yes	0.99	No	1.3	Yes
2012 Ecology Upland Soil Study	SA4-2C	Pb	0.94	Yes	0.98	Yes	No	1.2	Yes	0.99	No	0.84	Yes
2012 Ecology Upland Soil Study	SA4-3C	Cd,Cu,Pb,Zn	1.7	Yes	1.6	Yes	No	3.1	Yes	0.99	No	1.7	Yes
2012 Ecology Upland Soil Study	SA4-4C	Cd,Cu,Pb,Zn	1.3	Yes	1.2	Yes	No	1.8	Yes	0.99	No	1.4	Yes
2012 Ecology Upland Soil Study	SA4-5C	Cu	0.82	Yes	1	Yes	No	0.99	Yes	0.99	No	0.87	Yes
2012 Ecology Upland Soil Study	SA4-6C	Cd,Cu,Pb,Zn	1.7	Yes	1.1	Yes	No	3.6	Yes	0.99	No	1.9	Yes
2012 Ecology Upland Soil Study	SA4-7C	Cd,Cu,Pb,Zn	1.3	Yes	1.1	Yes	No	2.3	Yes	0.99	No	1.2	Yes
2012 Ecology Upland Soil Study	SA4-8C	Pb	0.97	Yes	0.78	Yes	No	1.2	Yes	0.99	No	0.84	Yes
2012 Ecology Upland Soil Study	SA5-1C	Cd,Cu,Pb,Se,Zn	1.3	Yes	1.6	Yes	No	2.5	Yes	1.2	No	1.4	Yes
2012 Ecology Upland Soil Study	SA5-2C	Cu,Pb,Zn	0.99	Yes	1	Yes	No	1.2	Yes	0.99	No	1.1	Yes
2012 Ecology Upland Soil Study	SA5-3C	Cd,Cu,Pb,Zn	1.6	Yes	1.4	Yes	No	2.2	Yes	0.99	No	2.3	Yes
2012 Ecology Upland Soil Study	SA5-4C	Cd,Pb,Zn	1.5	Yes	0.9	Yes	No	2.6	Yes	0.99	No	1.6	Yes
2012 Ecology Upland Soil Study	SA5-5C	Pb	0.86	Yes	0.99	Yes	No	1.1	Yes	0.99	No	0.73	Yes
2012 Ecology Upland Soil Study	SA5-7C	Cd,Pb,Zn	1.7	Yes	0.96	Yes	No	2.9	Yes	0.99	No	2.1	Yes
2012 Ecology Upland Soil Study	SA5-8C	Cd,Cu,Pb,Zn	1.3	Yes	1.5	Yes	No	2.5	Yes	0.99	No	1	Yes
2012 Ecology Upland Soil Study	SA6-1C	Cd,Pb,Zn	1.6	Yes	0.8	Yes	No	3	Yes	0.99	No	2.1	Yes
2012 Ecology Upland Soil Study	SA6-2C	Cd,Cu,Pb,Zn	1.7	Yes	1.2	Yes	No	2.9	Yes	0.99	No	2	Yes
2012 Ecology Upland Soil Study	SA6-3C	Cd,Cu,Pb,Zn	1.9	Yes	1.5	Yes	No	3.8	Yes	0.99	No	2.1	Yes
2012 Ecology Upland Soil Study	SA6-4C	NA	0.58	Yes	0.33	Yes	No	0.81	Yes	0.99	No	0.39	Yes
2012 Ecology Upland Soil Study	SA6-5C	NA	0.48	Yes	0.28	Yes	No	0.61	Yes	0.99	No	0.36	Yes
2012 Ecology Upland Soil Study	SA6-6C	Cd,Pb,Zn	1.6	Yes	0.89	Yes	No	4.4	Yes	0.99	No	1.7	Yes
2012 Ecology Upland Soil Study	SA6-7C	Cd,Cu,Pb,Zn	1.8	Yes	1.5	Yes	No	4.3	Yes	0.99	No	2.4	Yes
2012 Ecology Upland Soil Study	SA6-8C	Pb	0.78	Yes	0.51	Yes	No	1.1	Yes	0.99	No	0.58	Yes
2012 Ecology Upland Soil Study	SA7-1C	Cd,Pb,Zn	1.3	Yes	0.83	Yes	No	2.4	Yes	0.99	No	1.5	Yes
2012 Ecology Upland Soil Study	SA7-2C	Cd,Pb,Zn	1.3	Yes	0.83	Yes	No	2.4	Yes	0.99	No	1.8	Yes
2012 Ecology Upland Soil Study	SA7-3C	Cd,Cu,Pb,Zn	1.4	Yes	1.3	Yes	No	4.4	Yes	0.99	No	1.3	Yes
2012 Ecology Upland Soil Study	SA7-4C	Cd,Pb	1.2	Yes	0.56	Yes	No	2.2	Yes	0.99	No	0.85	Yes
2012 Ecology Upland Soil Study	SA7-5C	Cd,Cu,Pb,Zn	1.7	Yes	1.9	Yes	Yes	6.1	Yes	0.99	No	2.2	Yes
2012 Ecology Upland Soil Study	SA7-6C	Cd,Pb,Zn	1.9	Yes	0.97	Yes	No	3.5	Yes	0.99	No	2.9	Yes
2012 Ecology Upland Soil Study	SA7-7C	Cd,Cu,Pb,Se,Zn	2.5	Yes	1.7	Yes	No	8	Yes	1.2	Yes	5.1	Yes
2012 Ecology Upland Soil Study	SA7-8C	Cd,Cu,Pb,Zn	2.2	Yes	2.7	Yes	Yes	6	Yes	0.99	No	3.5	Yes
2012 Ecology Upland Soil Study	SA8-1C	Cd,Pb,Zn	1.9	Yes	0.92	Yes	No	2.9	Yes	0.99	No	2.5	Yes
2012 Ecology Upland Soil Study	SA8-2C	Cd,Cu,Pb,Zn	1.6	Yes	1.1	Yes	No	2.8	Yes	0.99	No	1.5	Yes
2012 Ecology Upland Soil Study	SA8-3C	Pb	0.87	Yes	0.79	Yes	No	1.2	Yes	0.99	No	0.68	Yes
2012 Ecology Upland Soil Study	SA8-4C	Cd,Pb,Zn	1.4	Yes	0.66	Yes	No	3.3	Yes	0.99	No	1.3	Yes
2012 Ecology Upland Soil Study	SA8-5C	Cd,Cu,Pb,Zn	1.7	Yes	1.3	Yes	No	5	Yes	0.99	No	1.8	Yes
2012 Ecology Upland Soil Study	SA8-6C	Cd,Pb,Zn	1.4	Yes	0.82	Yes	No	2.4	Yes	0.99	No	1.7	Yes
2012 Ecology Upland Soil Study	SA8-7C	Cd,Cu,Pb,Zn	2.6	Yes	1.8	Yes	No	6.9	Yes	0.99	No	3.9	Yes
2012 Ecology Upland Soil Study	SA8-8C	Cd,Cu,Pb,Se,Zn	2.6	Yes	2.2	Yes	Yes	8.8	Yes	1.4	Yes	5.5	Yes
2012 Ecology Upland Soil Study	SA9-10C	Cd,Cu,Pb,Zn	1.9	Yes	1.1	Yes	No	3.1	Yes	0.99	No	2	Yes
2012 Ecology Upland Soil Study	SA9-1C	Cd,Cu,Pb,Zn	3.1	Yes	1.4	Yes	No	6.5	Yes	0.99	No	3.5	Yes
2012 Ecology Upland Soil Study	SA9-2C	Cd,Cu,Pb,Zn	1.2	Yes	2.2	Yes	Yes	1.8	Yes	0.99	No	1.6	Yes
2012 Ecology Upland Soil Study	SA9-3C	Cd,Cu,Pb,Zn	1.1	Yes	1.7	Yes	No	1.4	Yes	0.99	No	1.3	Yes
2012 Ecology Upland Soil Study	SA9-4C	Cd,Cu,Pb,Se,Zn	1.4	Yes	1.1	Yes	No	3.5	Yes	2	Yes	2.2	Yes
2012 Ecology Upland Soil Study	SA9-5C	Cd,Cu,Pb,Zn	2.1	Yes	1.3	Yes	No	3.7	Yes	0.99	No	3.3	Yes
2012 Ecology Upland Soil Study	SA9-6C	Cd,Cu,Pb,Zn	2.2	Yes	1.2	Yes	No	4.4	Yes	0.99	No	2.5	Yes
2012 Ecology Upland Soil Study	SA9-7C	Cd,Cu,Pb,Zn	2.2	Yes	1.4	Yes	No	3.8	Yes	0.99	No	2.6	Yes
2012 Ecology Upland Soil Study	SA9-8C	Cd,Cu,Pb,Zn	2.4	Yes	1.7	Yes	No	4.7	Yes	0.99	No	3.8	Yes
2012 Ecology Upland Soil Study	SA9-9C	Cd,Cu,Pb,Zn	1.8	Yes	1.5	Yes	No	2.7	Yes	0.99	No	1.9	Yes
2014 UCR Upland Soil Study	ADA-001	Cd,Pb,Zn	1.5	Yes	0.98	Yes	No	2.5	Yes	0.53	Yes	1.4	Yes
2014 UCR Upland Soil Study	ADA-002	Cu,Se,Zn	0.85	Yes	1.4	Yes	No	0.5	Yes	1.5	Yes	1.3	Yes
2014 UCR Upland Soil Study	ADA-004	Cd,Pb,Se,Zn	1.3	Yes	0.98	Yes	No	1.3	Yes	1	Yes	1.6	Yes
2014 UCR Upland Soil Study	ADA-005	Cu,Se,Zn	0.88	Yes	1.6	Yes	No	0.71	Yes	1.8	Yes	1.3	Yes
2014 UCR Upland Soil Study	ADA-006	Cd,Pb	1.1	Yes	0.67	Yes	No	1.6	Yes	0.4	Yes	0.89	Yes
2014 UCR Upland Soil Study	ADA-008	Cd,Pb,Zn	1.5	Yes	0.91	Yes	No	3	Yes	0.79	Yes	1.5	Yes
2014 UCR Upland Soil Study	ADA-010	Cd,Cu,Pb,Zn	1.8	Yes	1.4	Yes	No	3.1	Yes	0.77	Yes	1.8	Yes
2014 UCR Upland Soil Study	ADA-015	Pb	0.82	Yes	0.49	Yes	No	1.2	Yes	0.28	Yes	0.68	Yes
2014 UCR Upland Soil Study	ADA-016	Pb	0.83	Yes	0.44	Yes	No	1	Yes	0.28	Yes	0.57	Yes
2014 UCR Upland Soil Study	ADA-017	Cd,Pb,Zn	1.3	Yes	0.87	Yes	No	2.1	Yes	0.46	Yes	1.2	Yes
2014 UCR Upland Soil Study	ADA-018	Cd,Cu,Pb,Zn	1.8	Yes	1.3	Yes	No	4.1	Yes	0.69	Yes	2.1	Yes
2014 UCR Upland Soil Study	ADA-019	NA	0.69	Yes	0.99	Yes	No	0.73	Yes	0.44	Yes	0.69	Yes
2014 UCR Upland Soil Study	ADA-020	NA	0.65	Yes	0.73	Yes	No	0.69	Yes	0.34	Yes	0.61	Yes
2014 UCR Upland Soil Study	ADA-021	Cu	0.71	Yes	2.2	Yes	Yes	0.65	Yes	0.75	Yes	0.71	Yes
2014 UCR Upland Soil Study	ADA-023	Cd,Cu,Pb,Se,Zn	1.4	Yes	1.5	Yes	No	1.2	Yes	1.6	Yes	1.4	Yes
2014 UCR Upland Soil Study	ADA-024	Cd,Cu,Pb,Zn	1.9	Yes	1.9	Yes	Yes	3.5	Yes	0.73	Yes	2.1	Yes
2014 UCR Upland Soil Study	ADA-025	Cd,Cu,Pb,Se,Zn	1.9	Yes	1.1	Yes	No	2.2	Yes	1.1	Yes	2.3	Yes
2014 UCR Upland Soil Study	ADA-026	Cd,Cu,Se,Zn	1.5	Yes	1.1	Yes	No	0.95	Yes	1.1	Yes	1.9	Yes
2014 UCR Upland Soil Study	ADA-028	Cd,Pb,Zn	1.3	Yes	0.95	Yes	No	2.1	Yes	0.4	Yes	1.1	Yes
2014 UCR Upland Soil Study	ADA-033	Cd,Zn	1.2	Yes	0.72	Yes	No	0.82	Yes	0.75	Yes	2.2	Yes
2014 UCR Upland Soil Study	ADA-034	Zn	0.61	Yes	0.7	Yes	No	0.6	Yes	0.61	Yes	1	Yes
2014 UCR Upland Soil Study	ADA-035	Cd,Pb,Zn	1.3	Yes	0.49	Yes	No	1.9	Yes	0.4	Yes	1.9	Yes
2014 UCR Upland Soil Study	ADA-039	Cd,Zn	1.3	Yes	0.58	Yes	No	0.5	Yes	0.65	Yes	1.3	Yes
2014 UCR Upland Soil Study	ADA-042	Pb	0.74	Yes	0.65	Yes	No	1.1	Yes	0.57	Yes	0.82	Yes
2014 UCR Upland Soil Study	ADA-043	Cd,Cu,Pb,Se,Zn	1.2	Yes	1.8	Yes	No	1.1	Yes	1.2	Yes	1.3	Yes
2014 UCR Upland Soil Study	ADA-044	Cd,Cu,Pb,Se,Zn	2	Yes	1.2	Yes	No	1.3	Yes	1.3	Yes	2.2	Yes
2014 UCR Upland Soil Study	ADA-045	Cd,Cu,Pb,Zn	1.9	Yes	1.2	Yes	No	3.5	Yes	0.77	Yes	2	Yes
2014 UCR Upland Soil Study	ADA-046	Cd,Pb,Zn	1.2	Yes	0.8	Yes	No	2.1	Yes	0.5	Yes	1	Yes
2014 UCR Upland Soil Study	ADA-047	Cd,Cu,Pb,Zn	1.5	Yes	1.1	Yes	No	2.4	Yes	0.73	Yes	2.2	Yes
2014 UCR Upland Soil Study	ADA-048	Cd,Cu,Pb,Se,Zn	1.2	Yes	1.2	Yes	No	1.1	Yes	1.5	Yes	1.3	Yes
2014 UCR Upland Soil Study	ADA-049	Cd,Zn	1.5	Yes	0.94	Yes	No	0.58	Yes	0.95	Yes	1.3	Yes
2014 UCR Upland Soil Study	ADA-050	Cd,Cu,Pb,Se,Zn	1.8	Yes	2	Yes	Yes	2.8	Yes	1.3	Yes	2.5	Yes
2014 UCR Upland Soil Study	ADA-051	Cd,Cu,Pb,Se,Zn	1.6	Yes	2.2	Yes	Yes	1	Yes	1.7	Yes	1.9	Yes
2014 UCR Upland Soil Study	ADA-052	Cd,Cu,Pb,Zn	1.8	Yes	1.1	Yes	No	2.9	Yes	0.77	Yes	2.1	Yes
2014 UCR Upland Soil Study	ADA-053	Pb	0.76	Yes	0.81	Yes	No	1.1	Yes	0.67	Yes	0.86	Yes
2014 UCR Upland Soil Study	ADA-054	Cd,Cu,Pb,Zn	1.8	Yes	1.4	Yes	No	2.9	Yes	0.81	Yes	2.1	Yes

Table 9-7. Summary of Maximum HQs for the Dietary Exposure for the Most Exposed Mammal Receptor at Each Location.

			Cadmium		Copper [a]			Lead		Selenium		Zinc	
Study	Location ID	Summary COPCs with TRV HQ ≥ 1	Masked Shrew Survival TRV HQ	Detect	Masked Shrew Survival TRV HQ	Detect	BTV	Masked Shrew Reproduction TRV HQ	Detect	Masked Shrew Growth TRV HQ	Detect	Masked Shrew Growth TRV HQ	Detect
2014 UCR Upland Soil Study	ADA-055	Cd,Cu,Pb,Se,Zn	1.9	Yes	1.9	Yes	Yes	1.7	Yes	1.7	Yes	2.5	Yes
2014 UCR Upland Soil Study	ADA-056	NA	0.74	Yes	0.77	Yes	No	0.86	Yes	0.42	Yes	0.87	Yes
2014 UCR Upland Soil Study	ADA-057	Cu,Pb	0.86	Yes	1.2	Yes	No	1.1	Yes	0.48	Yes	0.81	Yes
2014 UCR Upland Soil Study	ADA-058	NA	0.75	Yes	0.65	Yes	No	0.88	Yes	0.36	Yes	0.95	Yes
2014 UCR Upland Soil Study	ADA-059	Cu,Pb,Zn	0.95	Yes	1	Yes	No	1.2	Yes	0.57	Yes	1.1	Yes
2014 UCR Upland Soil Study	ADA-060	Cd,Cu,Pb,Zn	1.5	Yes	1.4	Yes	No	2.4	Yes	0.63	Yes	1.7	Yes
2014 UCR Upland Soil Study	ADA-061	Pb	0.84	Yes	0.85	Yes	No	1.2	Yes	0.42	Yes	0.95	Yes
2014 UCR Upland Soil Study	ADA-062	Cd,Pb,Zn	1.4	Yes	0.87	Yes	No	2.2	Yes	0.48	Yes	1.4	Yes
2014 UCR Upland Soil Study	ADA-063	Cd,Pb,Zn	1.5	Yes	0.76	Yes	No	1.4	Yes	0.75	Yes	1.3	Yes
2014 UCR Upland Soil Study	ADA-064	Pb,Zn	0.82	Yes	0.89	Yes	No	1.1	Yes	0.75	Yes	1.1	Yes
2014 UCR Upland Soil Study	ADA-065	Pb	0.9	Yes	0.58	Yes	No	1.3	Yes	0.34	Yes	0.73	Yes
2014 UCR Upland Soil Study	ADA-066	Cd,Pb,Zn	1.1	Yes	0.82	Yes	No	1.5	Yes	0.42	Yes	1.1	Yes
2014 UCR Upland Soil Study	ADA-067	Cd,Cu,Zn	1.6	Yes	2	Yes	Yes	0.96	Yes	0.75	Yes	1.3	Yes
2014 UCR Upland Soil Study	ADA-070	Cd,Cu,Pb,Zn	1.4	Yes	1	Yes	No	2.3	Yes	0.81	Yes	1.5	Yes
2014 UCR Upland Soil Study	ADA-071	Cd,Pb,Zn	1.3	Yes	0.79	Yes	No	2.3	Yes	0.53	Yes	1.2	Yes
2014 UCR Upland Soil Study	ADA-073	Cd,Pb,Zn	1.2	Yes	0.8	Yes	No	2.2	Yes	0.61	Yes	1.1	Yes
2014 UCR Upland Soil Study	ADA-076	Cd,Pb,Se,Zn	2.1	Yes	0.93	Yes	No	3	Yes	1.4	Yes	2.3	Yes
2014 UCR Upland Soil Study	ADA-078	Cd,Pb,Zn	1.3	Yes	0.72	Yes	No	2.1	Yes	0.63	Yes	1.3	Yes
2014 UCR Upland Soil Study	ADA-079	Cd,Pb,Zn	2	Yes	0.84	Yes	No	1.5	Yes	0.89	Yes	2	Yes
2014 UCR Upland Soil Study	ADA-081	Pb	0.86	Yes	0.76	Yes	No	1.3	Yes	0.46	Yes	0.7	Yes
2014 UCR Upland Soil Study	ADA-082	Cu,Pb	0.9	Yes	1.1	Yes	No	1.3	Yes	0.71	Yes	0.86	Yes
2014 UCR Upland Soil Study	ADA-084	Cd,Pb,Zn	1	Yes	0.89	Yes	No	1.5	Yes	0.61	Yes	1.2	Yes
2014 UCR Upland Soil Study	ADA-085	Cd,Pb,Zn	1.1	Yes	0.76	Yes	No	1.2	Yes	0.95	Yes	4.8	Yes
2014 UCR Upland Soil Study	ADA-088	Cd,Cu,Pb,Zn	1.3	Yes	1.1	Yes	No	1.9	Yes	0.81	Yes	1.3	Yes
2014 UCR Upland Soil Study	ADA-089	Cd,Cu,Pb,Zn	1.3	Yes	1.1	Yes	No	2.1	Yes	0.65	Yes	1.4	Yes
2014 UCR Upland Soil Study	ADA-090	Cd,Pb,Zn	1.3	Yes	0.86	Yes	No	1.8	Yes	0.59	Yes	1.4	Yes
2014 UCR Upland Soil Study	ADA-091	Cd,Pb,Zn	1.5	Yes	0.99	Yes	No	2.1	Yes	0.65	Yes	1.6	Yes
2014 UCR Upland Soil Study	ADA-092	Cd,Cu,Pb,Se,Zn	1.7	Yes	1	Yes	No	2.1	Yes	1.1	Yes	1.9	Yes
2014 UCR Upland Soil Study	ADA-093	Cd,Pb,Zn	1.1	Yes	0.68	Yes	No	1.6	Yes	0.65	Yes	1.2	Yes
2014 UCR Upland Soil Study	ADA-094	NA	0.68	Yes	0.72	Yes	No	0.92	Yes	0.36	Yes	0.69	Yes
2014 UCR Upland Soil Study	ADA-095	Pb	0.85	Yes	0.81	Yes	No	1.4	Yes	0.57	Yes	0.84	Yes
2014 UCR Upland Soil Study	ADA-096	Cd,Pb,Zn	1.3	Yes	0.8	Yes	No	2.2	Yes	0.75	Yes	1.4	Yes
2014 UCR Upland Soil Study	ADA-097	Cd,Cu,Pb,Zn	1.8	Yes	1.3	Yes	No	3	Yes	0.93	Yes	2	Yes
2014 UCR Upland Soil Study	ADA-099	Cd,Pb,Zn	1.3	Yes	0.99	Yes	No	2.1	Yes	0.57	Yes	1.5	Yes
2014 UCR Upland Soil Study	ADA-101	Cd,Pb,Zn	1	Yes	0.92	Yes	No	1.7	Yes	0.79	Yes	1.1	Yes
2014 UCR Upland Soil Study	ADA-102	Pb	0.85	Yes	0.85	Yes	No	1.3	Yes	0.53	Yes	0.96	Yes
2014 UCR Upland Soil Study	ADA-103	Cu,Pb,Zn	0.99	Yes	1.1	Yes	No	1.1	Yes	0.67	Yes	1.2	Yes
2014 UCR Upland Soil Study	ADA-104	Zn	0.79	Yes	0.63	Yes	No	0.88	Yes	0.93	Yes	1	Yes
2014 UCR Upland Soil Study	ADA-105	Cd,Cu,Pb,Zn	1.4	Yes	1.1	Yes	No	2.1	Yes	0.55	Yes	1.8	Yes
2014 UCR Upland Soil Study	ADA-106	Se,Zn	0.89	Yes	0.98	Yes	No	0.88	Yes	1.5	Yes	1.1	Yes
2014 UCR Upland Soil Study	ADA-107	Cd,Cu,Pb,Zn	1.3	Yes	1.5	Yes	No	1.4	Yes	0.65	Yes	1.5	Yes
2014 UCR Upland Soil Study	ADA-108	Cd,Cu,Pb,Zn	1	Yes	1	Yes	No	1.4	Yes	0.42	Yes	1	Yes
2014 UCR Upland Soil Study	ADA-109	Cd,Pb,Zn	1.5	Yes	0.9	Yes	No	2.5	Yes	0.91	Yes	1.8	Yes
2014 UCR Upland Soil Study	ADA-110	Cd,Pb,Zn	1.2	Yes	0.83	Yes	No	1.8	Yes	0.44	Yes	1.2	Yes
2014 UCR Upland Soil Study	ADA-111	NA	0.82	Yes	0.97	Yes	No	0.98	Yes	0.4	Yes	0.85	Yes
2014 UCR Upland Soil Study	ADA-112	NA	0.92	Yes	0.87	Yes	No	0.95	Yes	0.59	Yes	0.87	Yes
2014 UCR Upland Soil Study	ADA-113	Pb	0.83	Yes	0.79	Yes	No	1.3	Yes	0.52	Yes	0.79	Yes
2014 UCR Upland Soil Study	ADA-114	Pb	0.85	Yes	0.73	Yes	No	1.2	Yes	0.42	Yes	0.9	Yes
2014 UCR Upland Soil Study	ADA-115	Pb	0.81	Yes	0.56	Yes	No	1.3	Yes	0.36	Yes	0.87	Yes
2014 UCR Upland Soil Study	ADA-116	Pb	0.8	Yes	0.64	Yes	No	1.2	Yes	0.4	Yes	0.8	Yes
2014 UCR Upland Soil Study	ADA-117	Pb	0.99	Yes	0.69	Yes	No	1.4	Yes	0.32	Yes	0.97	Yes
2014 UCR Upland Soil Study	ADA-118	Cd,Pb,Zn	1.2	Yes	0.79	Yes	No	1.3	Yes	0.44	Yes	1.4	Yes
2014 UCR Upland Soil Study	ADA-119	Cd,Pb,Zn	1	Yes	0.87	Yes	No	1.5	Yes	0.38	Yes	1.1	Yes
2014 UCR Upland Soil Study	ADA-121	Cd,Cu,Pb,Zn	1.3	Yes	1.1	Yes	No	1.9	Yes	0.61	Yes	1.6	Yes
2014 UCR Upland Soil Study	ADA-122	Zn	0.86	Yes	0.57	Yes	No	0.94	Yes	0.71	Yes	1	Yes
2014 UCR Upland Soil Study	ADA-124	Pb	0.9	Yes	0.53	Yes	No	1.8	Yes	0.5	Yes	0.67	Yes
2014 UCR Upland Soil Study	ADA-125	Pb	0.76	Yes	0.52	Yes	No	1.4	Yes	0.38	Yes	0.54	Yes
2014 UCR Upland Soil Study	ADA-126	Cd,Cu,Pb,Zn	1.6	Yes	2.3	Yes	Yes	2.9	Yes	0.65	Yes	1.5	Yes
2014 UCR Upland Soil Study	ADA-127	Cd,Cu,Pb,Zn	1.4	Yes	1.3	Yes	No	1.5	Yes	0.75	Yes	1.7	Yes
2014 UCR Upland Soil Study	ADA-128	Cd,Pb,Zn	1.2	Yes	0.76	Yes	No	1.8	Yes	0.36	Yes	1	Yes
2014 UCR Upland Soil Study	ADA-131	Cd,Cu,Pb,Se,Zn	1.8	Yes	1	Yes	No	4	Yes	1.1	Yes	1.9	Yes
2014 UCR Upland Soil Study	ADA-132	Pb	0.92	Yes	0.61	Yes	No	1.9	Yes	0.44	Yes	0.87	Yes
2014 UCR Upland Soil Study	ADA-133	Cd,Pb,Zn	1.2	Yes	0.76	Yes	No	2	Yes	0.52	Yes	1.2	Yes
2014 UCR Upland Soil Study	ADA-135	Pb	0.8	Yes	0.82	Yes	No	1	Yes	0.5	Yes	0.96	Yes
2014 UCR Upland Soil Study	ADA-136	Cd,Pb,Zn	1.3	Yes	0.69	Yes	No	1.7	Yes	0.44	Yes	1.2	Yes
2014 UCR Upland Soil Study	ADA-139	Cd,Pb,Zn	1.2	Yes	0.83	Yes	No	1.9	Yes	0.73	Yes	1.4	Yes
2014 UCR Upland Soil Study	ADA-141	Pb	0.88	Yes	0.54	Yes	No	1.2	Yes	0.38	Yes	0.87	Yes
2014 UCR Upland Soil Study	ADA-142	Cd,Pb,Zn	1.2	Yes	0.54	Yes	No	1.9	Yes	0.4	Yes	1.1	Yes
2014 UCR Upland Soil Study	ADA-143	Pb	0.87	Yes	0.66	Yes	No	1.2	Yes	0.42	Yes	0.76	Yes
2014 UCR Upland Soil Study	ADA-144	Cd,Pb,Zn	1.3	Yes	0.8	Yes	No	2	Yes	0.51	Yes	1.1	Yes
2014 UCR Upland Soil Study	ADA-145	Cd,Pb,Zn	1.4	Yes	0.88	Yes	No	2.4	Yes	0.57	Yes	1.5	Yes
2014 UCR Upland Soil Study	ADA-146	Cd,Pb,Zn	1.4	Yes	0.81	Yes	No	2.2	Yes	0.5	Yes	1.5	Yes
2014 UCR Upland Soil Study	ADA-147	Cd,Pb,Zn	1.3	Yes	0.75	Yes	No	2.7	Yes	0.57	Yes	1	Yes
2014 UCR Upland Soil Study	ADA-148	Cd,Pb,Zn	1.3	Yes	0.83	Yes	No	2.7	Yes	0.48	Yes	1	Yes
2014 UCR Upland Soil Study	ADA-150	Cd,Pb,Zn	1.2	Yes	0.87	Yes	No	2.5	Yes	0.5	Yes	1	Yes
2014 UCR Upland Soil Study	ADA-151	Pb,Zn	0.94	Yes	0.76	Yes	No	2.6	Yes	0.53	Yes	1.1	Yes
2014 UCR Upland Soil Study	ADA-152	Cd,Cu,Pb,Zn	1.5	Yes	1	Yes	No	2.4	Yes	0.63	Yes	2	Yes
2014 UCR Upland Soil Study	ADA-153	Cd,Cu,Pb,Zn	1.5	Yes	1	Yes	No	2.5	Yes	0.61	Yes	1.7	Yes
2014 UCR Upland Soil Study	ADA-154	Cd,Cu,Pb,Zn	1.5	Yes	1.3	Yes	No	2.7	Yes	0.63	Yes	1.6	Yes
2014 UCR Upland Soil Study	ADA-155	Cd,Pb,Zn	1.2	Yes	0.57	Yes	No	2	Yes	0.5	Yes	1.1	Yes
2014 UCR Upland Soil Study	ADA-156	Cd,Pb,Zn	1.6	Yes	0.95	Yes	No	3.9	Yes	0.73	Yes	2	Yes
2014 UCR Upland Soil Study	ADA-158	Cd,Cu,Pb,Zn	1.6	Yes	1.3	Yes	No	4	Yes	0.89	Yes	2.2	Yes
2014 UCR Upland Soil Study	ADA-159	Cd,Cu,Pb,Zn	1.6	Yes	1	Yes	No	3	Yes	0.65	Yes	1.8	Yes
2014 UCR Upland Soil Study	ADA-160	Cd,Pb	1.1	Yes	0.55	Yes	No	1.8	Yes	0.36	Yes	0.88	Yes
2014 UCR Upland Soil Study	ADA-161	Cd,Pb,Zn	1.5	Yes	0.88	Yes	No	2.7	Yes	0.52	Yes	1.6	Yes
2014 UCR Upland Soil Study	ADA-162	Cd,Cu,Pb,Zn	2	Yes	1.3	Yes	No	4.7	Yes	0.83	Yes	2.5	Yes
2014 UCR Upland Soil Study	ADA-164	Cd,Pb,Se,Zn	1.7	Yes	0.98	Yes	No	3.2	Yes	1.6	Yes	1.9	Yes
2014 UCR Upland Soil Study	ADA-165	Cd,Cu,Pb,Zn	1.9	Yes	1.2	Yes	No	3.6	Yes	0.75	Yes	2.5	Yes
2014 UCR Upland Soil Study	ADA-168	Cd,Pb,Zn	1.5	Yes	0.91	Yes	No	2.3	Yes	0.57	Yes	1.9	Yes
2014 UCR Upland Soil Study	ADA-169	NA	0.43	Yes	0.55	Yes	No	0.79	Yes	0.32	Yes	0.49	Yes
2014 UCR Upland Soil Study	ADA-170	Pb,Zn	0.76	Yes	0.64	Yes	No	1.1	Yes	0.61	Yes	1.6	Yes
2014 UCR Upland Soil Study	ADA-171	Zn	0.83	Yes	0.77	Yes	No	0.93	Yes	0.59	Yes	2	Yes
2014 UCR Upland Soil Study	ADA-172	NA	0.42	Yes	0.36	Yes	No	0.8	Yes	0.52	Yes	0.37	Yes
2014 UCR Upland Soil Study	ADA-173	Pb	0.73	Yes	0.66	Yes	No	1	Yes	0.61	Yes	0.89	Yes
2014 UCR Upland Soil Study	ADA-174	NA	0.94	Yes	0.45	Yes	No	0.9	Yes	0.67	Yes	0.99	Yes
2014 UCR Upland Soil Study	ADA-175	NA	0.44	Yes	0.58	Yes	No	0.76	Yes	0.34	Yes	0.53	Yes
2014 UCR Upland Soil Study	ADA-176	NA	0.41	Yes	0.77	Yes	No	0.64	Yes	0.32	Yes	0.49	Yes
2014 UCR Upland Soil Study	ADA-177	NA	0.37	Yes	0.57	Yes	No	0.71	Yes	0.36	Yes	0.47	Yes
2014 UCR Upland Soil Study	ADA-178	NA	0.38	Yes	0.59	Yes	No	0.6	Yes	0.34	Yes	0.71	Yes
2014 UCR Upland Soil Study	ADA-179	Zn	0.68	Yes	0.52	Yes	No	0.82	Yes	0.59	Yes	1	Yes
2014 UCR Upland Soil Study	ADA-180	Cd,Pb,Se,Zn	1.1	Yes	0.72	Yes	No	1.1	Yes	1.1	Yes	1.7	Yes
2014 UCR Upland Soil Study	ADA-181	Cd,Se,Zn	1.1	Yes	0.79	Yes	No	0.94	Yes	1.2	Yes	1.3	Yes
2014 UCR Upland Soil Study	ADA-182	Cd,Se,Zn	1.2	Yes	0.87	Yes	No	0.47	Yes	1.2	Yes	1.1	Yes
2014 UCR Upland Soil Study	ADA-183	Cd,Cu,Se,Zn	2.2	Yes	1.4	Yes	No	0.52	Yes	6.6	Yes	2.6	Yes
2014 UCR Upland Soil Study	ADA-184	Cd,Se,Zn	1.8	Yes	0.97	Yes	No	0.72	Yes	1.2	Yes	1.6	Yes
2015 Bossburg Study	UDU-01-ICS	Pb	0.5	Yes	0.59	Yes	No	1.5	Yes	0.26	Yes	0.47	Yes
2015 Bossburg Study	UDU-02-ICS	Pb	0.45	Yes	0.78	Yes	No	2	Yes	0.24	Yes	0.55	Yes
2015 Bossburg Study	UDU-03-ICS	Cu,Pb	0.43	Yes	2.4	Yes	Yes	2.9	Yes	0.22	Yes	0.52	Yes
2015 Bossburg Study	UDU-04-ICS	Pb	0.67	Yes	0.75	Yes	No	15	Yes	0.38	Yes	0.8	Yes
2015 Bossburg Study	UDU-05-ICS	Cu	0.46	Yes	1	Yes	No	0.49	Yes	0.32	Yes	0.53	Yes
2015 Bossburg Study	UDU-06-ICS	Se	0.52	Yes	0.92	Yes	No	0.4	Yes	1.3	Yes	0.46	Yes

Notes:

[a]Copper is the only COPC for which some samples with concentrations ≤ BTV result in HQ ≥ 1 and some samples with concentrations > BTV result in HQs ≥ 1.

HQs are based on average daily dose estimates calculated using values in Appendix F; a few HQs differ from those in Tables 9-1 through 9-3 due to rounding of values reported in Appendix F relative to values presented in Table 4-1, 4-2, and 4-4.

≥ = greater than or equal to
BTV = background threshold value
Cd = cadmium
COPC = chemical of potential concern
Cu = copper
HQ = hazard quotient
ID = identification
NA = not applicable; no HQs ≥ 1
Pb = lead
Se = selenium
TRV = toxicity reference value
UCR = Upper Columbia River
Zn = zinc

Table 10-1. Summary of COCs that Present Unacceptable Risk to at Least One Receptor Group

COPC	Number of Sample Locations	COC Status	Count of HQ ≥ 1 for Plants[a]	Count of HQ ≥ 1 for Invertebrates[a]	Count of HQ ≥ 1 for Birds[b]	Count of HQ ≥ 1 for Mammals[b]	Count (percent) of Samples > BTV	Birds: Most Sensitive Endpoint	Birds: Receptor	Mammals: Most Sensitive Endpoint	Mammals: Receptor
Aluminum	253	Not retained	37 (15 %)	37 (15 %)	17 (7 %)	219 (87 %)	0 (0 %)	Growth	American robin	Reproduction	Masked shrew
Antimony	253	Not retained	0 (0 %)[c]	NA	NC	NC	179 (71 %)	NA	NA	NA	NA
Arsenic	253	COC	***76 (30 %)***	0 (0 %)[c]	NA	NA	35 (14 %)	NA	NA	NA	NA
Barium	253	COC	3 (1 %)[c]	***103 (41 %)***	0 (0 %)[c]	NA	78 (31 %)	Growth	California quail	NA	NA
Beryllium	253	Not retained	NA	NA	NC	NA	251 (100%)	NC	NC	NA	NA
Cadmium	253	COC	NA	NA	***139 (55 %)***	***157 (62 %)***	250 (99 %)	Growth	American robin	Survival	Masked shrew
Chromium	253	Not retained	1 (0 %)[c]	7 (3 %)[c]	0 (0 %)[c]	0 (0 %)[c]	75 (30 %)	Growth	American robin	Reproduction	Meadow vole
Cobalt	253	Not retained	1 (0 %)[c]	0 (0 %)[c]	NA	NA	4 (2 %)	NA	NA	NA	NA
Copper	253	COC	0 (0 %)[c]	2 (1 %)[c]	0 (0 %)[c]	***104 (41 %)***	21 (8 %)	Reproduction	Black-capped chickadee	Survival	Masked shrew
Iron	253	Not retained	6 (2 %)[c]	6 (2 %)[c]	0 (0 %)[c]	0 (0 %)[c]	8 (3 %)	Growth	American robin	Growth	Masked shrew
Lead	253	COC	***63 (25 %)***	NA	***160 (63 %)***	***195 (77 %)***	253 (100 %)	Reproduction	American robin	Reproduction	Masked shrew
Manganese	253	COC	***250 (99 %)***	***221 (87 %)***	NA	NA	70 (28 %)	NA	NA	NA	NA
Mercury	253	COC	NA	NA	***130 (51 %)***	0 (0 %)[c]	37 (15 %)	Reproduction	American robin	Reproduction	Masked shrew
Molybdenum	253	Not retained	0 (0 %)[c]	0 (0 %)[c]	0 (0 %)[c]	0 (0 %)[c]	37 (15 %)	Reproduction	Black-capped chickadee	Reproduction	Meadow vole
Nickel	253	Not retained	3 (1 %)[c]	NA	NA	NA	29 (11 %)	NA	NA	NA	NA
Selenium	253	COC	***35 (14 %)***	NA	9 (4 %)[c]	***36 (14 %)***	253 (100 %)	Growth	Black-capped chickadee	Growth	Masked shrew
Silver	253	Not retained	NA	0 (0 %)[c]	NA	NA	252 (100%)	NA	NA	NA	NA
Thallium	253	Not retained	0 (0 %)[c]	0 (0 %)[c]	NC	0 (0 %)[c]	16 (6 %)	NC	NC	Survival	Masked shrew
Vanadium	253	Not retained	NA	0 (0 %)[c]	0 (0 %)[c]	NA	12 (5 %)	Growth	American robin	NA	NA
Zinc	253	COC	***194 (77 %)***	***87 (34 %)***	***74 (29 %)***	***172 (68 %)***	243 (96 %)	Growth	Black-capped chickadee	Growth	Masked shrew

Notes:

[a] Hazard quotients are based on the BAB if available, otherwise-the Eco-SSL or SSL.

[b] Hazard quotients are based on the most sensitive endpoint (survival, growth, or reproduction) for the most sensitive receptor

[c] COPC not retained as a COC for receptor group due to neglegible risks to the receptor group

Counts of HQs for retained COCs are in bold and italics.

≥ = greater than or equal to

BAB = bioavailability adjusted benchmark

BTV = background threshold value

COC = chemical of concern

COPC = chemical of potential concern

Eco-SSL = ecological soil screening level

HQ = hazard quotient

NA = Not applicable (not a COPC)

NC = Not calculated because no acceptable TRV could be identified.

SSL = soil screening level

TRV = Toxicity reference value

Counts of HQs for retained COCs are in bold and italics

Table 10-2. Summary of Maximum HQs Among All COCs for Each Receptor Group (and Endpoint for Birds and Mammals)

		Plants			Invertebrates			Birds					Mammals				
Soil Study	Location ID	Maximum HQ [a]	COC [b]	Site > BTV	Maximum HQ [a]	COC [b]	Site > BTV	Maximum HQ [a]	COC [b]	Site > BTV	Endpoint [c]	Receptor [d]	Maximum HQ[a]	COC[b]	Site > BTV	Endpoint [c]	Receptor[d]
2012 Ecology Upland Soil Study	SA1-1C	11	Manganese	Yes	5.2	Manganese	Yes	1	Lead	Yes	Reproduction	American robin	1.4	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA1-2C	11	Manganese	Yes	5.2	Manganese	Yes	0.7	Zinc	Yes	Growth	Black-capped chickadee	1	Zinc	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA1-3C	4.7	Manganese	No	1.3	Barium	Yes	0.66	Mercury	No	Reproduction	American robin	0.99	Selenium	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA1-4C	4.2	Manganese	No	1.5	Barium	Yes	0.59	Zinc	Yes	Growth	Black-capped chickadee	0.99	Selenium	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA1-5C	5.2	Manganese	No	2.6	Manganese	No	0.6	Mercury	No	Reproduction	American robin	0.99	Selenium	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA1-6C	7.6	Manganese	Yes	3.7	Manganese	Yes	0.66	Lead	Yes	Reproduction	American robin	0.99	Selenium	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA1-7C	5.1	Manganese	No	2.5	Manganese	No	0.64	Mercury	No	Reproduction	American robin	0.99	Selenium	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA1-8C	6	Manganese	Yes	3	Manganese	Yes	0.77	Mercury	No	Reproduction	American robin	0.99	Selenium	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA10-1C	1.2	Zinc	Yes	1.5	Barium	Yes	1.9	Lead	Yes	Reproduction	American robin	2.5	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA10-2C	25	Manganese	Yes	12	Manganese	Yes	6	Lead	Yes	Reproduction	American robin	7.7	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA10-3C	13	Manganese	Yes	6.4	Manganese	Yes	3.4	Cadmium	Yes	Growth	American robin	3.8	Zinc	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA10-4C	10	Selenium	Yes	0.4	Barium	No	6.1	Selenium	Yes	Growth	Black-capped chickadee	10	Selenium	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA10-5C	3.8	Manganese	No	1.8	Manganese	No	1.2	Lead	Yes	Reproduction	American robin	1.6	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA10-6C	10	Manganese	Yes	4.9	Manganese	Yes	1.1	Lead	Yes	Reproduction	American robin	1.4	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA10-7C	17	Manganese	Yes	8.5	Manganese	Yes	1.7	Cadmium	Yes	Growth	American robin	2.3	Zinc	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA10-8C	13	Manganese	Yes	6.3	Manganese	Yes	1.8	Lead	Yes	Reproduction	American robin	2.4	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA11-1C	4	Manganese	No	2	Manganese	No	0.6	Zinc	Yes	Growth	Black-capped chickadee	1.4	Copper	No	Survival	Masked shrew
2012 Ecology Upland Soil Study	SA11-2C	5.5	Manganese	No	1.3	Barium	Yes	0.66	Lead	Yes	Reproduction	American robin	0.99	Selenium	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA11-3C	1.3	Selenium	Yes	1.1	Manganese	No	0.97	Mercury	No	Reproduction	American robin	1.4	Selenium	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA11-4C	6	Manganese	Yes	3	Manganese	Yes	2.7	Lead	Yes	Reproduction	American robin	3.5	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA11-5C	7.4	Manganese	Yes	3.6	Manganese	Yes	2.2	Lead	Yes	Reproduction	American robin	2.8	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA11-6C	1.7	Zinc	Yes	1.5	Manganese	No	3.2	Lead	Yes	Reproduction	American robin	4	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA11-7C	6.9	Zinc	Yes	3.2	Manganese	Yes	9.5	Lead	Yes	Reproduction	American robin	12	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA11-8C	7.1	Manganese	Yes	3.5	Manganese	Yes	4.4	Lead	Yes	Reproduction	American robin	5.5	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA11-9C	13	Manganese	Yes	6.3	Manganese	Yes	3.8	Lead	Yes	Reproduction	American robin	4.8	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA12-1C	7.3	Manganese	Yes	3.6	Manganese	Yes	1.3	Cadmium, Lead	Yes,Yes	Growth,Reproduction	American robin	2.3	Copper	Yes	Survival	Masked shrew
2012 Ecology Upland Soil Study	SA12-2C	6.7	Manganese	Yes	3.3	Manganese	Yes	1.5	Lead	Yes	Reproduction	American robin	1.9	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA12-3C	1.2	Selenium	Yes	1.5	Manganese	No	1.8	Mercury	Yes	Reproduction	American robin	1.8	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA12-4C	4.4	Manganese	No	1.3	Barium	Yes	1.1	Lead	Yes	Reproduction	American robin	1.5	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA12-6C	5.7	Manganese	Yes	2.8	Manganese	Yes	0.96	Mercury	No	Reproduction	American robin	1.9	Copper	Yes	Survival	Masked shrew
2012 Ecology Upland Soil Study	SA12-7C	11	Manganese	Yes	5.3	Manganese	Yes	1.3	Lead	Yes	Reproduction	American robin	2	Zinc	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA12-8C	6.2	Manganese	Yes	3	Manganese	Yes	1.6	Lead	Yes	Reproduction	American robin	2	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA12-9C	12	Manganese	Yes	6.1	Manganese	Yes	0.6	Zinc	Yes	Growth	Black-capped chickadee	0.99	Selenium	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA13-1C	3.9	Manganese	No	1.9	Manganese	No	0.71	Lead	Yes	Reproduction	American robin	1.1	Copper	No	Survival	Masked shrew
2012 Ecology Upland Soil Study	SA13-2C	5.7	Manganese	Yes	2.8	Manganese	Yes	2	Selenium	Yes	Growth	Black-capped chickadee	3.4	Selenium	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA13-3C	6.7	Manganese	Yes	3.3	Manganese	Yes	1.1	Lead	Yes	Reproduction	American robin	1.4	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA13-4C	3.8	Selenium	Yes	0.7	Manganese	No	2.3	Selenium	Yes	Growth	Black-capped chickadee	4	Selenium	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA13-5C	6.7	Manganese	Yes	3.3	Manganese	Yes	3.3	Lead	Yes	Reproduction	American robin	4.4	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA13-6C	10	Manganese	Yes	5	Manganese	Yes	1.8	Lead	Yes	Reproduction	American robin	2.3	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA13-7C	3.8	Manganese	No	1.9	Manganese	No	1.7	Lead	Yes	Reproduction	American robin	2.2	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA13-8C	5.4	Manganese	No	2.6	Manganese	No	1.1	Lead	Yes	Reproduction	American robin	1.5	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA2-1C	11	Manganese	Yes	5.6	Manganese	Yes	1.5	Lead	Yes	Reproduction	American robin	2.2	Zinc	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA2-2C	2.2	Zinc	Yes	1.1	Zinc	Yes	0.74	Zinc	Yes	Growth	Black-capped chickadee	1.2	Zinc	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA2-3C	1	Zinc	Yes	1.8	Manganese	No	0.74	Lead	Yes	Reproduction	American robin	0.99	Selenium	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA2-4C	5.8	Manganese	Yes	2.8	Manganese	Yes	1.5	Lead	Yes	Reproduction	American robin	1.9	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA2-5C	1.8	Manganese	No	0.89	Manganese	No	0.58	Selenium	Yes	Growth	Black-capped chickadee	0.99	Selenium	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA2-6C	4.4	Zinc	Yes	2.2	Zinc	Yes	2.3	Cadmium, Lead	Yes,Yes	Growth,Reproduction	American robin	3	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA2-7C	1.6	Zinc	Yes	2.5	Manganese	No	0.76	Cadmium	Yes	Growth	American robin	1.5	Copper	No	Survival	Masked shrew
2012 Ecology Upland Soil Study	SA2-8C	1.6	Zinc	Yes	2.6	Manganese	No	0.67	Zinc	Yes	Growth	Black-capped chickadee	0.99	Selenium	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA3-1C	3.9	Manganese	No	1.9	Manganese	No	0.58	Selenium	Yes	Growth	Black-capped chickadee	0.99	Selenium	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA3-2C	5.9	Manganese	Yes	2.9	Manganese	Yes	0.58	Selenium, Zinc	Yes,Yes	Growth,Growth	Black-capped chickadee	0.99	Selenium	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA3-3C	6.5	Manganese	Yes	3.2	Manganese	Yes	1.1	Lead	Yes	Reproduction	American robin	1.5	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA3-4C	4.5	Manganese	No	2.2	Manganese	No	0.58	Selenium	Yes	Growth	Black-capped chickadee	0.99	Selenium	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA3-5C	2.8	Manganese	No	1.4	Manganese	No	0.7	Lead	Yes	Reproduction	American robin	0.99	Selenium	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA3-6C	11	Manganese	Yes	5.4	Manganese	Yes	2.9	Lead	Yes	Reproduction	American robin	3.7	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA3-7C	2	Zinc	Yes	2.4	Manganese	No	2.5	Lead	Yes	Reproduction	American robin	3.2	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA3-8C	1.1	Zinc	Yes	2	Manganese	No	1.3	Lead	Yes	Reproduction	American robin	1.6	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA4-1C	1.3	Zinc	Yes	1.9	Manganese	No	1.3	Lead	Yes	Reproduction	American robin	1.7	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA4-2C	2.6	Manganese	No	1.3	Manganese	No	0.86	Lead	Yes	Reproduction	American robin	1.2	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA4-3C	2.5	Zinc	Yes	1.5	Manganese	No	2.5	Lead	Yes	Reproduction	American robin	3.1	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA4-4C	1.8	Zinc	Yes	1.8	Manganese	No	1.4	Lead	Yes	Reproduction	American robin	1.8	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA4-5C	3.8	Manganese	No	1.9	Manganese	No	0.75	Lead	Yes	Reproduction	American robin	1	Copper	No	Survival	Masked shrew
2012 Ecology Upland Soil Study	SA4-6C	2.2	Zinc	Yes	1.1	Zinc	Yes	2.9	Lead	Yes	Reproduction	American robin	3.6	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA4-7C	1.3	Zinc	Yes	2.6	Manganese	No	1.8	Lead	Yes	Reproduction	American robin	2.3	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA4-8C	2.8	Manganese	No	1.4	Manganese	No	0.91	Lead	Yes	Reproduction	American robin	1.2	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA5-1C	1.9	Zinc	Yes	1.1	Zinc	Yes	1.9	Lead	Yes	Reproduction	American robin	2.5	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA5-2C	1.5	Zinc	Yes	2.3	Barium	Yes	0.91	Lead	Yes	Reproduction	American robin	1.2	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA5-3C	2.8	Zinc	Yes	1.8	Zinc	Yes	1.7	Lead	Yes	Reproduction	American robin	2.3	Zinc	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA5-4C	2.4	Zinc	Yes	1.3	Zinc	Yes	2	Lead	Yes	Reproduction	American robin	2.6	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA5-5C	1	Zinc	Yes	0.97	Manganese	No	0.8	Lead	Yes	Reproduction	American robin	1.1	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA5-7C	3	Zinc	Yes	1.6	Zinc	Yes	2.2	Lead	Yes	Reproduction	American robin	2.9	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA5-8C	1.5	Arsenic	Yes	1.2	Manganese	No	1.9	Lead	Yes	Reproduction	American robin	2.5	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA6-1C	9.2	Manganese	Yes	4.5	Manganese	Yes	2.3	Lead	Yes	Reproduction	American robin	3	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA6-2C	4	Zinc	Yes	2	Zinc	Yes	2.3	Lead	Yes	Reproduction	American robin	2.9	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA6-3C	5.8	Manganese	Yes	2.8	Manganese	Yes	3	Lead	Yes	Reproduction	American robin	3.8	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA6-4C	0.96	Selenium	Yes	0.39	Zinc	No	0.63	Lead	Yes	Reproduction	American robin	0.99	Selenium	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA6-5C	0.96	Selenium	Yes	0.4	Manganese	No	0.58	Selenium	Yes	Growth	Black-capped chickadee	0.99	Selenium	Yes	Growth	Masked shrew
2012 Ecology Upland Soil Study	SA6-6C	4	Zinc	Yes	1.7	Zinc	Yes	3.5	Lead	Yes	Reproduction	American robin	4.4	Lead	Yes	Reproduction	Masked shrew

Table 10-2. Summary of Maximum HQs Among All COCs for Each Receptor Group (and Endpoint for Birds and Mammals)

		Plants			Invertebrates			Birds					Mammals				
Soil Study	Location ID	Maximum HQ [a]	COC [b]	Site > BTV	Maximum HQ [a]	COC [b]	Site > BTV	Maximum HQ [a]	COC [b]	Site > BTV	Endpoint [c]	Receptor [d]	Maximum HQ [a]	COC [b]	Site > BTV	Endpoint [c]	Receptor [d]
2012 Ecology Upland Soil Study	SA6-7C	6.3	Manganese	Yes	3.1	Manganese	Yes	3.5	Lead	Yes	Reproduction	American robin	4.3	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA6-8C	1.1	Zinc	Yes	1	Manganese	No	0.82	Lead	Yes	Reproduction	American robin	1.1	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA7-1C	3.7	Zinc	Yes	1.7	Zinc	Yes	1.9	Lead	Yes	Reproduction	American robin	2.4	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA7-2C	3.8	Zinc	Yes	2.1	Zinc	Yes	1.8	Lead	Yes	Reproduction	American robin	2.4	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA7-3C	3.2	Zinc	Yes	1.5	Zinc	Yes	3.5	Lead	Yes	Reproduction	American robin	4.4	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA7-4C	2.3	Zinc	Yes	0.97	Zinc	Yes	1.7	Lead	Yes	Reproduction	American robin	2.2	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA7-5C	6.1	Zinc	Yes	2.5	Zinc	Yes	4.9	Lead	Yes	Reproduction	American robin	6.1	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA7-6C	6.7	Zinc	Yes	3.3	Zinc	Yes	2.7	Lead	Yes	Reproduction	American robin	3.5	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA7-7C	13	Zinc	Yes	5.8	Zinc	Yes	6.5	Lead	Yes	Reproduction	American robin	8	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA7-8C	7.7	Zinc	Yes	4	Zinc	Yes	4.7	Lead	Yes	Reproduction	American robin	6	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA8-1C	5.1	Zinc	Yes	2.4	Zinc	Yes	2.2	Lead	Yes	Reproduction	American robin	2.9	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA8-2C	3.3	Zinc	Yes	1.4	Zinc	Yes	2.2	Lead	Yes	Reproduction	American robin	2.8	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA8-3C	1.4	Zinc	Yes	0.84	Manganese	No	0.89	Lead	Yes	Reproduction	American robin	1.2	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA8-4C	2.7	Zinc	Yes	1.3	Zinc	Yes	2.6	Lead	Yes	Reproduction	American robin	3.3	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA8-5C	4	Zinc	Yes	1.8	Zinc	Yes	4	Lead	Yes	Reproduction	American robin	5	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA8-6C	3.4	Zinc	Yes	1.6	Zinc	Yes	1.9	Lead	Yes	Reproduction	American robin	2.4	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA8-7C	8.1	Zinc	Yes	3.7	Zinc	Yes	5.5	Lead	Yes	Reproduction	American robin	6.9	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA8-8C	11	Zinc	Yes	5.2	Zinc	Yes	7	Lead	Yes	Reproduction	American robin	8.8	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA9-10C	2.1	Zinc	Yes	1.1	Zinc	Yes	2.4	Lead	Yes	Reproduction	American robin	3.1	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA9-1C	7.9	Manganese	Yes	3.8	Manganese	Yes	5	Lead	Yes	Reproduction	American robin	6.5	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA9-2C	1.8	Barium	Yes	7.8	Barium	Yes	1.4	Lead	Yes	Reproduction	American robin	2.2	Copper	Yes	Survival	Masked shrew
2012 Ecology Upland Soil Study	SA9-3C	5.7	Manganese	Yes	2.8	Manganese	Yes	1.1	Lead	Yes	Reproduction	American robin	1.4	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA9-4C	2.3	Zinc	Yes	1.3	Zinc	Yes	2.7	Lead	Yes	Reproduction	American robin	3.5	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA9-5C	7.9	Manganese	Yes	3.8	Manganese	Yes	2.9	Lead	Yes	Reproduction	American robin	3.7	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA9-6C	2.4	Zinc	Yes	1.4	Zinc	Yes	3.3	Lead	Yes	Reproduction	American robin	4.4	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA9-7C	5.7	Manganese	Yes	2.8	Manganese	Yes	3	Lead	Yes	Reproduction	American robin	3.8	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA9-8C	9.2	Manganese	Yes	4.5	Manganese	Yes	3.6	Lead	Yes	Reproduction	American robin	4.7	Lead	Yes	Reproduction	Masked shrew
2012 Ecology Upland Soil Study	SA9-9C	6.1	Manganese	Yes	3	Manganese	Yes	2.1	Lead	Yes	Reproduction	American robin	2.7	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-001	1.7	Zinc	Yes	1.4	Manganese	No	1.9	Lead	Yes	Reproduction	American robin	2.5	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-002	1.7	Zinc	Yes	1.1	Zinc	Yes	0.88	Selenium	Yes	Growth	Black-capped chickadee	1.5	Selenium	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-004	2.6	Zinc	Yes	1.3	Barium, Zinc	Yes,Yes	1.3	Cadmium	Yes	Growth	American robin	1.6	Zinc	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-005	1.7	Selenium	Yes	1.3	Manganese	No	1.1	Selenium	Yes	Growth	Black-capped chickadee	1.8	Selenium	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-006	1.7	Zinc	Yes	0.99	Manganese	No	1.2	Lead	Yes	Reproduction	American robin	1.6	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-008	1.7	Zinc	Yes	1.7	Manganese	No	2.3	Lead	Yes	Reproduction	American robin	3	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-010	6.3	Manganese	Yes	3.1	Manganese	Yes	2.3	Lead	Yes	Reproduction	American robin	3.1	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-015	1.1	Zinc	Yes	1.2	Manganese	No	0.96	Lead	Yes	Reproduction	American robin	1.2	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-016	1.3	Zinc	Yes	0.88	Manganese	No	0.79	Lead	Yes	Reproduction	American robin	1	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-017	2	Zinc	Yes	1	Zinc	Yes	1.6	Lead	Yes	Reproduction	American robin	2.1	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-018	1.8	Zinc	Yes	2.2	Manganese	No	3.2	Lead	Yes	Reproduction	American robin	4.1	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-019	2.4	Manganese	No	1.2	Manganese	No	0.59	Zinc	Yes	Growth	Black-capped chickadee	0.99	Copper	No	Survival	Masked shrew
2014 UCR Upland Soil Study	ADA-020	1.3	Zinc	Yes	1	Manganese	No	0.57	Zinc	Yes	Growth	Black-capped chickadee	0.73	Copper	No	Survival	Masked shrew
2014 UCR Upland Soil Study	ADA-021	3	Manganese	No	1.5	Manganese	No	0.59	Zinc	Yes	Growth	Black-capped chickadee	2.2	Copper	Yes	Survival	Masked shrew
2014 UCR Upland Soil Study	ADA-023	1.7	Zinc	Yes	0.98	Zinc	Yes	1.3	Cadmium	Yes	Growth	American robin	1.6	Selenium	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-024	2	Zinc	Yes	1.2	Zinc	Yes	2.7	Lead	Yes	Reproduction	American robin	3.5	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-025	6.8	Manganese	Yes	3.3	Manganese	Yes	2	Cadmium	Yes	Growth	American robin	2.3	Zinc	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-026	1.6	Zinc	Yes	1.9	Barium	Yes	1.4	Cadmium	Yes	Growth	American robin	1.9	Zinc	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-028	1.3	Zinc	Yes	2	Manganese	No	1.6	Lead	Yes	Reproduction	American robin	2.1	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-033	2.7	Zinc	Yes	1.8	Zinc	Yes	1.3	Zinc	Yes	Growth	Black-capped chickadee	2.2	Zinc	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-034	1.3	Zinc	Yes	2.1	Manganese	No	0.7	Zinc	Yes	Growth	Black-capped chickadee	1	Zinc	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-035	5.7	Manganese	Yes	2.8	Manganese	Yes	1.5	Lead	Yes	Reproduction	American robin	1.9	Lead, Zinc	Yes,Yes	Reproduction,Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-039	2.4	Zinc	Yes	1.9	Barium	Yes	1.2	Cadmium	Yes	Growth	American robin	1.3	Cadmium, Zinc	Yes,Yes	Survival,Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-042	1.5	Zinc	Yes	1.4	Barium	Yes	0.81	Lead	Yes	Reproduction	American robin	1.1	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-043	1.2	Selenium	Yes	3.5	Barium	Yes	1.1	Cadmium	Yes	Growth	American robin	1.3	Zinc	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-044	2.1	Zinc	Yes	1.3	Barium	Yes	2.2	Cadmium	Yes	Growth	American robin	2.2	Zinc	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-045	1.7	Zinc	Yes	2.5	Manganese	No	2.7	Lead	Yes	Reproduction	American robin	3.5	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-046	1.5	Zinc	Yes	1.4	Manganese	No	1.6	Lead	Yes	Reproduction	American robin	2.1	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-047	2.4	Zinc	Yes	1.4	Zinc	Yes	1.9	Lead	Yes	Reproduction	American robin	2.4	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-048	1.5	Selenium	Yes	4.3	Barium	Yes	1.1	Cadmium	Yes	Growth	American robin	1.5	Selenium	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-049	6.7	Manganese	Yes	3.3	Manganese	Yes	1.4	Cadmium	Yes	Growth	American robin	1.5	Cadmium	Yes	Survival	Masked shrew
2014 UCR Upland Soil Study	ADA-050	2.1	Zinc	Yes	1.2	Zinc	Yes	2.2	Lead	Yes	Reproduction	American robin	2.8	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-051	2.2	Zinc	Yes	2.4	Barium	Yes	1.6	Cadmium	Yes	Growth	American robin	2.2	Copper	Yes	Survival	Masked shrew
2014 UCR Upland Soil Study	ADA-052	1.6	Zinc	Yes	1.9	Manganese	No	2.2	Lead	Yes	Reproduction	American robin	2.9	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-053	8.8	Manganese	Yes	4.3	Manganese	Yes	1	Mercury	No	Reproduction	American robin	1.1	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-054	1.7	Zinc	Yes	1.5	Manganese	No	2.3	Lead	Yes	Reproduction	American robin	2.9	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-055	7.6	Manganese	Yes	4.5	Barium	Yes	1.9	Cadmium	Yes	Growth	American robin	2.5	Zinc	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-056	9.4	Manganese	Yes	4.6	Manganese	Yes	0.66	Lead	Yes	Reproduction	American robin	0.87	Zinc	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-057	4.2	Manganese	No	2	Manganese	No	0.82	Lead	Yes	Reproduction	American robin	1.1	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-058	8.9	Manganese	Yes	4.3	Manganese	Yes	0.79	Mercury	No	Reproduction	American robin	0.95	Zinc	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-059	8.5	Manganese	Yes	4.2	Manganese	Yes	1	Mercury	No	Reproduction	American robin	1.2	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-060	1.7	Zinc	Yes	1.7	Manganese	No	1.8	Lead	Yes	Reproduction	American robin	2.4	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-061	11	Manganese	Yes	5.2	Manganese	Yes	0.87	Lead	Yes	Reproduction	American robin	1.2	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-062	1.2	Zinc	Yes	1.6	Manganese	No	1.6	Lead	Yes	Reproduction	American robin	2.2	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-063	7.1	Manganese	Yes	4.2	Barium	Yes	1.4	Cadmium	Yes	Growth	American robin	1.5	Cadmium	Yes	Survival	Masked shrew
2014 UCR Upland Soil Study	ADA-064	10	Manganese	Yes	5	Manganese	Yes	0.88	Lead	Yes	Reproduction	American robin	1.1	Lead, Zinc	Yes,Yes	Reproduction,Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-065	1.4	Zinc	Yes	1	Manganese	No	0.95	Lead	Yes	Reproduction	American robin	1.3	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-066	1.5	Zinc	Yes	1.6	Manganese	No	1.2	Lead	Yes	Reproduction	American robin	1.5	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-067	6.2	Manganese	Yes	3	Manganese	Yes	1.6	Cadmium	Yes	Growth	American robin	2	Copper	Yes	Survival	Masked shrew
2014 UCR Upland Soil Study	ADA-070	1.4	Zinc	Yes	2.2	Manganese	No	1.8	Lead	Yes	Reproduction	American robin	2.3	Lead	Yes	Reproduction	Masked shrew

Table 10-2. Summary of Maximum HQs Among All COCs for Each Receptor Group (and Endpoint for Birds and Mammals)

		Plants			Invertebrates			Birds					Mammals				
Soil Study	Location ID	Maximum HQ [a]	COC [b]	Site > BTV	Maximum HQ [a]	COC [b]	Site > BTV	Maximum HQ [a]	COC [b]	Site > BTV	Endpoint [c]	Receptor [d]	Maximum HQ[a]	COC[b]	Site > BTV	Endpoint [c]	Receptor[d]
2014 UCR Upland Soil Study	ADA-071	1.7	Zinc	Yes	2.1	Manganese	No	1.8	Lead	Yes	Reproduction	American robin	2.3	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-073	1.7	Zinc	Yes	1.9	Manganese	No	1.7	Lead	Yes	Reproduction	American robin	2.2	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-076	2.7	Zinc	Yes	1.2	Barium	Yes	2.4	Lead	Yes	Reproduction	American robin	3	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-078	2	Zinc	Yes	1.3	Barium	Yes	1.7	Lead	Yes	Reproduction	American robin	2.1	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-079	1.5	Zinc	Yes	2.8	Barium	Yes	2.1	Cadmium	Yes	Growth	American robin	2	Cadmium, Zinc	Yes,Yes	Survival,Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-081	1.2	Zinc	Yes	1.8	Manganese	No	1	Lead	Yes	Reproduction	American robin	1.3	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-082	3.1	Manganese	No	1.5	Manganese	No	1	Lead	Yes	Reproduction	American robin	1.3	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-084	7.2	Manganese	Yes	3.5	Manganese	Yes	1.1	Lead	Yes	Reproduction	American robin	1.5	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-085	2.5	Zinc	Yes	1.6	Zinc	Yes	2.8	Zinc	Yes	Growth	Black-capped chickadee	4.8	Zinc	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-088	5.9	Manganese	Yes	2.9	Manganese	Yes	1.5	Lead	Yes	Reproduction	American robin	1.9	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-089	7	Manganese	Yes	3.4	Manganese	Yes	1.6	Lead	Yes	Reproduction	American robin	2.1	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-090	5.9	Manganese	Yes	2.9	Manganese	Yes	1.6	Mercury	Yes	Reproduction	American robin	1.8	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-091	1.8	Zinc	Yes	2.3	Manganese	No	1.6	Lead	Yes	Reproduction	American robin	2.1	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-092	7	Manganese	Yes	3.4	Manganese	Yes	1.6	Cadmium, Lead	Yes,Yes	Growth,Reproduction	American robin	2.1	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-093	8.7	Manganese	Yes	4.3	Manganese	Yes	1.3	Lead	Yes	Reproduction	American robin	1.6	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-094	4.2	Manganese	No	2	Manganese	No	0.75	Mercury	No	Reproduction	American robin	0.92	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-095	5.6	Manganese	No	2.8	Manganese	No	1	Lead	Yes	Reproduction	American robin	1.4	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-096	5.7	Manganese	Yes	2.8	Manganese	Yes	1.8	Lead	Yes	Reproduction	American robin	2.2	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-097	1.2	Zinc	Yes	2.6	Manganese	No	2.3	Lead	Yes	Reproduction	American robin	3	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-099	7.2	Manganese	Yes	3.5	Manganese	Yes	1.6	Lead, Mercury	Yes,Yes	Reproduction	American robin	2.1	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-101	5	Manganese	No	2.5	Manganese	No	1.2	Lead	Yes	Reproduction	American robin	1.7	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-102	1.2	Zinc	Yes	1.2	Barium	Yes	0.97	Lead	Yes	Reproduction	American robin	1.3	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-103	9.7	Manganese	Yes	4.8	Manganese	Yes	0.92	Mercury	No	Reproduction	American robin	1.2	Zinc	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-104	1.1	Zinc	Yes	1.3	Barium	Yes	1	Mercury	No	Reproduction	American robin	1	Zinc	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-105	1.8	Zinc	Yes	1.3	Barium	Yes	1.6	Lead	Yes	Reproduction	American robin	2.1	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-106	7.2	Manganese	Yes	3.5	Manganese	Yes	1	Mercury	No	Reproduction	American robin	1.5	Selenium	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-107	10	Manganese	Yes	4.9	Manganese	Yes	1.2	Cadmium	Yes	Growth	American robin	1.5	Zinc	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-108	1	Zinc	Yes	1.8	Manganese	No	1	Lead	Yes	Reproduction	American robin	1.4	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-109	1.3	Zinc	Yes	1.5	Manganese	No	1.9	Lead	Yes	Reproduction	American robin	2.5	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-110	1.6	Zinc	Yes	1.1	Manganese	No	1.3	Lead	Yes	Reproduction	American robin	1.8	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-111	1	Zinc	Yes	2.4	Manganese	No	0.94	Mercury	No	Reproduction	American robin	0.98	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-112	6.9	Manganese	Yes	3.4	Manganese	Yes	1.2	Mercury	No	Reproduction	American robin	0.95	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-113	6.8	Manganese	Yes	3.3	Manganese	Yes	1.4	Mercury	No	Reproduction	American robin	1.3	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-114	6.8	Manganese	Yes	3.3	Manganese	Yes	1.3	Mercury	No	Reproduction	American robin	1.2	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-115	5.4	Manganese	No	2.6	Manganese	No	0.97	Lead	Yes	Reproduction	American robin	1.3	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-116	1.3	Zinc	Yes	2.5	Manganese	No	0.9	Lead	Yes	Reproduction	American robin	1.2	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-117	5.8	Manganese	Yes	2.8	Manganese	Yes	1.1	Lead	Yes	Reproduction	American robin	1.4	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-118	6.5	Manganese	Yes	3.2	Manganese	Yes	1.1	Cadmium	Yes	Growth	American robin	1.4	Zinc	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-119	4.3	Manganese	No	2.1	Manganese	No	1.1	Lead	Yes	Reproduction	American robin	1.5	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-121	1.5	Zinc	Yes	2.6	Manganese	No	1.4	Lead	Yes	Reproduction	American robin	1.9	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-122	7.4	Manganese	Yes	3.6	Manganese	Yes	1.1	Mercury	No	Reproduction	American robin	1	Zinc	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-124	1.8	Zinc	Yes	1.4	Manganese	No	1.5	Lead	Yes	Reproduction	American robin	1.8	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-125	1.4	Zinc	Yes	1.1	Manganese	No	1.1	Lead	Yes	Reproduction	American robin	1.4	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-126	2.1	Zinc	Yes	1.1	Zinc	Yes	2.3	Lead	Yes	Reproduction	American robin	2.9	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-127	1.9	Zinc	Yes	1.5	Barium	Yes	1.3	Cadmium	Yes	Growth	American robin	1.7	Zinc	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-128	2	Zinc	Yes	1.1	Zinc	Yes	1.4	Lead	Yes	Reproduction	American robin	1.8	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-131	2.5	Zinc	Yes	1.3	Barium	Yes	3.1	Lead	Yes	Reproduction	American robin	4	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-132	1.8	Zinc	Yes	0.75	Manganese	No	1.5	Lead	Yes	Reproduction	American robin	1.9	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-133	2	Zinc	Yes	1.6	Manganese	No	1.6	Lead	Yes	Reproduction	American robin	2	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-135	2.7	Zinc	Yes	1.4	Zinc	Yes	0.79	Lead	Yes	Reproduction	American robin	1	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-136	2	Zinc	Yes	1.1	Zinc	Yes	1.3	Lead	Yes	Reproduction	American robin	1.7	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-139	1.8	Zinc	Yes	1.8	Manganese	No	1.4	Lead	Yes	Reproduction	American robin	1.9	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-141	1.4	Zinc	Yes	1.4	Manganese	No	1.1	Mercury	No	Reproduction	American robin	1.2	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-142	1.8	Zinc	Yes	1.1	Manganese	No	1.5	Lead	Yes	Reproduction	American robin	1.9	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-143	1.8	Zinc	Yes	0.9	Zinc	Yes	0.95	Lead	Yes	Reproduction	American robin	1.2	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-144	1.8	Zinc	Yes	0.84	Zinc	Yes	1.6	Lead	Yes	Reproduction	American robin	2	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-145	1.6	Zinc	Yes	1.8	Manganese	No	1.9	Lead	Yes	Reproduction	American robin	2.4	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-146	2.4	Zinc	Yes	1.2	Zinc	Yes	1.7	Lead	Yes	Reproduction	American robin	2.2	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-147	1.8	Zinc	Yes	0.82	Zinc	Yes	2.1	Lead	Yes	Reproduction	American robin	2.7	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-148	3.1	Zinc	Yes	1.3	Zinc	Yes	2.1	Lead	Yes	Reproduction	American robin	2.7	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-150	2.9	Zinc	Yes	1.3	Zinc	Yes	1.9	Lead	Yes	Reproduction	American robin	2.5	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-151	3.3	Zinc	Yes	1.3	Zinc	Yes	2.1	Lead	Yes	Reproduction	American robin	2.6	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-152	2.4	Zinc	Yes	1.3	Zinc	Yes	1.9	Lead	Yes	Reproduction	American robin	2.4	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-153	1.7	Zinc	Yes	1.5	Manganese	No	1.9	Lead	Yes	Reproduction	American robin	2.5	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-154	2.3	Zinc	Yes	1.1	Zinc	Yes	2.1	Lead	Yes	Reproduction	American robin	2.7	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-155	2.3	Zinc	Yes	1.5	Manganese	No	1.6	Lead	Yes	Reproduction	American robin	2	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-156	2.1	Zinc	Yes	1.1	Zinc	Yes	3	Lead	Yes	Reproduction	American robin	3.9	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-158	3.4	Zinc	Yes	1.8	Zinc	Yes	3.1	Lead	Yes	Reproduction	American robin	4	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-159	2.4	Zinc	Yes	1.1	Zinc	Yes	2.3	Lead	Yes	Reproduction	American robin	3	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-160	1.9	Zinc	Yes	0.87	Zinc	Yes	1.4	Lead	Yes	Reproduction	American robin	1.8	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-161	3.3	Zinc	Yes	1.3	Zinc	Yes	2.2	Lead	Yes	Reproduction	American robin	2.7	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-162	3.4	Zinc	Yes	1.7	Zinc	Yes	3.8	Lead	Yes	Reproduction	American robin	4.7	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-164	1.9	Zinc	Yes	1.1	Zinc	Yes	2.5	Lead	Yes	Reproduction	American robin	3.2	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-165	4	Zinc	Yes	2	Zinc	Yes	2.8	Lead	Yes	Reproduction	American robin	3.6	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-168	3.4	Zinc	Yes	1.8	Zinc	Yes	1.8	Lead	Yes	Reproduction	American robin	2.3	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-169	4.4	Manganese	No	2.1	Manganese	No	0.85	Mercury	No	Reproduction	American robin	0.79	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-170	1.6	Zinc	Yes	2.1	Manganese	No	1.2	Mercury	No	Reproduction	American robin	1.6	Zinc	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-171	2.2	Zinc	Yes	1.1	Zinc	Yes	1.1	Zinc	Yes	Growth	Black-capped chickadee	2	Zinc	Yes	Growth	Masked shrew

Table 10-2. Summary of Maximum HQs Among All COCs for Each Receptor Group (and Endpoint for Birds and Mammals)

		Plants			Invertebrates			Birds					Mammals				
Soil Study	Location ID	Maximum HQ [a]	COC [b]	Site > BTV	Maximum HQ [a]	COC [b]	Site > BTV	Maximum HQ [a]	COC [b]	Site > BTV	Endpoint [c]	Receptor [d]	Maximum HQ[a]	COC[b]	Site > BTV	Endpoint [c]	Receptor[d]
2014 UCR Upland Soil Study	ADA-172	5	Manganese	No	2.4	Manganese	No	1.3	Mercury	No	Reproduction	American robin	0.8	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-173	6	Manganese	Yes	2.9	Manganese	Yes	1.1	Mercury	No	Reproduction	American robin	1	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-174	6.4	Manganese	Yes	3.1	Manganese	Yes	1.5	Mercury	No	Reproduction	American robin	0.99	Zinc	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-175	4.9	Manganese	No	2.4	Manganese	No	0.66	Mercury	No	Reproduction	American robin	0.76	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-176	3.9	Manganese	No	1.9	Manganese	No	0.72	Mercury	No	Reproduction	American robin	0.77	Copper	No	Survival	Masked shrew
2014 UCR Upland Soil Study	ADA-177	5.2	Manganese	No	2.5	Manganese	No	0.93	Mercury	No	Reproduction	American robin	0.71	Lead	Yes	Reproduction	Masked shrew
2014 UCR Upland Soil Study	ADA-178	4	Manganese	No	1.9	Manganese	No	0.77	Mercury	No	Reproduction	American robin	0.71	Zinc	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-179	1.2	Zinc	Yes	2.6	Manganese	No	1	Mercury	No	Reproduction	American robin	1	Zinc	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-180	1.4	Zinc	Yes	1.8	Barium	Yes	1.1	Mercury	No	Reproduction	American robin	1.7	Zinc	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-181	1.2	Selenium	Yes	1.3	Barium	Yes	1.4	Mercury	No	Reproduction	American robin	1.3	Zinc	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-182	1.3	Zinc	Yes	1.3	Manganese	No	1.1	Cadmium	Yes	Growth	American robin	1.2	Cadmium, Selenium	Yes,Yes	Survival,Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-183	6.4	Selenium	Yes	1.3	Barium	Yes	3.9	Selenium	Yes	Growth	Black-capped chickadee	6.6	Selenium	Yes	Growth	Masked shrew
2014 UCR Upland Soil Study	ADA-184	1.3	Zinc	Yes	2.3	Barium	Yes	1.8	Cadmium	Yes	Growth	American robin	1.8	Cadmium	Yes	Survival	Masked shrew
2015 Bossburg Study	UDU-01-ICS	1.5	Manganese, Zinc	No,No	0.83	Zinc	No	1.1	Lead	Yes	Reproduction	American robin	1.5	Lead	Yes	Reproduction	Masked shrew
2015 Bossburg Study	UDU-02-ICS	1.7	Zinc	Yes	0.94	Zinc	Yes	1.5	Lead	Yes	Reproduction	American robin	2	Lead	Yes	Reproduction	Masked shrew
2015 Bossburg Study	UDU-03-ICS	2.3	Lead	Yes	1.4	Copper	Yes	2.1	Lead	Yes	Reproduction	American robin	2.9	Lead	Yes	Reproduction	Masked shrew
2015 Bossburg Study	UDU-04-ICS	14	Lead	Yes	1.5	Zinc	Yes	12	Lead	Yes	Reproduction	American robin	15	Lead	Yes	Reproduction	Masked shrew
2015 Bossburg Study	UDU-05-ICS	1.8	Manganese	No	0.88	Manganese	No	0.55	Zinc	Yes	Growth	Black-capped chickadee	1	Copper	No	Survival	Masked shrew
2015 Bossburg Study	UDU-06-ICS	1.3	Selenium	Yes	0.77	Manganese	No	0.77	Selenium	Yes	Growth	Black-capped chickadee	1.3	Selenium	Yes	Growth	Masked shrew

Notes:

[a] Maximum HQs are based on the BAB if available, otherwise it is based on the Eco-SSL or SSL.

[b] COC associated with the maximum HQ. If multiple COCs have the same HQ, each COC is listed.

[c] Endpoint associated with minimum TRV. Multiple endpoints listed when multiple COCs have the same HQ.

[d] Receptor associated with the minimum TRV for the most sensitive endpoint.

> = greater than

BAB = bioavailability adjusted benchmark

BTV = background threshold value

COC = chemical of concern

Eco-SSL = ecological soil screening level

HQ = hazard quotient

ID = identification

SSL = soil screening level

TRV = toxicity reference value

UCR = Upper Columbia River