APPENDIX C:

EMISSION INVENTORIES, COSTS, AND OTHER ESTIMATES USED AS A BASIS FOR THE ULP PEIS IMPACT ANALYSES

This page intentionally left blank

APPENDIX C:

EMISSION INVENTORIES, COSTS, AND OTHER ESTIMATES USED AS A BASIS FOR THE ULP PEIS IMPACT ANALYSES

This appendix is a compilation of the emission inventories, cost assumptions and estimates, equipment and materials utilized, and workforce estimates used as the basis for the impact analyses conducted for the ULP PEIS. Estimates of waste volumes (other than those for the waste-rock piles) are also provided. Unless specified elsewhere, the level of effort (number of workers and worker hours), equipment and equipment hours, and cost estimates are based on RS Means construction data (RS Means 2009). Section C.1 presents information to support the analyses for the exploration phase. Sections C.2 and C.3 present similar information for the mine development and operations phase and the reclamation phase, respectively.

C.1 EXPLORATION

Under Alternatives 3 through 5, exploration activities are assumed to occur on the lease tracts being evaluated in the ULP PEIS. Under Alternative 3, Lease Tracts 5, 6, 7, 8, 9, 11, 13, 13A, 15, 18, 21, and 25 are evaluated for potential uranium exploration and mining. Leases for these lease tracts were held in 2007 by Gold Eagle Mining, Inc., and Cotter Corporation. Lease Tract 7 was composed of two tracts (7 and 7A) in 2007, but since then it has been combined into one least tract. Hence, for the purposes of the ULP PEIS, Alternative 3 evaluates 12 lease tracts. Alternatives 4 and 5 evaluate all 31 lease tracts for potential future exploration and mining activities. Tables C.1-1 through C.1-9 tabulate various information developed for use as the basis for the impact analyses presented in Section 4 of the ULP PEIS.

TABLE C.1-1 Number of Mines Considered per Mine Size and Alternative[a,b]

	No. of Mines per Alternative		
Mine Size	Alt. 3	Alt. 4	Alt. 5
Small	2	6	0
Medium	4	10	16
Large	1	2	2
Very large	1	1	1
Total	8	19	19

[a] Alternatives 1 and 2 are not presented in the table because they do not involve potential future mines to be developed.

[b] The range in size and number of mines considered is based on past mining experience in the region (Cotter 2011a).

TABLE C.1-2 Total Disturbed Acreage per Mine Size and Alternative during Exploration[a,b]

	Disturbed Acreage per Alternative[a]		
Mine Size	Alt. 3	Alt. 4	Alt. 5
Small	0.11	0.33	0
Medium	0.44	1.10	1.76
Large	0.17	0.33	0.33

[a] Alternatives 1 and 2 are not presented in the table because they do not involve potential future mines to be developed. The very large mine size is not considered for exploration because it is only used in reference to the existing open-pit mine on Lease Tract JD-7.

[b] Based on a 20 × 60 ft drilling pad per borehole with two, four, and six exploratory boreholes assumed for each small, medium, and large mine, respectively.

TABLE C.1-3 Assumed Workforce per Labor Category and Alternative during Exploration

	No. of Workers per Alternative[a]		
Labor Category	Alt. 3	Alt. 4	Alt. 5
Foreman	2.4	5.9	7.0
Laborer	3.4	8.3	9.9
Equipment operator	2.0	4.8	5.7
Truck driver[b]	0.1	0.3	0.3
Cement finisher	0.3	0.8	1.0
Total	8.2	20.1	23.9

[a] No exploration activities for Alternatives 1 and 2.

[b] Also assumed to operate equipment.

TABLE C.1-4 Assumed Total Costs per Alternative during Exploration[a]

Cost Element	Cost ($ 2009) per Alternative		
	Alt. 3	Alt. 4	Alt. 5
Drawings showing boring details	4,810	11,840	14,060
Report and recommendations from PE	10,790	26,560	31,540
Mobilization and demobilization	2,569	6,606	6,606
Mobilization and demobilization, over 500 mi	13,734	35,316	35,316
Air rotary drilling, 6-in.-diameter borehole, unconsolidated, depth of >100 ft	397,667	978,873	1,162,411
Air rotary drilling, 6-in.-diameter borehole, consolidated, depth of >100 ft	132,655	326,536	387,762
Air rotary drilling, 8-in.-diameter borehole, unconsolidated, depth of ≤100 ft	31,488	77,509	92,042
Air rotary drilling, 8-in.-diameter borehole, consolidated, depth of ≤100 ft	17,806	43,830	52,048
Casing for initial borehole	183,082	450,663	535,163
Sample collection during borehole advancement	522,285	1,285,624	1,526,679
Move drill rig around site	72,246	191,609	232,444
Drumming of drill cuttings	202,581	498,474	591,867
Decontamination of drill rig, etc.	1,809	4,453	5,288
Surface pads, concrete (3,000 lb/in.^{2} or psi, 6-in.-thick concrete)	187,534	461,623	548,177
Total direct costs	1,781,057	4,399,517	5,221,404
Contractor's overhead and profit (6%)	107,000	264,000	313,000
Subtotal contractor's costs	1,888,057	4,663,517	5,534,404
Contractor's bond (1%)	19,000	47,000	56,000
Total contractor's field costs	1,907,057	4,710,517	5,590,404
Construction management (10%)	191,000	471,000	559,000
Total field costs	2,098,057	5,181,517	6,149,404
Architect/engineer costs (25%)	524,000	1,295,000	1,538,000
Subtotal	2,622,057	6,476,517	7,687,404
Program management (6%)	157,000	389,000	462,000
Total exploration costs	2,779,000	6,866,000	8,149,000

[a] Exploration activities were assumed to be completed within a 1-year time frame.

TABLE C.1-5 Assumed Equipment and Total Hours Operated per Mine Size and Alternative during Exploration[a]

Items Assumed	Hours Operated per Mine Size			
	Small	Medium	Large	Very Large
Alternative 3				
Truck, highway, 24,500 GVW,[b] 4×2, 2-axle	214	874	324	0
Flatbed, 8×16 ft	214	862	322	0
Front-end loader, wheeled, 2.5-yd^3 capacity	193	772	290	0
Gas engine, vibrator	221	882	331	0
Water truck	104	416	156	0
Driller/auger	111	452	168	0
Cement truck	141	561	211	0
Alternative 4				
Truck, highway, 24,500 GVW, 4×2, 2-axle	654	2,192	654	0
Flatbed, 8×16 ft	646	2,159	646	0
Front-end loader, wheeled, 2.5-yd^3 capacity	579	1,930	579	0
Gas engine, vibrator	661	2,203	661	0
Water truck	312	1,039	312	0
Driller/auger	339	1,135	339	0
Cement truck	421	1,401	421	0
Alternative 5				
Truck, highway, 24,500 GVW, 4×2, 2-axle	0	3,511	654	0
Flatbed, 8×16 ft	0	3,456	646	0
Front-end loader, wheeled, 2.5-yd^3 capacity	0	3,087	579	0
Gas engine, vibrator	0	3,525	661	0
Water truck	0	1,661	312	0
Driller/auger	0	1,817	339	0
Cement truck	0	2,241	421	0

[a] Exploration activities were assumed to be completed within a 1-year time frame.

[b] GVW = gross vehicle weight.

TABLE C.1-6 Assumed Total Material Amounts per Alternative during Exploration[a]

	Amount of Materials per Mine Size			
Items Assumed	Small	Medium	Large	Total
Alternative 3				
Diesel fuel (gal)	12,000	49,000	18,000	79,000
Oil and grease (gal)	300	1,100	400	1,800
Water (gal)	12,000	49,000	18,000	79,000
55-gal drums (each)	385	1,539	577	2,501
Concrete (yd^3)	90	360	130	580
Alternative 4				
Diesel fuel (gal)	37,000	124,000	37,000	198,000
Oil and grease (gal)	800	2,700	800	4,300
Water (gal)	37,000	121,000	37,000	195,000
55-gal drums (each)	1,154	3,846	1,154	6,154
Concrete (yd^3)	270	890	270	1,430
Alternative 5				
Diesel fuel (gal)	0	198,000	37,000	235,000
Oil and grease (gal)	0	4,400	800	5,200
Water (gal)	0	194,000	37,000	231,000
55-gal drums (each)	0	6,153	1,154	7,307
Concrete (yd^3)	0	1,420	270	1,690

[a] Exploration activities were assumed to be completed within a 1-year time frame.

TABLE C.1-7 Assumed Annual Air Emissions on an Individual Mine Basis during Exploration[a]

Criteria Pollutant	Annual Air Emissions (tons) per Mine Size		
	Small	Medium	Large
Total hydrocarbons (THC)	0.1	0.2	0.2
Reactive organic compounds (ROCs)	0.1	0.1	0.2
Nitrogen oxides (NO_x)	0.6	1.2	1.8
Sulfur dioxide (SO_2)	0.1	0.1	0.2
Carbon monoxide (CO)	0.3	0.5	0.8
Total suspended particulates (TSP)	0.1	0.2	0.3
Particulate matter ≤10 μm (PM_{10})[b]	0.1	0.2	0.3
Particulate matter ≤2.5 μm ($PM_{2.5}$)[c]	0.1	0.1	0.2
Carbon dioxide (CO_2)[d]	68.6	138	206

[a] The latest emission factors were taken from the U.S. Environmental Protection Agency's (EPA's) WebFIRE application located at http://cfpub.epa.gov/webfire/.

[b] Assumes that the construction emission factor for fugitive dust PM_{10} is 0.22 ton/acre-mo (average conditions) (SCAQMD 2007).

[c] Assumes that 21% of fugitive dust PM_{10} is $PM_{2.5}$ and that 89% of combustion PM_{10} is $PM_{2.5}$ (SCAQMD undated).

[d] The CO_2 emission factor for diesel fuel was taken from EPA (2008).

TABLE C.1-8 Assumed Total Air Emissions during Exploration[a]

Criteria Pollutant	Total Air Emission (tons) per Alternative		
	Alt. 3	Alt. 4	Alt. 5
Total hydrocarbons (THC)	2.2	5.4	6.5
Reactive organic compounds (ROCs)	2.1	5.2	6.2
Nitrogen oxides (NO_x)	17	43	51
Sulfur dioxide (SO_2)	2.0	4.8	5.7
Carbon monoxide (CO)	7.4	18.3	21.7
Total suspended particulates (TSP)	2	5	5
Particulate matter ≤10 μm (PM_{10})[b]	2	4	5
Particulate matter ≤2.5 μm ($PM_{2.5}$)[c]	1	3	4
Carbon dioxide (CO_2)[d]	2,192	5,415	6,432

[a] The latest emission factors were taken from the EPA's WebFIRE application located at http://cfpub.epa.gov/webfire/.

[b] Assumes that the construction emission factor for fugitive dust PM_{10} is 0.22 ton/acre-mo (average conditions) (SCAQMD 2007).

[c] Assumes that 21% of fugitive dust PM_{10} is $PM_{2.5}$ and that 89% of combustion PM_{10} is $PM_{2.5}$ (SCAQMD undated).

[d] The CO_2 emission factor for diesel fuel was taken from EPA (2008).

TABLE C.1-9 Wastes Generated per Alternative during Exploration

Waste Category	Waste Generated (gal) per Alternative		
	Alt. 3	Alt. 4	Alt. 5
Sanitary[a]	33,000	81,000	97,000
Other	15,000	36,000	43,000

[a] Amount of sanitary waste was estimated based on the total exploration workforce.

C.2 MINE DEVELOPMENT AND OPERATIONS

Tables C.2-1 through C.2-16 tabulate various information developed for use as the basis for the impact analyses presented in Section 4 of the ULP PEIS.

TABLE C.2-1 Estimated Material Amounts and Labor Time per Mine Size during Development

	Amount per Mine Size			
Cost Element	Small	Medium	Large	Very Large
Labor (person-hours)	5,015	7,584	11,500	14,671
Steel (tons)	400	528	695	816
Lumber (1,000 board feet)	92	120	153	177
Fuel (gal)	4,981	7,663	11,494	14,559
Lubricant (gal)	1,250	1,750	2,750	3,500
Explosives (tons)	186	249	333	395
Electricity (kWh)	41,000	61,000	102,000	132,000

TABLE C.2-2 Estimated Materials and Labor Time per Alternative during Development

	Amount per Alternative		
Cost Element	Alt. 3	Alt. 4	Alt. 5
Labor (person-hours)	67,000	144,000	159,000
Steel (tons)	4,400	9,900	10,600
Lumber (1,000 board feet)	1,000	2,200	2,400
Fuel (gal)	67,000	144,000	159,000
Lubricant (gal)	16,000	35,000	38,000
Explosives (tons)	2,100	4,700	5,000
Electricity (kWh)	580,000	1,232,000	1,375,000

TABLE C.2-3 Number of Workers per Mine Size and Worker Salary per Labor Category

Labor Category	No. of Workers per Mine Size				Individual Annual Salary with Overhead and Profit ($)
	Small	Medium	Large	Very Large	
Mine workers	6	10	16	50	81,250
Mechanic	0.1	0.1	0.1	0.1	81,250
Geologist	0.1	0.1	0.1	0.1	137,500
Surveyor	0.1	0.1	0.1	0.1	81,250
Engineer	0.1	0.1	0.1	0.1	81,250
Environmental specialist	0.1	0.1	0.1	0.1	75,000
Other administrative support (e.g., accountant)	0.1	0.1	0.1	0.1	83,333
Total	6.6	10.6	16.6	50.6	

TABLE C.2-4 Annual Worker Salaries per Labor Category and Mine Size

Labor Category	Salary ($) per Mine Size			
	Small	Medium	Large	Very Large
Mine workers	487,500	812,500	1,300,000	4,062,500
Mechanic	8,125	8,125	8,125	8,125
Geologist	13,750	13,750	13,750	13,750
Surveyor	8,125	8,125	8,125	8,125
Engineer	8,125	8,125	8,125	8,125
Environmental specialist	7,500	7,500	7,500	7,500
Other administrative support (e.g., accountant)	8,333	8,333	8,333	8,333
Total	541,458	866,458	1,353,958	4,116,458

TABLE C.2-5 Number and Cost of Capital Equipment Units per Mine Size

Items Assumed	Number of Units per Mine Size[a]				Unit Cost ($)
	Small	Medium	Large	Very Large	
Underground equipment					
Diesel skid steer loaders, 2-yd^3 capacity	1	2	3	–[a]	55,000
Diesel trucks (buggies), 5- to 10-ton capacity	2	4	8	–	77,800
Development drill, jumbo	1	1	1	–	55,000
Production drills, jacklegs	3	6	9	–	300
Exploration drills, longhole	1	1	2	–	82,000
Diesel boss buggies and utility vehicles	2	3	4	–	12,200
Surface Equipment					
Front-end loader, 2- to 3-yd^3 capacity	1	1	1	1	342,000
Loaders, 8- to 10-yd^3 capacity	–	–	–	3	123,000
Backhoe/skid loader or excavator	1	1	1	1	157,000
Highway haul trucks, 22- to 24-ton capacity	2	2	3	–	599,000
Dump truck, 12 yd^3	–	–	–	3	200,000
Bulldozer, 200 hp	1	1	1	–	315,000
Bulldozer, 400 hp	–	–	–	3	625,000
Motor grader, 140 hp	1	1	1	1	160,000
Flatbed trailer with tractor or 1-ton vehicle	1	1	1	–	10,000
Maintenance truck	–	–	–	1	158,000
Pickup truck, ¾ ton, four-wheel drive	1	1	2	4	30,000
Snow plow	1	1	1	–	62,000
Power generators	1	1	2	–	79,950
Scraper	–	–	–	4	77,200
Truck, ≥60 tons	–	–	–	4	599,000

[a] A dash indicates none.

TABLE C.2-6 Total Capital Equipment Costs per Alternative

Items Assumed	Total Capital Equipment Cost ($ 2009) per Alternative		
	Alt. 3	Alt. 4	Alt. 5
Underground equipment			
Diesel skid steer loaders, 2-yd^3 capacity	715,000	1,760,000	2,090,000
Diesel trucks (buggies), 5- to 10-ton capacity	2,178,400	5,290,400	6,224,000
Development drill, jumbo	385,000	990,000	990,000
Production drills, jacklegs	11,700	28,800	34,200
Exploration drills, longhole	656,000	1,640,000	1,640,000
Diesel boss buggies and utility vehicles	244,000	610,000	683,200
Surface equipment			
Front-end loader, 2- to 3-yd^3 capacity	2,736,000	6,498,000	6,498,000
Loaders, 8- to 10-yd^3 capacity	369,000	369,000	369,000
Backhoe/skid loader or excavator	1,256,000	2,983,000	2,983,000
Highway haul trucks, 22- to 24-ton capacity	8,985,000	22,762,000	22,762,000
Dump truck, 12 yd^3	600,000	600,000	600,000
Bulldozer, 200 hp	2,205,000	5,670,000	5,670,000
Bulldozer, 400 hp	1,875,000	1,875,000	1,875,000
Motor grader, 140 hp	1,280,000	3,040,000	3,040,000
Flatbed trailer with tractor or 1-ton vehicle	70,000	180,000	180,000
Maintenance truck	158,000	158,000	158,000
Pickup truck, ¾ ton, four-wheel drive	360,000	720,000	720,000
Snow plow	434,000	1,116,000	1,116,000
Power generators	639,600	1,599,000	1,599,000
Scraper	308,800	308,800	308,800
Truck, ≥60 tons	2,396,000	2,396,000	2,396,000
Total	27,862,500	60,594,000	61,936,200

TABLE C.2-7 Estimated Total Capital Costs per Mine Size

	Total Capital Cost ($ 2009) per Mine Size			
Cost Element	Small	Medium	Large	Very Large
Equipment purchase	2,727,000	2,951,000	4,121,000	6,486,000
Labor	242,000	366,000	555,000	708,000
Steel	232,000	306,000	403,000	473,000
Lumber	23,000	30,000	38,000	44,000
Fuel	13,000	20,000	30,000	38,000
Lubricant	5,000	7,000	11,000	14,000
Explosives	124,000	166,000	222,000	263,000
Tires	9,000	14,000	20,000	26,000
Construction materials	223,000	317,000	451,000	554,000
Electricity	4,000	6,000	10,000	13,000
Total direct costs	3,602,000	4,183,000	5,861,000	8,619,000
Contractor's overhead and profit (6%)	216,000	251,000	352,000	517,000
Subtotal contractor's costs	3,818,000	4,434,000	6,213,000	9,136,000
Contractor's bond (1%)	38,000	44,000	62,000	91,000
Total contractor's field costs	3,856,000	4,478,000	6,275,000	9,227,000
Construction management (10%)	386,000	448,000	628,000	923,000
Total field costs	4,242,000	4,926,000	6,903,000	10,150,000
Architecture/engineering costs (25%)	1,061,000	1,232,000	1,726,000	2,538,000
Subtotal	5,303,000	6,158,000	8,629,000	12,688,000
Program management (6%)	318,000	369,000	518,000	761,000
Total capital costs	5,621,000	6,527,000	9,147,000	13,449,000

TABLE C.2-8 Estimated Total Capital Costs per Alternative

Cost Element	Total Capital Cost ($ 2009) per Alternative		
	Alt. 3	Alt. 4	Alt. 5
Equipment purchase	27,863,000	60,595,000	61,937,000
Labor	3,213,000	6,934,000	7,681,000
Steel	2,565,000	5,732,000	6,174,000
Lumber	246,000	555,000	593,000
Fuel	174,000	375,000	414,000
Lubricant	64,000	138,000	152,000
Explosives	1,396,000	3,108,000	3,359,000
Tires	118,000	257,000	283,000
Construction materials	2,717,000	5,958,000	6,524,000
Electricity	57,000	121,000	135,000
Total direct costs	38,413,000	83,773,000	87,252,000
Contractor's overhead and profit (6%)	2,305,000	5,026,000	5,235,000
Subtotal contractor's costs	40,718,000	88,799,000	92,487,000
Contractor's bond (1%)	407,000	888,000	925,000
Total contractor's field costs	41,125,000	89,687,000	93,412,000
Construction management (10%)	4,113,000	8,969,000	9,341,000
Total field costs	45,238,000	98,656,000	102,753,000
Architecture/engineering costs (25%)	11,310,000	24,664,000	25,688,000
Subtotal	56,548,000	123,320,000	128,441,000
Program management (6%)	3,393,000	7,399,000	7,706,000
Total capital costs	59,941,000	130,719,000	136,147,000

TABLE C.2-9 Assumed Annual Air Emissions on an Individual Mine Basis during Development[a]

Criteria Pollutant	Annual Air Emissions (tons) per Mine Size			
	Small	Medium	Large	Very Large
Total hydrocarbons (THC)	0.1	0.1	0.1	0.2
Reactive organic compounds (ROCs)	0.1	0.1	0.1	0.2
Nitrogen oxides (NO_x)	2.2	3.0	4.2	5.1
Sulfur dioxide (SO_2)	0.3	0.4	0.5	0.6
Carbon monoxide (CO)	6.5	8.8	11.8	14.0
Total suspended particulates (TSP)	11.3	15.5	20.6	58.1
Particulate matter ≤10 μm (PM_{10})[b]	9.6	13.1	17.4	37.5
Particulate matter ≤2.5 μm ($PM_{2.5}$)[c]	1.2	1.6	2.1	5.0
Carbon dioxide (CO_2)[d]	56.8	84.3	126	162

[a] The latest emission factors were taken from the EPA's WebFIRE application located at http://cfpub.epa.gov/webfire/.

[b] Assumes that the construction emission factor for fugitive dust PM_{10} is 0.22 ton/acre-mo (average conditions) (SCAQMD 2007).

[c] Assumes that 21% of fugitive dust PM_{10} is $PM_{2.5}$ and that 89% of combustion PM_{10} is $PM_{2.5}$ (SCAQMD undated).

[d] The CO_2 emission factor for diesel fuel was taken from EPA (2008).

TABLE C.2-10 Estimated Annual Air Emissions per Alternative during Development[a]

Criteria Pollutant	Annual Air Emissions (tons) per Alternative		
	Alt. 3	Alt. 4	Alt. 5
Total hydrocarbons (THC)	0.8	1.8	2.0
Reactive organic compounds (ROCs)	0.8	1.7	1.9
Nitrogen oxides (NO_x)	26	57	62
Sulfur dioxide (SO_2)	3.1	6.9	7.5
Carbon monoxide (CO)	74	165	176
Total suspended particulates (TSP)	262	520	554
Particulate matter ≤10 μm (PM_{10})[b]	225	459	489
Particulate matter ≤2.5 μm ($PM_{2.5}$)[c]	36	73	78
Carbon dioxide (CO_2)[d]	745	1,601	1,767

[a] The latest emission factors were taken from the EPA's WebFIRE application located at http://cfpub.epa.gov/webfire/.

[b] Assumes that the construction emission factor for fugitive dust PM_{10} is 0.22 ton/acre-mo (average conditions) (SCAQMD 2007).

[c] Assumes that 21% of fugitive dust PM_{10} is $PM_{2.5}$ and that 89% of combustion PM_{10} is $PM_{2.5}$ (SCAQMD undated).

[d] The CO_2 emission factor for diesel fuel was taken from EPA (2008).

TABLE C.2-11 Wastes Generated per Alternative during Development

Waste Category	Waste Generated (gal) per Alternative		
	Alt. 3	Alt. 4	Alt. 5
Sanitary[a]	136,000	292,000	322,000
Other	60,000	130,000	143,000

[a] Amount of sanitary waste was estimated based on total construction workforce.

TABLE C.2-12 Total Worker Peak-Year Annual Wages per Mine Size and Alternative

	Annual Wages ($) per Alternative		
Mine Size	Alt. 3	Alt. 4	Alt. 5
Small	1,083,000	3,249,000	0
Medium	3,466,000	8,665,000	13,863,000
Large	1,354,000	2,708,000	2,708,000
Very large	4,116,000	4,116,000	4,116,000
Total	10,019,000	18,738,000	20,688,000

TABLE C.2-13 Peak-Year Annual Water Usage per Mine Size and Alternative during Operations[a]

	Monthly Volume per Mine Size (gal)	Total Annual Volume per Alternative (gal)		
Mine Size		Alt. 3	Alt. 4	Alt. 5
Small	7,583	181,992	545,976	0
Medium	30,666	1,471,968	3,679,920	5,887,872
Large	45,999	551,988	1,103,976	1,103,976
Very large[b]	160,000	960,000	960,000	960,000
Total		3,165,948	6,289,872	7,951,848

[a] Based on per-mine water use from Cotter (2011b) and Ribeiro (2012).

[b] Assumes water usage for 6 months only (summer) for dust suppression activities.

TABLE C.2-14 Total Peak-Year Annual Cost of Operations per Alternative

Item	Annual Cost of Operations ($) per Alternative		
	Alt. 3	Alt. 4	Alt. 5
Mining equipment operations	5,553,000	$5,553,000	4,579,000
Utilities (electricity)	229,000	489,000	546,000
Diesel fuel	180,000	373,000	425,000
Other materials (explosives)	41,000	83,000	95,000
Water	21,000	36,000	45,000
Worker salaries	10,019,000	18,738,000	20,687,000
Total	16,043,000	25,272,000	26,377,000

TABLE C.2-15 Assumed Annual Air Emissions on an Individual Mine Basis during Operations[a]

Criteria Pollutant	Annual Air Emissions (tons) per Mine Size			
	Small	Medium	Large	Very Large
Total hydrocarbons (THC)	0.75	0.59	4.48	8.63
Reactive organic compounds (ROCs)	0.72	0.57	4.30	8.29
Nitrogen oxides (NO_x)	7.36	5.85	44.03	84.71
Sulfur dioxide (SO_2)	0.95	0.75	5.66	10.89
Carbon monoxide (CO)	3.42	2.84	20.30	38.90
Total suspended particulates (TSP)	7.11	0.56	4.23	8.15
Particulate matter ≤10 μm (PM_{10})[b]	4.00	0.53	4.02	7.74
Particulate matter ≤2.5 μm ($PM_{2.5}$)[c]	0.79	0.47	3.58	6.89
Carbon dioxide (CO_2)[d]	672	532	4,025	7,748

[a] The latest emission factors were taken from the EPA's WebFIRE application located at http://cfpub.epa.gov/webfire/.

[b] Assumes that the construction emission factor for fugitive dust PM_{10} is 0.22 ton/acre-mo (average conditions) (SCAQMD 2007).

[c] Assumes that 21% of fugitive dust PM_{10} is $PM_{2.5}$ and that 89% of combustion PM_{10} is $PM_{2.5}$ (SCAQMD undated).

[d] The CO_2 emission factor for diesel fuel was taken from EPA (2008).

TABLE C.2-16 Estimated Peak-Year Annual Air Emissions per Alternative during Operations[a]

Criteria Pollutant	Annual Air Emissions (tons) per Alternative		
	Alt. 3	Alt. 4	Alt. 5
Total hydrocarbons (THC)	14.0	28.0	31.6
Reactive organic compounds (ROCs)	13.4	26.9	30.4
Nitrogen oxides (NO_x)	137.7	275.5	313.1
Sulfur dioxide (SO_2)	17.7	35.4	40.1
Carbon monoxide (CO)	64.2	128.4	145.1
Total suspended particulates (TSP)	32	65	74
Particulate matter ≤10 μm (PM_{10})[b]	23	45	51
Particulate matter ≤2.5 μm ($PM_{2.5}$)[c]	11.8	23.5	26.7
Carbon dioxide (CO_2)[d]	13,000	25,000	29,000

[a] The latest emission factors were taken from the EPA's WebFIRE application located at http://cfpub.epa.gov/webfire/.

[b] Assumes that the construction emission factor for fugitive dust PM_{10} is 0.22 ton/acre-mo (average conditions) (SCAQMD 2007).

[c] Assumes that 21% of fugitive dust PM_{10} is $PM_{2.5}$ and that 89% of combustion PM_{10} is $PM_{2.5}$ (SCAQMD undated).

[d] The CO_2 emission factor for diesel fuel was taken from EPA (2008).

C.3 RECLAMATION

The reclamation phase would occur under each of the five alternatives evaluated in the ULP PEIS. Tables C.3-1 through C.3-8 tabulate the information developed as a basis for the impact analyses discussed in Chapter 4. The basis for the estimated values used in Table C.3-1 is that it would take 3 months per mine site for 1 team to complete reclamation. Under Alternatives 1 and 2, 10 mine sites would be reclaimed (9 mines plus JD-7, the open-pit mine).

The assumptions made for Alternative 3 would be the same as those made for Alternatives 1 and 2 because essentially the same number of mines would be reclaimed.

The assumptions made for Alternatives 4 and 5 would be the same since the number of mines would be the same (i.e., 18 mines plus JD-7). Each of the 18 underground mines would require 3 months to reclaim by 1 team. It is assumed that there would be 5 reclamation teams for the 18 underground mines. Three of these teams would be able to work for 12 months rather than only 9 months, because they would be working at the southern lease tracts (i.e., where no snow would inhibit field work). Thus, 3 teams × 12 months = 36 months, plus 2 teams × 9 months = 18 months, for a total of 54 months available for reclamation. The open-pit mine (JD-7) would be reclaimed by a separate team consisting of 14 workers, and it is assumed that reclamation would take 12 months to complete.

TABLE C.3-1 Assumed Workforce per Labor Category, Team, JD-7 Mine, and Alternative during Reclamation

Labor Category	No. of Workers per Team[a]	No. of Workers for JD-7 Mine	Total No. of Workers per Alternative			
			Alts. 1 and 2[b]	Alt. 3[c]	Alt. 4[d]	Alt. 5[e]
Foreman	1	1	4	4	6	6
Equipment operator	3	10	19	19	25	25
Truck driver[f]	1	2	5	5	7	7
Electrician/mechanic[g]	0	1	1	1	1	1
Total	5	14	29	29	39	39

[a] Other than for work on JD-7 open-pit mine.

[b] Three teams plus the JD-7 team.

[c] Three teams plus the JD-7 team.

[d] Five teams plus the JD-7 team.

[e] Five teams plus the JD-7 team.

[f] Also assumed to operate equipment.

[g] Assumed for very large mine (JD-7) reclamation only.

TABLE C.3-2 Total Disturbed Acreage per Mine Size and Alternative during Reclamation[a]

Mine Size	Disturbed Acreage per Alternative		
	Alt. 3	Alt. 4	Alt. 5
Small	20	60	0
Medium	60	150	240
Large	20	40	40
Very large	210	210	210

[a] Alternatives 1 and 2 would each involve the reclamation of 257 acres (Cotter 2012) as shown in Table 2.2-1 and involve 10 lease tracts.

TABLE C.3-3 Assumed Total Costs per Alternative during Reclamation

Cost Element	Costs ($ 2009) per Alternative			
	Alts. 1 and 2	Alt. 3	Alt. 4	Alt. 5
Remove aboveground structures	58,436	62,085	136,157	149,067
Seal portal(s)	23,000	18,400	43,700	43,700
Establish 3:1 slopes	447,621	539,931	801,189	853,440
Pock areas of steep slope to reduce future erosion	486,831	587,229	871,371	928,200
Spread available topsoil over pocking	58,009	69,971	103,829	110,600
Cut and fill and water bars on access road	153,906	185,646	275,474	293,440
Revegetate slope and access road	1,297,055	1,564,541	2,321,577	2,472,985
Place obstruction boulders at access entrance	3,060	2,448	5,814	5,814
Replace ore in mine	13,472	17,963	35,925	41,314
Remove 18 in. of subsurface from ore pad area	98,760	131,680	263,360	302,864
Rip compacted areas	59,427	71,683	106,368	113,305
Spread topsoil over disturbed areas	40,072	48,335	71,723	76,401
Backfill sedimentation pond	28,122	33,922	50,335	53,618
Seal ventilation shafts (72-in. diameter)	85,190	68,152	161,861	161,861
Seal power drop holes	2,540	2,032	4,826	4,826
Remove power drops	4,690	3,752	8,911	8,911
Rip vent and power drop pads	8,327	10,045	14,905	15,877
Push topsoil over vent and power drop pads	3,955	4,770	7,078	7,540
Revegetate area around vent and power drop pads	60,917	73,480	109,034	116,145
Conduct initial site mobilization	49,840	39,872	94,696	94,696
Conduct secondary seeding mobilization	18,380	14,704	34,922	34,922
Total direct costs	3,001,610	3,550,640	5,523,056	5,889,526
Contractor's overhead and profit (6%)	180,000	213,000	331,000	353,000
Subtotal contractor's costs	3,181,610	3,763,640	5,854,056	6,242,526
Contractor's bond (1%)	32,000	38,000	60,000	63,000
Total contractor's field costs	3,213,610	3,801,640	5,914,056	6,305,526
Construction management (10%)	321,000	380,000	591,000	630,000
Total field costs	3,534,610	4,181,640	6,505,056	6,935,526
Architecture/engineering costs (25%)	883,000	1,045,000	1,626,000	1,733,000
Subtotal	4,417,610	5,226,640	8,131,056	8,668,526
Program management (6%)	266,000	314,000	488,000	521,000
Total reclamation costs (rounded)	4,684,000	5,541,000	8,619,000	9,189,000

TABLE C.3-4 Assumed Equipment and Total Hours of Operation per Mine Size and Alternative during Reclamation

Items Assumed	Total Hours of Operation per Mine Size			
	Small	Medium	Large	Very Large
Alternatives 1 and 2				
Bulldozer, 310 hp	903	0	0	3,719
Diesel skid steer loaders, 2-yd^3 capacity	725	0	0	2,614
Motor grader, 140 hp	233	0	0	729
Excavator , 125 hp	1,179	0	0	4,953
Front-end loader, 2- to 3-yd^3 capacity	1,149	0	0	626
Grass drill and seeder	725	0	0	2,614
Dump trucks, 12 yd	1,189	0	0	1,998
Flatbed trailer with tractor or 1-ton vehicle	144	0	0	16
Pickup truck, ¾ ton, four-wheel drive	0	0	0	4,400
Alternative 3				
Bulldozer, 310 hp	369	1,092	361	3,719
Diesel skid steer loaders, 2-yd^3 capacity	279	806	263	2,614
Motor grader, 140 hp	85	238	77	729
Excavator, 125 hp	487	1,445	479	4,953
Front-end loader, 2- to 3-yd^3 capacity	255	909	427	626
Grass drill and seeder	279	806	263	2,614
Dump trucks, 12 yd	331	1,152	498	1,998
Flatbed trailer with tractor or 1-ton vehicle	32	64	16	16
Pickup truck, ¾ ton, four-wheel drive	0	2,200	2,200	4,400
Alternative 4				
Bulldozer, 310 hp	1,108	2,731	723	3,719
Diesel skid steer loaders, 2-yd^3 capacity	838	2,016	527	2,614
Motor grader, 140 hp	254	595	153	729
Excavator, 125 hp	1,461	3,612	958	4,953
Front-end loader, 2- to 3-yd^3 capacity	766	2,273	853	626
Grass drill and seeder	838	2,016	527	2,614
Dump trucks, 12 yd	992	2,879	996	1,998
Flatbed trailer with tractor or 1-ton vehicle	96	160	32	16
Pickup truck, ¾ ton, four-wheel drive	0	4,400	2,200	4,400
Alternative 5				
Bulldozer, 310 hp	0	4,369	723	3,719
Diesel skid steer loaders, 2-yd^3 capacity	0	3,225	527	2,614
Motor grader, 140 hp	0	952	153	729
Excavator, 125 hp	0	5,780	958	4,953
Front-end loader, 2- to 3-yd^3 capacity	0	3,638	853	626
Grass drill and seeder	0	3,225	527	2,614
Dump trucks, 12 yd	0	4,607	996	1,998
Flatbed trailer with tractor or 1-ton vehicle	0	256	32	16
Pickup truck, ¾ ton, four-wheel drive	0	4,400	2,200	4,400

TABLE C.3-5 Assumed Amounts of Materials per Mine Size and Alternative during Reclamation

	Amount of Materials per Mine Size				
Items Assumed	Small	Medium	Large	Very Large	Total
Alternatives 1 and 2					
Diesel fuel (gal)	25,000	0	0	76,000	101,000
Oil and grease (gal)	1,300	0	0	3,800	5,100
Water (gal)	45,350	0	0	114,900	160,000
Grass seed (40 lb/acre) (tons)	0.9	0	0	4.2	5.14
Hay, delivered (1 ton/acre) (tons)	47	0	0	210	257
Alternative 3					
Diesel fuel (gal)	9,000	29,000	12,000	76,000	126,000
Oil and grease (gal)	400	1,700	900	3,800	6,800
Water (gal)	29,000	53,400	29,000	114,900	226,000
Grass seed (40 lb/acre) (tons)	0.4	1.2	0.4	4.2	6.2
Hay, delivered (1 ton/acre) (tons)	20	60	20	210	310
Alternative 4					
Diesel fuel (gal)	26,000	71,000	22,000	76,000	195,000
Oil and grease (gal)	1,200	4,100	1,400	3,800	10,500
Water (gal)	53,400	99,900	38,800	114,900	307,000
Grass seed (40 lb/acre) (tons)	1.2	3.0	0.8	4.2	9.2
Hay, delivered (1 ton/acre) (tons)	60	150	40	210	460
Alternative 5					
Diesel fuel (gal)	0	111,000	22,000	76,000	209,000
Oil and grease (gal)	0	6,000	1,400	3,800	11,200
Water (gal)	0	151,200	38,800	114,900	305,000
Grass seed (40 lb/acre) (tons)	0.0	4.8	0.8	4.2	9.8
Hay, delivered (1 ton/acre) (tons)	0	240	40	210	490

TABLE C.3-6 Assumed Annual Air Emissions on an Individual Mine Basis during Reclamation[a]

	Annual Air Emissions (tons) per Mine Size			
Criteria Pollutant	Small	Medium	Large	Very Large
Total hydrocarbons (THC)	0.05	0.09	0.14	0.92
Reactive organic compounds (ROCs)	0.05	0.08	0.13	0.88
Nitrogen oxides (NO_x)	0.52	0.84	1.30	9.07
Sulfur dioxide (SO_2)	0.07	0.11	0.18	1.18
Carbon monoxide (CO)	0.24	0.41	0.66	4.33
Total suspended particulates (TSP)	2.00	2.97	7.88	157
Particulate matter ≤10 μm (PM_{10})[b]	1.05	1.54	5.98	137
Particulate matter ≤2.5 μm ($PM_{2.5}$)[c]	0.19	0.29	1.22	28.1
Carbon dioxide (CO_2)[d]	48.6	80.4	128	854

[a] The latest emission factors were taken from the EPA's WebFIRE application located at http://cfpub.epa.gov/webfire/.

[b] Assumes that the construction emission factor for fugitive dust PM_{10} is 0.22 ton/acre-mo (average conditions) (SCAQMD 2007).

[c] Assumes that 21% of fugitive dust PM_{10} is $PM_{2.5}$ and that 89% of combustion PM_{10} is $PM_{2.5}$ (SCAQMD undated).

[d] The CO_2 emission factor for diesel fuel was taken from EPA (2008).

TABLE C.3-7 Assumed Total Air Emissions during Reclamation[a]

Criteria Pollutant	Total Air Emissions (tons) per Alternative			
	Alts. 1 and 2	Alt. 3	Alt. 4	Alt. 5
Total hydrocarbons (THC)	1.2	1.5	2.4	2.6
Reactive organic compounds (ROCs)	1.2	1.5	2.3	2.5
Nitrogen oxides (NO_x)	12	15	23	25
Sulfur dioxide (SO_2)	1.6	2.0	3.0	3.3
Carbon monoxide (CO)	5.8	7.2	11.1	12.0
Total suspended particulates (TSP)	167	180	216	221
Particulate matter ≤10 μm (PM_{10})[b]	142	150	172	175
Particulate matter ≤2.5 μm ($PM_{2.5}$)[c]	29	31	35	35
Carbon dioxide (CO_2)[d]	1,140	1,420	2,200	2,360

[a] The latest emission factors were taken from the EPA's WebFIRE application located at http://cfpub.epa.gov/webfire/.

[b] Assumes that the construction emission factor for fugitive dust PM_{10} is 0.22 ton/acre-mo (average conditions) (SCAQMD 2007).

[c] Assumes that 21% of fugitive dust PM_{10} is $PM_{2.5}$ and that 89% of combustion PM_{10} is $PM_{2.5}$ (SCAQMD undated).

[d] The CO_2 emission factor for diesel fuel was taken from EPA (2008).

TABLE C.3-8 Wastes Generated per Alternative during Reclamation

Waste Category	Waste Generated (gal) per Alternative			
	Alts. 1 and 2	Alt. 3	Alt. 4	Alt. 5
Sanitary[a]	81,000	126,000	162,000	154,000
Other	36,000	56,000	72,000	68,000

[a] Amount of sanitary waste was estimated based on the total reclamation workforce.

C.4 REFERENCES

Cotter, E., 2011a, personal communication from Cotter (S.M. Stoller Corporation, Grand Junction, Colo.) to M. Picel (Argonne National Laboratory, Argonne, Ill.), Nov. 10.

Cotter, E., 2011b, personal communication from Cotter (S.M. Stoller Corporation, Grand Junction, Colo.) to M. Picel (Argonne National Laboratory, Argonne, Ill.), Nov. 17.

Cotter, E., 2012, personal communication from Cotter (S.M. Stoller Corporation, Grand Junction, Colo.) to M. Picel (Argonne National Laboratory, Argonne, Ill.), Feb. 16.

EPA (U.S. Environmental Protection Agency), 2008, *Climate Leaders Greenhouse Gas Inventory Protocol Core Module Guidance: Direct Emissions from Mobile Combustion Sources*, EPA430-K-08-004, May. Available at http://www.epa.gov/climateleadership/documents/resources/ mobilesource_guidance.pdf.EPA430-K-08-004.

Ribeiro, T., 2012, personal communication from Ribeiro (U.S. Department of Energy, Office of Legacy Management) to M. Picel (Argonne National Laboratory, Argonne, Ill.), Aug. 21.

RS Means (R.S. Means Company, Inc.), 2009, *Building Construction Cost Data 2009, 67th Annual Edition*, Kingston, Mass.

SCAQMD (South Coast Air Quality Management District), 2007, "Software User's Guide: URBEMIS2007 for Windows, Version 9.2, Emissions Estimation for Land Use Development Projects," Diamond Bar, Calif., Nov. Available at http://www.urbemis.com/software/URBEMIS9%20Users%20Manual%20Appendices.pdf. Accessed Oct. 24, 2012.

SCAQMD, undated, "Handout #1." Available at www.aqmd.gov/CEQA/handbook/PM2_5/handout1.doc. Accessed Oct. 24, 2012.