APPENDIX A

Table A-1. Human Exposure Pathways

Exposure medium	Route of exposure	Type of fate and transport	Pathway[a]
Groundwater	Ingestion	Groundwater	**1** WMU → groundwater → humans *Ingestion of contaminated groundwater as a drinking water source.*
Air	Inhalation	Direct air	**2a (on site or off site)** WMU → air → humans *Inhalation of volatiles*
Air	Inhalation	Direct air	**2b (on site or off site)** WMU → air → humans *Inhalation of suspended particulates*
Soil	Ingestion	Direct soil	**3 (on site)** WMU → humans *Ingestion of contaminated soil*
Soil	Ingestion	Overland	**3 (off site)** WMU → overland → humans *Ingestion of contaminated soil*
Soil	Ingestion	Air deposition	**4** WMU → air → deposition to soil → humans *Ingestion of contaminated soil*
Soil	Dermal	Direct soil	**5 (on site)** WMU → humans *Dermal contact with contaminated soil*
Soil	Dermal	Overland	**5 (off site)** WMU → overland → humans *Dermal contact with contaminated soil*
Soil	Dermal	Air deposition	**6** WMU → air → deposition to surface soil → humans *Dermal contact with contaminated soil*
Plant (veg/root)	Ingestion	Air deposition	**8** WMU → air → deposition to soil/garden crops → garden crops → humans *Consumption of contaminated crops grown in home gardens*
Plant (veg)	Ingestion	Air diffusion	**8a** WMU → air → garden crops → humans *Consumption of contaminated crops grown in home gardens*
Plant (veg/root)	Ingestion	Direct soil	**9 (on site)** WMU → garden crops → humans *Consumption of contaminated crops grown in home gardens*
Plant (veg/root)	Ingestion	Overland	**9 (off site)** WMU → overland → garden crops → humans *Consumption of contaminated crops grown in home gardens*
Animal	Ingestion	Air deposition	**10** WMU → air → deposition to soil/feed crops → feed crops/soil →

Exposure medium	Route of exposure	Type of fate and transport	Pathway[a]
(beef/milk)			cattle → humans *Consumption of animal products with elevated levels of toxicant caused by eating contaminated feed crops and soil*
Animal (beef/milk)	Ingestion	Air diffusion	**10a** WMU → air → feed crops → cattle → humans *Consumption of animal products with elevated levels of toxicant caused by eating contaminated feed crops*
Animal (beef/milk)	Ingestion	Direct soil	**11 (on site)** WMU → feed crops → cattle → humans *Consumption of animal products with elevated levels of toxicant caused by eating contaminated feed crops and soil*
Animal (beef/milk)	Ingestion	Overland	**11 (off site)** WMU → overland → feed crops/soil → cattle → humans *Consumption of animal products with elevated levels of toxicant caused by eating contaminated feed crops and soil*
Groundwater	Dermal (bathing)	Groundwater	**14** WMU → groundwater → humans *Dermal bathing contact with contaminated groundwater*
Surface water	Ingestion	Air diffusion	**17** WMU → air → surface water → humans *Ingestion of contaminated surface water as a drinking water source*
Surface water	Ingestion	Overland	**19** WMU → overland flow → surface water → humans *Ingestion of contaminated surface water as a drinking water source*
Surface water	Ingestion	Air deposition	**20** WMU → air → deposition to soil → overland flow → surface water → humans *Ingestion of contaminated surface water as a drinking water source*
Fish	Ingestion	Air diffusion	**21** WMU → air → surface water → fish → humans *Consumption of fish contaminated by toxicants in surface water*
Fish	Ingestion	Overland	**23** WMU → overland flow → surface water → fish → humans *Consumption of fish contaminated by toxicants in surface water*
Fish	Ingestion	Air deposition	**24** WMU → air → deposition to surface soil → overland flow → surface water → fish → humans *Consumption of fish contaminated by toxicants in surface water*
Animal (beef/milk)	Ingestion	Air diffusion	**33** WMU → air → surface water → cattle → humans *Consumption of animal products with elevated levels of toxicant caused by drinking contaminated surface water*

Exposure medium	Route of exposure	Type of fate and transport	Pathway[a]
Animal (beef/milk)	Ingestion	Overland	**35** WMU → overland flow → surface water → cattle → humans *Consumption of animal products with elevated levels of toxicant caused by drinking contaminated surface water*
Animal (beef/milk)	Ingestion	Air deposition	**36** WMU → air → deposition to soil → overland flow → surface water → cattle → humans *Consumption of animal products with elevated levels of toxicant caused by drinking contaminated surface water*
Surface water	Dermal (bathing)	Air diffusion	**37** WMU → air → surface water → humans *Dermal bathing contact with contaminated surface water*
Surface water	Dermal (bathing)	Air deposition	**38** WMU → air → deposition to soil → overland flow → surface water → humans *Dermal bathing contact with contaminated surface water*
Surface water	Dermal (bathing)	Overland	**42** WMU → overland flow → surface water → humans *Dermal bathing contact with contaminated surface water*

Overland = Soil erosion.
Overland flow = Both runoff and soil erosion; or, for surface impoundments, a spill directly to surface water.
Veg = Aboveground fruits and vegetables.
Root = Belowground (or root) vegetables.

[a]Some pathway numbers are missing, reflecting pathways that have been eliminated from the analysis or combined with other pathways.

Table A-2. Ecological Exposure Pathways

	Exposure medium	Route of exposure	Type of fate and transport	Pathway[a]
Terr I	Soil	Ingestion	Direct soil	**3 (on site)** WMU → mammals, birds, soil fauna *Ingestion of contaminated soil*
	Soil	Direct contact	Direct soil	**5 (on site)** WMU → plants, soil fauna *Direct contact with contaminated soil*
	Plant	Ingestion	Direct soil	**9 (on site)** WMU → vegetation → mammals, birds *Consumption of contaminated vegetation (e.g., forage grasses)*
	Soil fauna	Ingestion	Direct soil	**11a (on site)** WMU → soil fauna → mammals, birds *Consumption of soil fauna (e.g., earthworms, insects) with elevated levels of toxicant*
	Animals	Ingestion	Direct soil	**11b (on site)** WMU → soil fauna/vegetation → animals → predatory mammals, birds *Consumption of animals with elevated levels of toxicant*
Terr II	Soil	Ingestion	Overland	**3 (off site)** WMU → overland → mammals, birds, soil fauna *Ingestion of contaminated soil*
	Soil	Direct contact	Overland	**5 (off site)** WMU → overland → plants, soil fauna *Direct contact with contaminated soil*
	Plant	Ingestion	Overland	**9 (off site)** WMU → overland → vegetation → mammals, birds *Consumption of contaminated vegetation (e.g., forage grasses)*
	Soil fauna	Ingestion	Overland	**11c (off site)** WMU → overland → soil fauna → mammals, birds *Consumption of soil fauna (e.g., earthworms, insects) with elevated levels of toxicant*
	Animals	Ingestion	Overland	**11d (off site)** WMU → overland → soil fauna/vegetation → animals → predatory mammals, birds *Consumption of animals with elevated levels of toxicant*
Terr III	Soil	Ingestion	Air deposition	**4** WMU → air → deposition to soil → mammals, birds, soil fauna *Ingestion of contaminated soil*
	Soil	Direct contact	Air deposition	**6** WMU → air → deposition to surface soil → plants, soil fauna *Direct contact with contaminated soil*
Terr IV	Plant	Ingestion	Air deposition	**8** WMU → air → deposition to soil → vegetation → mammals, birds *Consumption of contaminated vegetation (e.g., forage grasses)*
Terr V	Plant	Ingestion	Air diffusion	**8a** WMU → air → vegetation → mammals, birds *Consumption of contaminated vegetation (e.g., forage grasses)*
Aq I	Surface water	Ingestion	Air diffusion	**17** WMU → air → surface water → mammals, birds *Ingestion of contaminated surface water as a drinking water*

				source
	Fish	Ingestion	Air diffusion	**21** WMU → air → surface water → fish → mammals, birds, fish *Consumption of fish contaminated by toxicants in surface water*
	Surface water	Direct contact	Air diffusion	**37** WMU → air → surface water → fish, daphnids, benthos *Direct contact with contaminated surface water, sediments*
Aq II	Surface water	Ingestion	Air deposition	**20** WMU → air → deposition to soil → overland flow → surface water → mammals, birds *Ingestion of contaminated surface water as a drinking water source*
	Fish	Ingestion	Air deposition	**24** WMU → air → deposition to surface soil → overland flow → surface water → fish → mammals, birds, fish *Consumption of fish contaminated by toxicants in surface water*
	Surface water	Direct contact	Air deposition	**38** WMU → air → deposition to soil → overland flow → surface water → fish, daphnids, benthos *Direct contact with contaminated surface water, sediments*
Aq III	Surface water	Ingestion	Overland	**19** WMU → overland flow → surface water → mammals, birds *Ingestion of contaminated surface water as a drinking water source*
	Fish	Ingestion	Overland	**23** WMU → overland flow → surface water → fish → mammals, birds, fish *Consumption of fish contaminated by toxicants in surface water*
	Surface water	Direct contact	Overland	**42** WMU → overland flow → surface water → fish, daphnids, benthos *Direct contact with contaminated surface water, sediments*

Overland = Soil erosion.
Overland flow = Both runoff and soil erosion; or, for surface impoundments, a spill directly to surface water.

[a]Some pathway numbers are missing, reflecting pathways that have been eliminated from the analysis.

Table A-3. Summary of Human Receptors for Exposure Pathways

Pathway	Receptor						
	Adult	Child	Subs. farmer	Home gardener	Subs. fisher	Fish consumer	Worker
1: Groundwater-ingestion	_						
2a: Direct air-inhalation of volatiles (on site)	_[a]						_
2a: Direct air-inhalation of volatiles (off site)	_						
2b: Direct air-inhalation of particles (on site)	_[a]						_
2b: Direct air-inhalation of particles (off site)	_						
3: Direct soil-soil ingestion (on site)	_[a]	_[a]					
3: Overland-soil ingestion (off site)	_	_					
4: Air deposition-soil ingestion	_	_					
5: Direct soil-dermal (soil) (on site)	_[a]	_[a]					_
5: Direct soil-dermal (soil) (off site)	_	_					
6: Air deposition-dermal (soil)	_	_					
8: Air deposition-veg/root ingestion			_	_			
8a: Air diffusion-veg/root ingestion			_	_			
9: Direct soil-veg/root ingestion (on site)			_[a]	_[a]			
9: Overland-veg/root ingestion (off site)			_	_			
10: Air deposition-beef/milk ingestion			_				
10a: Air diffusion-beef/milk ingestion			_				
11: Direct soil-beef/milk ingestion (on site)			_[a]				
11: Overland-beef/milk ingestion (off site)			_				
14: Groundwater-dermal (bathing)	_	_					
17: Air diffusion-drinking water ingestion	_						
19: Overland-drinking water ingestion	_						
20: Air deposition-drinking water ingestion	_						
21: Air diffusion-fish ingestion	_				_	_	
23: Overland-fish ingestion	_				_	_	
24: Air deposition-fish ingestion	_				_	_	
33: Air diffusion (SW)-beef/milk ingestion			_				
35: Overland (SW)-beef/milk ingestion			_				
36: Air deposition (OF/SW)-beef/milk ingestion			_				

(continued)

Table A-3. Summary of Human Receptors for Exposure Pathways (continued)

37: Air diffusion (SW)-dermal (bathing)	_	_
38: Air deposition (OF/SW)-dermal (bathing)	_	_
42: Overland (SW)-dermal (bathing)	_	_

[a]On-site pathways for receptors other than workers are modeled only for the land applicaation unit after closure.

Table A-4. Summary of Ecological Receptors by Exposure Pathways

	Receptor						
Pathway	**Mammals**	**Birds**	**Plants**	**Soil fauna**	**Fish**	**Daphnids**	**Benthos**
3: Direct soil-soil ingestion (on site)	_[a]	_[a]		_			
3: Direct soil-soil ingestion (off site)	_	_		_			
4: Air deposition-soil ingestion	_	_		_			
5: Direct soil-dermal soil (on site)			_	_			
5: Direct soil-dermal soil (off site)			_	_			
6: Air deposition-dermal soil			_	_			
8: Air deposition-veg/root ingestion	_	_					
8a: Air diffusion-veg ingestion	_	_					
9: Direct soil-veg/root ingestion (on site)	_	_					
9: Overland-veg/root ingestion (off site)	_	_					
11a: Direct soil-soil fauna ingestion (on site)	_	_					
11b: Direct soil-animals ingestion (on site)	_	_					
11c: Overland-soil fauna ingestion (off site)	_	_					
11d: Overland-animals ingestion (off site)	_	_					
17: Air diffusion-drinking water ingestion	_	_					
18: Groundwater (SW)-drinking water ingestion	_	_					
19: Overland-drinking water ingestion	_	_					
20: Air deposition-drinking water ingestion	_	_					
21: Air diffusion-fish ingestion	_	_			_		
22: Groundwater (SW)-fish ingestion	_	_			_		
23: Overland-fish ingestion	_	_			_		
24: Air deposition-fish ingestion	_	_			_		
37: Air diffusion (SW)-direct contact					_	_	_
38: Air deposition (OF/SW)-direct contact					_	_	_
40: Groundwater (SW)-direct contact					_	_	_
42: Overland (SW)-direct contact					_	_	_

[a]On-site pathways are modeled only for the land application unit after closure.

Table A-5. Pathways Modeled for Each Waste Management Unit

Pathway	Waste management unit					
	Ash monofill	Land appl. unit	Wastepile	Surface impound.	Tank	Water use
1: Groundwater-ingestion		_	_	_		
2a: Direct air-inhalation volatiles		_	_	_	_	
2b: Direct air-inhalation particles	_	_	_			
3: Direct soil-soil ingestion		_	_			
4: Air deposition-soil ingestion	_	_	_			
5: Direct soil-dermal (soil)		_	_			
6: Air deposition-dermal (soil)	_	_	_			
8: Air deposition-veg/root ingestion	_	_	_			
8a: Air diffusion-veg/root ingestion		_	_	_	_	
9: Direct soil or overland-veg/root ingestion		_	_			
10: Air deposition-beef/milk ingestion	_	_	_			
10a: Air diffusion-beef/milk ingestion		_	_	_	_	
11: Direct soil or overland-beef/milk ingestion		_	_			
14: Groundwater-dermal (bathing)						_
17: Air diffusion-drinking water ingestion		_	_	_	_	
19: Overland-drinking water ingestion		_	_	_		
20: Air deposition-drinking water ingestion	_	_	_			
21: Air diffusion-fish ingestion		_	_	_	_	
23: Overland-fish ingestion		_	_	_		
24: Air deposition-fish ingestion	_	_	_			
33: Air diffusion (SW)-beef/milk ingestion		_	_	_	_	
35: Overland (SW)-beef/milk ingestion		_	_	_		
36: Air deposition (OF/SW)-beef/milk ingestion	_	_	_			
37: Air diffusion (SW)-dermal (bathing)		_	_	_	_	
38: Air deposition (OF/SW)-dermal (bathing)	_	_	_			
42: Overland (SW)-dermal (bathing)		_	_	_		

OF = Overland flow.
SW = Surface water.