APPENDIX B

Emissions Calculations

APPENDIX B-1

Post-modification Emissions Calculations

APPENDIX B-1 INDEX

Units	Definitions
°C	degree Celsius
acfm	actual cubic feet per minute
bhp	brake horsepower
dcf	dry cubic feet
dscf	dry standard cubic feet
dscf	dry standard cubic feet
dscfm	dry standard cubic feet per minute
ft^2	square feet
g	gram
gal	gallon
gpm	gallon per minute
gr	grain
hp	horsepower
hp-hr	horsepower-hour
hr	hour
kW	kilowatt
lb	pound
mg	milligram
mg/kg	milligram per kilogram
mg/L	milligram per liter
min	minute
mmBtu	million British thermal units
mph	miles per hour
Mtpy	million tons per year
ppm	part per million
tpy	ton per year
yr	year

Acronyms	Definitions
AEI	Air Emissions Inventory
AO	Approval Order
BCM	Bingham Canyon Mine
BSFC	brake-specific fuel consumption
CDPHE	Colorado Department of Public Health and Environment
CMB	Chemical Mass Balance
CO	carbon monoxide
EPA	U.S. Environmental Protection Agency
H_2SO_4	sulfuric acid
HAP	hazardous air pollutant
HC	hydrocarbon
ID	identification
KUC	Kennecott Utah Copper LLC
LPG	liquefied petroleum gas
MSDS	material safety data sheet
MSL	mean sea level
NH_3	ammonia
NOI	Notice of Intent
NO_x	nitrogen oxides
PM	particulate matter
PM_{10}	particulate matter less than 10 micrometers in aerodynamic diameter
$PM_{2.5}$	particulate matter less than 2.5 micrometers in aerodynamic diameter
PTE	potential to emit
SIP	State Implementation Plan
SO_2	sulfur dioxide
SO_x	sulfur oxides
SX/EW	solvent extraction/electrowinning
UDAQ	Utah Division of Air Quality
VMT	vehicle miles traveled
VOC	volatile organic compound

TABLE B1-1

Emissions Summary (260 MM case)

KUC—Bingham Canyon Mine

	Point Sources	Other Fugitive Sources	Haulroad Fugitives (within pit influence boundary)	Haulroad Fugitives (outside pit influence boundary)	Mobile Sources	Post Project BCM PTEs
PM_{10} Emissions (tpy)	6.28	226	573	480	228	1,513
$PM_{2.5}$ Emissions (tpy)	2.60	37	60	48	221	368
SO_2 Emissions (tpy)	0.0002				6.56	6.56
NO_X Emissions (tpy)	1.17				5,829	5,830
CO Emissions (tpy)	10.6				1,672	1,682
VOC Emissions (tpy)	0.20	11.30			302	314
HAP Emissions (tpy)		1.37				1.37
$PM_{10}+SO_2+NO_X$ Emissions (tpy)	7.44					7,350

NOTES:

(1) Calculations assume 85,000,000 tons per year ore production.

(2) Mobile Source emissions shown above are the maximum emissions between 2011 through 2028.

(3) Haulroad emissions shown above are the maximum emissions between 2011 through 2028.

(4) Calculations incorporate 75% control efficiency for the haulroads within the pit influence boundary and 85% outside the pit influence boundary. Calcs for C6/C7 transfer point baghouse and C7/C8 transfer point baghouse are based on 0.007 gr/dscf grain loading.

(5) Haulroad emissions inside the pit influence boundary include a 0.20 escape factor in the calculations.

TABLE B1-2
In-pit Crusher
KUC—Bingham Canyon Mine

Source Name	PM_{10} Emission Factor (gr/dscf)	Hours of Operation (hrs/yr)	Design Flow Rate (dcf/min)	PM_{10} Emissions with Primary Control (lbs/hr)	PM_{10} Emissions with Primary Control (tpy)	$PM_{2.5}$ Emissions with Primary Control (tpy)	PM_{10} Pit Escape Factor (%)	$PM_{2.5}$ Pit Escape Factor (%)	Controlled PM_{10} Emissions from the pit (tpy)	Controlled $PM_{2.5}$ Emissions from the pit (tpy)	Control System and Comments
In Pit Crusher	0.016	8,760	12,898	1.77	7.75	2.28	20	21	1.55	0.48	Emissions controlled with a baghouse. Source Located in the pit.

NOTES:
Emissions based on AO limits.
Emissions for $PM_{2.5}$ based on factors from AP-42, Table B.2.2, Category 3 - Mechanically Generated Aggregate and Unprocessed Ores.
PM_{10} and $PM_{2.5}$ Pit Escape Factor applied to the calculations and is based on University of Utah study (1996).

TABLE B1-3
New In-pit Crusher
KUC—Bingham Canyon Mine

Source Name	PM_{10} Emission Factor (gr/dscf)	Hours of Operation (hrs/yr)	Design Flow Rate (dcf/min)	PM_{10} Emissions with Primary Control (lbs/hr)	PM_{10} Emissions with Primary Control (tpy)	$PM_{2.5}$ Emissions with Primary Control (tpy)	PM_{10} Pit Escape Factor (%)	$PM_{2.5}$ Pit Escape Factor (%)	Controlled PM_{10} Emissions from the pit (tpy)	Controlled $PM_{2.5}$ Emissions from the pit (tpy)	Control System and Comments
New In Pit Crusher	0.007	8,760	12,898	0.77	3.39	1.00	20	21	0.68	0.21	Emissions controlled with a baghouse. Source Located in the pit.

NOTES:
The new crusher is expected to be similar to the existing crusher.
Emissions for $PM_{2.5}$ based on factors from AP-42, Table B.2.2, Category 3 - Mechanically Generated Aggregate and Unprocessed Ores.
PM_{10} and $PM_{2.5}$ Pit Escape Factor applied to the calculations and is based on University of Utah study (1996).

TABLE B1-4
C6/C7 Conveyor Transfer Point
KUC—Bingham Canyon Mine

Source Name	PM_{10} Emission Factor (gr/dscf)	Hours of Operation (hrs/yr)	Design Flow Rate (dcf/min)	Controlled PM_{10} Emissions (lbs/hr)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
C6/C7 Conveyor Transfer Point	0.007	8,760	5,120	0.31	1.35	0.40	Emissions controlled with a baghouse.

NOTES:
Emissions based on AO limits.
Emissions for $PM_{2.5}$ based on factors from AP-42, Table B.2.2, Category 3 - Mechanically Generated Aggregate and Unprocessed Ores.
KUC is proposing a lower grain loading for the baghouse.

TABLE B1-5

C7/C8 Conveyor Transfer Point

KUC—Bingham Canyon Mine

Source Name	PM_{10} Emission Factor (gr/dscf)	Hours of Operation (hrs/yr)	Design Flow Rate (dcf/min)	Controlled PM_{10} Emissions (lbs/hr)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
C7/C8 Conveyor Transfer Point	0.007	8,760	3,168	0.19	0.83	0.24	Emissions controlled with a baghouse.

NOTES:

Emissions based on AO limits.

Emissions for $PM_{2.5}$ based on factors from AP-42, Table B.2.2, Category 3 - Mechanically Generated Aggregate and Unprocessed Ores.

KUC is proposing a lower grain loading for the baghouse.

TABLE B1-6

Lime Bin

KUC—Bingham Canyon Mine

Source Name	PM_{10} Emission Factor (gr/dscf)	Hours of Operation (hrs/yr)	Design Flow Rate (dcf/min)	Controlled PM_{10} Emissions (lbs/hr)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Lime Bin	0.016	8,760	616	0.08	0.37	0.13	Emissions controlled with a baghouse.

NOTES:

Emissions based on AO limits.

Lime is an industrial nonmetalic mineral.

Emissions for PM2.5 based on factors from AP-42, Table B.2.2, Category 4 - Mechanically Generated Processed Ores and Nonmetallic Minerals.

TABLE B1-7

Lime Bin

KUC—Bingham Canyon Mine

Source Name	PM_{10} Emission Factor (gr/dscf)	Hours of Operation (hrs/yr)	Design Flow Rate (dcf/min)	Controlled PM_{10} Emissions (lbs/hr)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Lime Bin	0.016	8,760	616	0.08	0.37	0.13	Emissions controlled with a baghouse.

NOTES:

Emissions based on AO limits.

Lime is an industrial nonmetalic mineral.

Emissions for $PM_{2.5}$ based on factors from AP-42, Table B.2.2, Category 4 - Mechanically Generated Processed Ores and Nonmetallic Minerals.

TABLE B1-8

Sample Preparation

KUC—Bingham Canyon Mine

Source Name	PM_{10} Emission Factor (gr/dscf)	Hours of Operation (hrs/yr)	Design Flow Rate (dcf/min)	PM_{10} Emissions with Primary Control (lbs/hr)	PM_{10} Emissions with Primary Control (tpy)	$PM_{2.5}$ Emissions with Primary Control (tpy)	PM_{10} Pit Escape Factor (%)	$PM_{2.5}$ Pit Escape Factor (%)	Controlled PM_{10} Emissions from the pit (tpy)	Controlled $PM_{2.5}$ Emissions from the pit (tpy)	Control System and Comments
Sample Preparation	0.016	2,920	4,269	0.59	0.85	0.25	20	21	0.17	0.05	Emissions controlled with a baghouse. Source Located in the pit.

NOTES:

Hours of operation will continue to be 8 hours per day. No change in hours of operation due to the proposed project.

Emissions for $PM_{2.5}$ based on factors from AP-42, Table B.2.2, Category 3 - Mechanically Generated Aggregate and Unprocessed Ores.

Material handled during sample preparation is ore and waste rock material.

PM_{10} and $PM_{2.5}$ Pit Escape Factor applied to the calculations and is based on University of Utah study (1996).

TABLE B1-9

Gasoline and Diesel Fueling

KUC—Bingham Canyon Mine

Source Name	Total VOC Emissions (tpy)	Total HAP Emissions (tpy)
Gasoline and Diesel Fueling	4.24	1.29

Gasoline Fueling

Source Name	Annual Throughput (1,000 gal/yr)	VOC Emissions (tpy)	Primary Control System and Comments
Gasoline Fueling	530	3.45	Stage I Vapor Recovery

NOTES:

VOC Emission Factor (lb/10^3 gal) 13

Emission Factor obtained from AP-42, Table 5.2-7.

Station used to fuel light trucks and vehicles.

VOC Emission Factors (lb/10^3 gal) from AP-42, Table 5.2.7

Balanced Submerged Filling	0.3
Underground Tank Breathing & Emptying	1
Vehicle refueling Displacement Losses (uncontrolled)	11
Spillage	0.7

HAP Calculations

HAP	Concentration	Emissions (tpy)
Xylenes	6.5%	0.22
Toluene	10.0%	0.34
Naphthalene	0.2%	0.01
Benzene	3.0%	0.10
1,2,4-Trimethyl Benzene	7.0%	0.24
Ethyl Alcohol	10.0%	0.34
Cyclohexane	0.5%	0.02
Total HAP Emissions		1.28

NOTES:

(1) HAP Concentration data obtained from the MSDS for Gasoline.

Diesel Fueling

Source Name	Annual Throughput (1,000 gal/yr)	VOC Emissions (tpy)	Primary Control System and Comments
Diesel Fueling	55,000	0.80	Submerged Pipe

NOTES:

VOC Emission Factor (lb/10^3 gal) 0.029

In the absence of an applicable AP-42 emission factor, the Colorado Department of Public Health and Environment guidance on emissions from service stations was used for estimating diesel dispensing emissions.

Stations are used to fuel light trucks, vehicles and haul trucks.

HAP Calculations

HAP	Concentration	Emissions (tpy)
Toluene	0.5%	0.00399
Naphthalene	0.5%	0.00399
Total HAP Emissions		0.00798

NOTES:

(1) HAP Concentration data obtained from the MSDS for Diesel.

TABLE B1-10

Truck Offloading Ore at In-pit Crusher

KUC—Bingham Canyon Mine

Source Name	PM_{10} Aerodynamic Particle Size Multiplier (k)	$PM_{2.5}$ Aerodynamic Particle Size Multiplier (k)	Moisture Content (%)	Wind Speed (mph)	PM_{10} Emission Factor (lbs/ton)	$PM_{2.5}$ Emission Factor (lbs/ton)	Annual Process Rate (tpy)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Primary Control Efficiency (%)	PM_{10} Emissions with Primary Controls (tpy)	$PM_{2.5}$ Emissions with Primary Controls (tpy)	PM_{10} Pit Escape Factor (%)	$PM_{2.5}$ Pit Escape Factor (%)	Controlled PM_{10} Emissions from the pit (tpy)	Controlled $PM_{2.5}$ Emissions from the pit (tpy)	Control System and Comments
Truck Offloading Ore	0.35	0.053	4	7	0.00066	0.00010	85,000,000	27.9	4.2	90	2.79	0.42	20	21	0.56	0.09	Inherent material characteristics and physical enclosures. Source Located in the pit.

NOTES:

Emission factors estimated using methodology in AP-42, Section 13.2.4.

Wind speed and moisture content data based on historical data.

PM_{10} and $PM_{2.5}$ Pit Escape Factor applied to the calculations and is based on University of Utah study (1996).

Characteristics of the ore material, such as large diameter material, and inherent material moisture content of 4 percent, limit dust being generated during the transfer operations.

The control efficiency listed is based on previous determinations of BACT by UDAQ. This control efficiency has been applied in the 1994 SIP and 2005 SIP calculations and modeling.

TABLE B1-11

In-pit Enclosed Transfer Points 1, 2, and 3

KUC—Bingham Canyon Mine

Source Name	Number of Transfer Points	PM_{10} Aerodynamic Particle Size Multiplier (k)	$PM_{2.5}$ Aerodynamic Particle Size Multiplier (k)	Moisture Content (%)	Wind Speed (mph)	PM_{10} Emission Factor (lbs/ton)	$PM_{2.5}$ Emission Factor (lbs/ton)	Annual Process Rate (tpy)	Uncontrolled PM_{10} Emissions per Transfer Point (tpy)	Uncontrolled $PM_{2.5}$ Emissions per Transfer Point (tpy)	Primary Control Efficiency (%)	PM_{10} Emissions with primary controls per Transfer Point (tpy)	$PM_{2.5}$ Emissions with primary controls per Transfer Point (tpy)	PM_{10} Emissions with Primary Controls (tpy)	$PM_{2.5}$ Emissions with Primary Controls (tpy)	PM_{10} Pit Escape Factor (%)	$PM_{2.5}$ Pit Escape Factor (%)	Controlled PM_{10} Emissions from the pit (tpy)	Controlled $PM_{2.5}$ Emissions from the pit (tpy)	Control System and Comments
In-Pit Enclosed Transfer Point 1, 2, 3	3	0.35	0.053	4	7	0.00066	0.00010	85,000,000	27.9	4.2	90	2.79	0.42	8.38	1.27	20	21	1.68	0.27	Emissions controlled by enclosures. Source located in the pit.

NOTES:

Emission factors estimated using methodology in AP-42, Section 13.2.4.

Wind speed and moisture content data based on historical data.

PM_{10} and $PM_{2.5}$ Pit Escape Factor applied to the calculations and is based on University of Utah study (1996).

The control efficiency listed is based on previous determinations of BACT by UDAQ. This control efficiency has been applied in the 1994 SIP and 2005 SIP calculations and modeling.

TABLE B1-12
New In-pit Enclosed Transfer Point 1, 2, and 3
KUC—Bingham Canyon Mine

Source Name	Number of Transfer Points	PM_{10} Aerodynamic Particle Size Multiplier (k)	$PM_{2.5}$ Aerodynamic Particle Size Multiplier (k)	Moisture Content (%)	Wind Speed (mph)	PM_{10} Emission Factor (lbs/ton)	$PM_{2.5}$ Emission Factor (lbs/ton)	Annual Process Rate (tpy)	Uncontrolled PM_{10} Emissions per Transfer Point (tpy)	Uncontrolled $PM_{2.5}$ Emissions per Transfer Point (tpy)	Primary Control Efficiency (%)	PM_{10} Emissions with primary controls per Transfer Point (tpy)	$PM_{2.5}$ Emissions with primary controls per Transfer Point (tpy)	PM_{10} Emissions with Primary Controls (tpy)	$PM_{2.5}$ Emissions with Primary Controls (tpy)	PM_{10} Pit Escape Factor (%)	$PM_{2.5}$ Pit Escape Factor (%)	Controlled PM_{10} Emissions from the pit (tpy)	Controlled $PM_{2.5}$ Emissions from the pit (tpy)	Control System and Comments
New In-Pit Enclosed Transfer Point 1, 2, 3	3	0.35	0.053	4	7	0.00066	0.00010	85,000,000	27.9	4.2	90	2.79	0.42	8.38	1.27	20	21	1.68	0.27	Emissions controlled by enclosures. Source located in the pit.

NOTES:
Emission factors estimated using methodology in AP-42, Section 13.2.4.
Wind speed and moisture content data based on historical data.
PM_{10} and $PM_{2.5}$ Pit Escape Factor applied to the calculations and is based on University of Utah study (1996).
The control efficiency listed is based on previous determinations of BACT by UDAQ. This control efficiency has been applied in the 1994 SIP and 2005 SIP calculations and modeling.

TABLE B1-13

In-pit Enclosed Transfer Point 4 and 5 (proposed new transfer point with the relocation of the existing in-pit crusher)

KUC—Bingham Canyon Mine

Source Name	Number of Transfer Points	PM_{10} Aerodynamic Particle Size Multiplier (k)	$PM_{2.5}$ Aerodynamic Particle Size Multiplier (k)	Moisture Content (%)	Wind Speed (mph)	PM_{10} Emission Factor (lbs/ton)	$PM_{2.5}$ Emission Factor (lbs/ton)	Annual Process Rate (tpy)	Uncontrolled PM_{10} Emissions per Transfer Point (tpy)	Uncontrolled $PM_{2.5}$ Emissions per Transfer Point (tpy)	Primary Control Efficiency (%)	PM_{10} Emissions with Primary Controls per Transfer Point (tpy)	$PM_{2.5}$ Emissions with Primary Controls per Transfer Point (tpy)	PM_{10} Emissions with Primary Controls (tpy)	$PM_{2.5}$ Emissions with Primary Controls (tpy)	PM_{10} Pit Escape Factor (%)	$PM_{2.5}$ Pit Escape Factor (%)	Controlled PM_{10} Emissions from the Pit (tpy)	Controlled $PM_{2.5}$ Emissions from the Pit (tpy)	Control System and Comments
In-Pit Enclosed Transfer Point 4,5	2	0.35	0.053	4	7	0.00066	0.00010	85,000,000	27.9	4.2	90	2.79	0.42	5.59	0.85	20	21	1.12	0.18	Emissions controlled by enclosures. Source located in the pit.

NOTES:

Emission factors estimated using methodology in AP-42, Section 13.2.4.

Wind speed and moisture content data based on historical data.

PM_{10} and $PM_{2.5}$ Pit Escape Factor applied to the calculations and is based on University of Utah study (1996).

The control efficiency listed is based on previous determinations of BACT by UDAQ. This control efficiency has been applied in the 1994 SIP and 2005 SIP calculations and modeling.

TABLE B1-14

Conveyor-Stacker Transfer Point

KUC—Bingham Canyon Mine

Source Name	PM_{10} Aerodynamic Particle Size Multiplier (k)	$PM_{2.5}$ Aerodynamic Particle Size Multiplier (k)	Moisture Content (%)	Wind Speed (mph)	PM_{10} Emission Factor (lbs/ton)	$PM_{2.5}$ Emission Factor (lbs/ton)	Annual Process Rate (tpy)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Control Efficiency (%)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Conveyor-Stacker Transfer Point	0.35	0.053	4	7	0.00066	0.00010	85,000,000	27.9	4.2	90	2.79	0.42	Inherent material characteristics and physical enclosures.

NOTES:

Emission factors estimated using methodology in AP-42, Section 13.2.4.

Wind speed and moisture content data based on historical data.

Characteristics of the ore material, such as large diameter material, and inherent material moisture content of 4 percent, limit dust being generated during the transfer operations.

The control efficiency listed is based on previous determinations of BACT by UDAQ. This control efficiency has been applied in the 1994 SIP and 2005 SIP calculations and modeling.

TABLE B1-15

Coarse Ore Stacker

KUC—Bingham Canyon Mine

Source Name	PM_{10} Aerodynamic Particle Size Multiplier (k)	$PM_{2.5}$ Aerodynamic Particle Size Multiplier (k)	Moisture Content (%)	Wind Speed (mph)	PM_{10} Emission Factor (lbs/ton)	$PM_{2.5}$ Emission Factor (lbs/ton)	Annual Process Rate (tpy)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Control Efficiency (%)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Coarse Ore Stacker (Drop to Coarse Ore Storage Pile)	0.35	0.053	4	7	0.00066	0.00010	85,000,000	27.9	4.2	90	2.79	0.42	Inherent material characteristics and physical enclosures.

NOTES:

Emission factors estimated using methodology in AP-42, Section 13.2.4.

Wind speed and moisture content data based on historical data.

Characteristics of the ore material, such as large diameter material, and inherent material moisture content of 4 percent, limit dust being generated during the transfer operations.

The control efficiency listed is based on previous determinations of BACT by UDAQ. This control efficiency has been applied in the 1994 SIP and 2005 SIP calculations and modeling.

TABLE B1-16
Reclaim Tunnels
KUC—Bingham Canyon Mine

Source Name	PM_{10} Aerodynamic Particle Size Multiplier (k)	$PM_{2.5}$ Aerodynamic Particle Size Multiplier (k)	Moisture Content (%)	Wind Speed (mph)	PM_{10} Emission Factor (lbs/ton)	$PM_{2.5}$ Emission Factor (lbs/ton)	Annual Process Rate (tpy)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Control Efficiency (%)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Reclaim Tunnels (Coarse Ore Reclaim Tunnel Vent)	0.35	0.053	4	7	0.00066	0.00010	85,000,000	27.9	4.2	90	2.79	0.42	Inherent material characteristics and physical enclosures.

NOTES:
Emission factors estimated using methodology in AP-42, Section 13.2.4.
Wind speed and moisture content data based on historical data.
Characteristics of the ore material, such as large diameter material, and inherent material moisture content of 4 percent, limit dust being generated during the transfer operations.
The control efficiency listed is based on previous determinations of BACT by UDAQ. This control efficiency has been applied in the 1994 SIP and 2005 SIP calculations and modeling.

TABLE B1-17

Disturbed Areas

KUC—Bingham Canyon Mine

Source Name	Number of Days per Year	Number of Days of precipitation	PM Emission Factor (tons/acre-yr)	PM_{10} Emission Factor (tons/acre-yr)	$PM_{2.5}$ Emission Factor (tons/acre-yr)	Total Disturbed Area (acres)	Uncontrolled PM_{10} Emissions (tpy)	Primary Control Efficiency (%)	PM_{10} Emissions with Primary Controls (tpy)	$PM_{2.5}$ Emissions with Primary Controls (tpy)	PM_{10} Pit Escape Factor (%)	$PM_{2.5}$ Pit Escape Factor (%)	Controlled PM_{10} Emissions from the pit (tpy)	Controlled $PM_{2.5}$ Emissions from the pit (tpy)	Control System and Comments
Disturbed Areas (Unstabilized Areas) - areas Outside the Pit	365	106	0.38	0.18	0.03	256	32.7	0	32.7	7.0	100	100	32.67	6.97	Inherent material characteristics and water application from passing water trucks is used to further reduce emissions.
Disturbed Areas (Unstabilized Areas) - areas Inside the Pit	365	106	0.38	0.18	0.03	310	39.6	0	39.6	8.4	20	21	7.92	1.77	Inherent material characteristics and source located in the pit.

NOTES:

PM Emission factor estimated using methodology in AP-42, Section 11.9-4 (Wind Erosion of Exposed Areas).

PM_{10} and $PM_{2.5}$ emission factor derived from ratio of transfer particle size multipliers in AP 42, Fifth Edition, Table 13.2.4 (EPA, 2006), (Wind Erosion of Pile Surfaces and Ground Areas around Piles).

Characteristics of the ore material, such as large diameter material, and inherent material moisture content of 4 percent, limit dust being generated.

PM_{10} and $PM_{2.5}$ Pit Escape Factor applied to the calculations and is based on University of Utah study (1996).

Days of precipitation data obtained from the East Butte Meterological Station. Number of days with at least 0.01 inches of precipitation per year.

Distribution of acres in and out of pit are based on expected mine operations provided by the KUC Mine group.

TABLE B1-18
Cold Solvent Degreasing Parts
KUC—Bingham Canyon Mine

Source Name	Throughput (gal/yr)	Specific Gravity	Density (lbs/gal)	Percent VOCs	Uncontrolled VOC Emissions (tpy)	Control Efficiency (%)	Controlled VOC Emissions (tpy)	Control System and Comments
Cold Solvent Degreasing Parts	500	0.81	6.76	100	1.69	0	1.69	Degreasers are enclosed.

NOTES:
Emissions estimated based on material balance.
Throughput based on one solvent change per year for 8 degreasers.

TABLE B1-19
Haul Roads
KUC—Bingham Canyon Mine

Max Hauled: **260,000,000 tons per year**

Emissions for 2011

Activity & Road Description	Number of days of precipitation	PM Emission Factor (lbs/VMT)	PM_{10} Emission Factor (lbs/VMT)	$PM_{2.5}$ Emission Factor (lbs/VMT)	Annual Material Hauled (tons)	Round Trip Haul Distance (miles)	Number of Round Trips	Vehicle Miles Traveled (VMT)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Control Efficiency (%)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Haul Roads Inside the Pit	106	12.66	3.11	0.31	214,000,000	3.9	891,667	3,477,500	5,411	541	75	1,353	135	Water Sprays and Road Base.
Haul Roads Outside the Pit	106	12.66	3.11	0.31	214,000,000	0.8	891,667	713,333	1,110	111	85	167	17	Chemical Suppressants and Water Sprays
								4,190,833				1,519	152	

Emissions for 2012

Activity & Road Description	Number of days of precipitation	PM Emission Factor (lbs/VMT)	PM_{10} Emission Factor (lbs/VMT)	$PM_{2.5}$ Emission Factor (lbs/VMT)	Annual Material Hauled (tons)	Round Trip Haul Distance (miles)	Number of Round Trips	Vehicle Miles Traveled (VMT)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Control Efficiency (%)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Haul Roads Inside the Pit	106	12.66	3.11	0.31	235,000,000	4.4	979,167	4,308,333	6,704	670	75	1,676	168	Water Sprays and Road Base.
Haul Roads Outside the Pit	106	12.66	3.11	0.31	235,000,000	0.7	979,167	685,417	1,067	107	85	160	16	Chemical Suppressants and Water Sprays
								4,993,750				1,836	184	

Emissions for 2013

Activity & Road Description	Number of days of precipitation	PM Emission Factor (lbs/VMT)	PM_{10} Emission Factor (lbs/VMT)	$PM_{2.5}$ Emission Factor (lbs/VMT)	Annual Material Hauled (tons)	Round Trip Haul Distance (miles)	Number of Round Trips	Vehicle Miles Traveled (VMT)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Control Efficiency (%)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Haul Roads Inside the Pit	106	12.66	3.11	0.31	255,000,000	5.5	1,062,500	5,843,750	9,094	909	75	2,273	227	Water Sprays and Road Base.
Haul Roads Outside the Pit	106	12.66	3.11	0.31	255,000,000	2.1	1,062,500	2,231,250	3,472	347	85	521	52	Chemical Suppressants and Water Sprays
								8,075,000				2,794	279	

Emissions for 2014

Activity & Road Description	Number of days of precipitation	PM Emission Factor (lbs/VMT)	PM_{10} Emission Factor (lbs/VMT)	$PM_{2.5}$ Emission Factor (lbs/VMT)	Annual Material Hauled (tons)	Round Trip Haul Distance (miles)	Number of Round Trips	Vehicle Miles Traveled (VMT)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Control Efficiency (%)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Haul Roads Inside the Pit	106	12.66	3.11	0.31	259,000,000	6.2	1,079,167	6,690,833	10,412	1,041	75	2,603	260	Water Sprays and Road Base.
Haul Roads Outside the Pit	106	12.66	3.11	0.31	259,000,000	1.3	1,079,167	1,402,917	2,183	218	85	327	33	Chemical Suppressants and Water Sprays
								8,093,750				2,930	293	

Emissions for 2015

Activity & Road Description	Number of days of precipitation	PM Emission Factor (lbs/VMT)	PM_{10} Emission Factor (lbs/VMT)	$PM_{2.5}$ Emission Factor (lbs/VMT)	Annual Material Hauled (tons)	Round Trip Haul Distance (miles)	Number of Round Trips	Vehicle Miles Traveled (VMT)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Control Efficiency (%)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Haul Roads Inside the Pit	106	12.66	3.11	0.31	259,000,000	5.8	1,079,167	6,259,167	9,740	974	75	2,435	244	Water Sprays and Road Base.
Haul Roads Outside the Pit	106	12.66	3.11	0.31	259,000,000	2.7	1,079,167	2,913,750	4,534	453	85	680	68	Chemical Suppressants and Water Sprays
								9,172,917				3,115	312	

TABLE B1-19
Haul Roads
KUC—Bingham Canyon Mine

Emissions for 2016

Activity & Road Description	Number of days of precipitation	PM Emission Factor (lbs/VMT)	PM_{10} Emission Factor (lbs/VMT)	$PM_{2.5}$ Emission Factor (lbs/VMT)	Annual Material Hauled (tons)	Round Trip Haul Distance (miles)	Number of Round Trips	Vehicle Miles Traveled (VMT)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Control Efficiency (%)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Haul Roads Inside the Pit	106	12.66	3.11	0.31	260,000,000	6.8	1,083,333	7,366,667	11,463	1,146	75	2,866	287	Water Sprays and Road Base.
Haul Roads Outside the Pit	106	12.66	3.11	0.31	260,000,000	1.9	1,083,333	2,058,333	3,203	320	85	480	48	Chemical Suppressants and Water Sprays
								9,425,000				3,346	335	

Emissions for 2017

Activity & Road Description	Number of days of precipitation	PM Emission Factor (lbs/VMT)	PM_{10} Emission Factor (lbs/VMT)	$PM_{2.5}$ Emission Factor (lbs/VMT)	Annual Material Hauled (tons)	Round Trip Haul Distance (miles)	Number of Round Trips	Vehicle Miles Traveled (VMT)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Control Efficiency (%)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Haul Roads Inside the Pit	106	12.66	3.11	0.31	242,000,000	6.2	1,008,333	6,251,667	9,728	973	75	2,432	243	Water Sprays and Road Base.
Haul Roads Outside the Pit	106	12.66	3.11	0.31	242,000,000	3.0	1,008,333	3,025,000	4,707	471	85	706	71	Chemical Suppressants and Water Sprays
								9,276,667				3,138	314	

Emissions for 2018

Activity & Road Description	Number of days of precipitation	PM Emission Factor (lbs/VMT)	PM_{10} Emission Factor (lbs/VMT)	$PM_{2.5}$ Emission Factor (lbs/VMT)	Annual Material Hauled (tons)	Round Trip Haul Distance (miles)	Number of Round Trips	Vehicle Miles Traveled (VMT)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Control Efficiency (%)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Haul Roads Inside the Pit	106	12.66	3.11	0.31	217,000,000	3.4	904,167	3,074,167	4,784	478	75	1,196	120	Water Sprays and Road Base.
Haul Roads Outside the Pit	106	12.66	3.11	0.31	217,000,000	6.4	904,167	5,786,667	9,005	900	85	1,351	135	Chemical Suppressants and Water Sprays
								8,860,833				2,547	255	

Emissions for 2019

Activity & Road Description	Number of days of precipitation	PM Emission Factor (lbs/VMT)	PM_{10} Emission Factor (lbs/VMT)	$PM_{2.5}$ Emission Factor (lbs/VMT)	Annual Material Hauled (tons)	Round Trip Haul Distance (miles)	Number of Round Trips	Vehicle Miles Traveled (VMT)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Control Efficiency (%)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Haul Roads Inside the Pit	106	12.66	3.11	0.31	204,000,000	4.8	850,000	4,080,000	6,349	635	75	1,587	159	Water Sprays and Road Base.
Haul Roads Outside the Pit	106	12.66	3.11	0.31	204,000,000	5.3	850,000	4,505,000	7,010	701	85	1,052	105	Chemical Suppressants and Water Sprays
								8,585,000				2,639	264	

Emissions for 2020

Activity & Road Description	Number of days of precipitation	PM Emission Factor (lbs/VMT)	PM_{10} Emission Factor (lbs/VMT)	$PM_{2.5}$ Emission Factor (lbs/VMT)	Annual Material Hauled (tons)	Round Trip Haul Distance (miles)	Number of Round Trips	Vehicle Miles Traveled (VMT)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Control Efficiency (%)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Haul Roads Inside the Pit	106	12.66	3.11	0.31	154,000,000	5.8	641,667	3,721,667	5,791	579	75	1,448	145	Water Sprays and Road Base.
Haul Roads Outside the Pit	106	12.66	3.11	0.31	154,000,000	3.5	641,667	2,245,833	3,495	349	85	524	52	Chemical Suppressants and Water Sprays
								5,967,500				1,972	197	

TABLE B1-19
Haul Roads
KUC—Bingham Canyon Mine

Emissions for 2021

Activity & Road Description	Number of days of precipitation	PM Emission Factor (lbs/VMT)	PM_{10} Emission Factor (lbs/VMT)	$PM_{2.5}$ Emission Factor (lbs/VMT)	Annual Material Hauled (tons)	Round Trip Haul Distance (miles)	Number of Round Trips	Vehicle Miles Traveled (VMT)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Control Efficiency (%)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Haul Roads Inside the Pit	106	12.66	3.11	0.31	101,000,000	3.1	420,833	1,304,583	2,030	203	75	508	51	Water Sprays and Road Base.
Haul Roads Outside the Pit	106	12.66	3.11	0.31	101,000,000	7.2	420,833	3,030,000	4,715	472	85	707	71	Chemical Suppressants and Water Sprays
								4,334,583				1,215	121	

Emissions for 2022

Activity & Road Description	Number of days of precipitation	PM Emission Factor (lbs/VMT)	PM_{10} Emission Factor (lbs/VMT)	$PM_{2.5}$ Emission Factor (lbs/VMT)	Annual Material Hauled (tons)	Round Trip Haul Distance (miles)	Number of Round Trips	Vehicle Miles Traveled (VMT)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Control Efficiency (%)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Haul Roads Inside the Pit	106	12.66	3.11	0.31	71,000,000	4.2	295,833	1,242,500	1,933	193	75	483	48	Water Sprays and Road Base.
Haul Roads Outside the Pit	106	12.66	3.11	0.31	71,000,000	7.7	295,833	2,277,917	3,545	354	85	532	53	Chemical Suppressants and Water Sprays
								3,520,417				1,015	102	

Emissions for 2023

Activity & Road Description	Number of days of precipitation	PM Emission Factor (lbs/VMT)	PM_{10} Emission Factor (lbs/VMT)	$PM_{2.5}$ Emission Factor (lbs/VMT)	Annual Material Hauled (tons)	Round Trip Haul Distance (miles)	Number of Round Trips	Vehicle Miles Traveled (VMT)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Control Efficiency (%)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Haul Roads Inside the Pit	106	12.66	3.11	0.31	77,000,000	5.5	320,833	1,764,583	2,746	275	75	686	69	Water Sprays and Road Base.
Haul Roads Outside the Pit	106	12.66	3.11	0.31	77,000,000	10.3	320,833	3,304,583	5,142	514	85	771	77	Chemical Suppressants and Water Sprays
								5,069,167				1,458	146	

Emissions for 2024

Activity & Road Description	Number of days of precipitation	PM Emission Factor (lbs/VMT)	PM_{10} Emission Factor (lbs/VMT)	$PM_{2.5}$ Emission Factor (lbs/VMT)	Annual Material Hauled (tons)	Round Trip Haul Distance (miles)	Number of Round Trips	Vehicle Miles Traveled (VMT)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Control Efficiency (%)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Haul Roads Inside the Pit	106	12.66	3.11	0.31	90,000,000	6.9	375,000	2,587,500	4,026	403	75	1,007	101	Water Sprays and Road Base.
Haul Roads Outside the Pit	106	12.66	3.11	0.31	90,000,000	6.7	375,000	2,512,500	3,910	391	85	586	59	Chemical Suppressants and Water Sprays
								5,100,000				1,593	159	

Emissions for 2025

Activity & Road Description	Number of days of precipitation	PM Emission Factor (lbs/VMT)	PM_{10} Emission Factor (lbs/VMT)	$PM_{2.5}$ Emission Factor (lbs/VMT)	Annual Material Hauled (tons)	Round Trip Haul Distance (miles)	Number of Round Trips	Vehicle Miles Traveled (VMT)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Control Efficiency (%)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Haul Roads Inside the Pit	106	12.66	3.11	0.31	84,000,000	7.5	350,000	2,625,000	4,085	408	75	1,021	102	Water Sprays and Road Base.
Haul Roads Outside the Pit	106	12.66	3.11	0.31	84,000,000	8.1	350,000	2,835,000	4,412	441	85	662	66	Chemical Suppressants and Water Sprays
								5,460,000				1,683	168	

TABLE B1-19
Haul Roads
KUC—Bingham Canyon Mine

Emissions for 2026

Activity & Road Description	Number of days of precipitation	PM Emission Factor (lbs/VMT)	PM_{10} Emission Factor (lbs/VMT)	$PM_{2.5}$ Emission Factor (lbs/VMT)	Annual Material Hauled (tons)	Round Trip Haul Distance (miles)	Number of Round Trips	Vehicle Miles Traveled (VMT)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Control Efficiency (%)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Haul Roads Inside the Pit	106	12.66	3.11	0.31	80,000,000	4.7	333,333	1,566,667	2,438	244	75	609	61	Water Sprays and Road Base.
Haul Roads Outside the Pit	106	12.66	3.11	0.31	80,000,000	10.9	333,333	3,633,333	5,654	565	85	848	85	Chemical Suppressants and Water Sprays
								5,200,000				1,458	146	

Emissions for 2027

Activity & Road Description	Number of days of precipitation	PM Emission Factor (lbs/VMT)	PM_{10} Emission Factor (lbs/VMT)	$PM_{2.5}$ Emission Factor (lbs/VMT)	Annual Material Hauled (tons)	Round Trip Haul Distance (miles)	Number of Round Trips	Vehicle Miles Traveled (VMT)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Control Efficiency (%)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Haul Roads Inside the Pit	106	12.66	3.11	0.31	84,000,000	4.2	350,000	1,470,000	2,288	229	75	572	57	Water Sprays and Road Base.
Haul Roads Outside the Pit	106	12.66	3.11	0.31	84,000,000		350,000	0	0	0	85	0	0	Chemical Suppressants and Water Sprays
								1,470,000				572	57	

Emissions for 2028

Activity & Road Description	Number of days of precipitation	PM Emission Factor (lbs/VMT)	PM_{10} Emission Factor (lbs/VMT)	$PM_{2.5}$ Emission Factor (lbs/VMT)	Annual Material Hauled (tons)	Round Trip Haul Distance (miles)	Number of Round Trips	Vehicle Miles Traveled (VMT)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Control Efficiency (%)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Haul Roads Inside the Pit	106	12.66	3.11	0.31	85,000,000	4.2	354,167	1,487,500	2,315	231	75	579	58	Water Sprays and Road Base.
Haul Roads Outside the Pit	106	12.66	3.11	0.31	85,000,000		354,167	0	0	0	85	0	0	Chemical Suppressants and Water Sprays
								1,487,500				579	58	

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Fugitive PM_{10} Emissions	1,519	1,836	2,794	2,930	3,115	3,346	3,138	2,547	2,639	1,972	1,215	1,015	1,458	1,593	1,683	1,458	572	579
$PM_{2.5}$ Emissions	152	184	279	293	312	335	314	255	264	197	121	102	146	159	168	146	57	58

Average Vehicle Weight - Full (tons)	413
Average Vehicle Weight - Empty (tons)	173
S = Silt Content (%)	4
Vehicle Capacity (tons)	240
W = Average Vehicle Weight (tons)	293

NOTES:
Days of precipitation data obtained from the East Butte Meterological Station.
Haul Road Distances and Maximum Material Hauled based on data provided by KUC Mine Group.
240-Ton Truck capacity used in the calculation.
Average Vehicle Weight is used in the calculation.

TABLE B1-19

Haul Roads

KUC—Bingham Canyon Mine

AP-42 emission calculations for <u>unpaved</u> roads. Chapter 13.2.2 (11/06)

$$E = k \times \left(\frac{s}{12}\right)^{a} \times \left(\frac{W}{3}\right)^{b} \times \left(\frac{365 - p}{365}\right)$$

Equation (1a):

$$E = k \times \left(\frac{s}{12}\right)^{a} \times \left(\frac{W}{3}\right)^{b} \times \left(\frac{365 - p}{365}\right)$$

	Unpaved		
	PM	PM_{10}	$PM_{2.5}$
k =	4.9	1.5	0.150
a =	0.7	0.9	0.9
b =	0.45	0.45	0.45

E: emission factor (lb/VMT) VMT = vehicle miles traveled
k, a, b: dimensionless constants from Table 13.2.2-2
S: silt content (%) of road surface
W: mean vehicle weight (tons); = (wt.loaded + wt.unloaded / 2)
p: number of days with at least 0.01 inches of precipitation per year; not used for calculating hourly emissions (default = 90)

TABLE B1-20

Low-grade Coarse Ore Storage Piles

KUC—Bingham Canyon Mine

Source Name	Size of Storage Pile (acres)	Mean Wind Speed (mph)	PM Emission Factor (lb/acre-hr)	PM_{10} Emission Factor (lb/acre-hr)	$PM_{2.5}$ Emission Factor (lb/acre-hr)	Hours of Operation (hrs/yr)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Primary Control Efficiency (%)	PM_{10} Emissions with Primary Controls (tpy)	$PM_{2.5}$ Emissions with Primary Controls (tpy)	PM_{10} Pit Escape Factor (%)	$PM_{2.5}$ Pit Escape Factor (%)	Controlled PM_{10} Emissions from the pit (tpy)	Controlled $PM_{2.5}$ Emissions from the pit (tpy)	Control System and Comments
Low-grade Coarse Ore Storage Piles	10	7	5.04	2.38	0.36	8,760	104.4	15.8	90	10.44	1.58	20	21	2.09	0.33	Inherent material characteristics and mechanical compaction to minimize emissions. Water application from passing water trucks is used to further reduce emissions. Source is located in the pit.

NOTES:

Emission factors estimated using methodology in AP-42, Table 11.9-1.

Based on ratio of transfer particle size multipliers in AP 42, Fifth Edition, Table 13.2.4 (EPA, 2006), assume PM_{10} to be 47% of PM and $PM_{2.5}$ to be 15% of PM_{10}.

PM_{10} and $PM_{2.5}$ Pit Escape Factor applied to the calculations and is based on University of Utah study (1996).

Characteristics of the ore material, such as large diameter material, and inherent material moisture content of 4 percent, limit dust being generated during the transfer operations.

Wind speed and moisture content data based on historical data.

The control efficiency listed is based on previous determinations of BACT by UDAQ. This control efficiency has been applied in the 1994 SIP and 2005 SIP calculations and modeling.

TABLE B1-21
Front-end Loaders
KUC—Bingham Canyon Mine

Source Name	Moisture Content (%)	PM_{10} Emission Factor (lbs/ton)	$PM_{2.5}$ Emission Factor (lbs/ton)	Annual Process Rate (tpy)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Primary Control Efficiency (%)	PM_{10} Emissions with Primary Controls (tpy)	$PM_{2.5}$ Emissions with Primary Controls (tpy)	PM_{10} Pit Escape Factor (%)	$PM_{2.5}$ Pit Escape Factor (%)	Controlled PM_{10} Emissions from the pit (tpy)	Controlled $PM_{2.5}$ Emissions from the pit (tpy)	Control System and Comments
Front-end Loaders (Operation in Pit)	4	0.0256	0.0042	10,350,000	132.6	21.61	70	39.8	6.5	20	21	7.96	1.36	Water application from passing water trucks is used to further reduce emissions. Source located in the pit.
Front-end Loaders (Operation out of Pit)	4	0.0256	0.0042	1,150,000	14.7	2.40	70	4.4	0.7	100	100	4.42	0.72	Water application from passing water trucks is used to further reduce emissions.

NOTES:
Emission factors estimated using methodology outlined in AP-42, Table 11.9-1.
PM_{10} and $PM_{2.5}$ Pit Escape Factor applied to the calculations and is based on University of Utah study (1996).
Moisture content data based on historical data.
Front end loaders operate primarily in vehicular traveled areas. These areas are subject to road watering.
Front end loaders are not utilized for loading primary ore and waste haulage trucks.
70 percent Control Efficiency for water application in the areas where loaders are operated, per UDAQ policy.
Process rates in and out of pit are based on expected mine operations provided by the KUC Mine group.

TABLE B1-22

Truck Loading

KUC—Bingham Canyon Mine

Source Name	PM_{10} Aerodynamic Particle Size Multiplier (k)	$PM_{2.5}$ Aerodynamic Particle Size Multiplier (k)	Moisture Content (%)	Wind Speed (mph)	PM_{10} Emission Factor (lbs/ton)	$PM_{2.5}$ Emission Factor (lbs/ton)	Annual Process Rate (tpy)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Primary Control Efficiency (%)	PM_{10} Emissions with Primary Controls (tpy)	$PM_{2.5}$ Emissions with Primary Controls (tpy)	PM_{10} Pit Escape Factor (%)	$PM_{2.5}$ Pit Escape Factor (%)	Controlled PM_{10} Emissions from the pit (tpy)	Controlled $PM_{2.5}$ Emissions from the pit (tpy)	Control System and Comments
Truck Loading	0.35	0.053	4	7	0.00066	0.00010	260,000,000	85.4	12.9	90	8.5	1.3	20	21	1.71	0.27	Inherent material characteristics and minimal drop distance. Source is located in the pit.

NOTES:

Emission factors estimated using methodology in AP-42, Section 13.2.4.

Wind speed and moisture content data based on historical data.

PM_{10} and $PM_{2.5}$ Pit Escape Factor applied to the calculations and is based on University of Utah study (1996).

Characteristics of the ore/waste rock material, such as large diameter material, and inherent material moisture content of 4 percent, limit dust being generated during the transfer operations.

The control efficiency listed is based on previous determinations of BACT by UDAQ. This control efficiency has been applied in the 1994 SIP and 2005 SIP calculations and modeling.

Ore and waste rock is loaded into the haultrucks with shovels.

TABLE B1-23
Truck Offloading of Waste Rock
KUC—Bingham Canyon Mine

Source Name	PM_{10} Aerodynamic Particle Size Multiplier (k)	$PM_{2.5}$ Aerodynamic Particle Size Multiplier (k)	Moisture Content (%)	Wind Speed (mph)	PM_{10} Emission Factor (lbs/ton)	$PM_{2.5}$ Emission Factor (lbs/ton)	Annual Process Rate (tpy)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Primary Control Efficiency (%)	Controlled PM_{10} Emissions (tpy)	Controlled $PM_{2.5}$ Emissions (tpy)	Control System and Comments
Truck Offloading of Waste Rock	0.35	0.053	4	7	0.00066	0.00010	175,000,000	57.5	8.7	0	57.5	8.7	Inherent material characteristics and mechanical compaction to minimize emissions. Water application from passing water trucks is used to further reduce emissions.

NOTES:
Emission factors estimated using methodology in AP-42, Section 13.2.4.
Wind speed and moisture content data based on historical data.
Characteristics of the waste rock material, such as large diameter material, and inherent material moisture content of 4 percent, limit dust being generated during the transfer operations.
Mechanical compaction is achieived with dozers operating in the waste rock disposal areas.

TABLE B1-24
Graders
KUC—Bingham Canyon Mine

Source Name	Mean Vehicle Speed (mph)	Number of Graders	Hours of Operation (hrs/yr)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Primary Control Efficiency (%)	PM_{10} Emissions with Primary Controls (tpy)	$PM_{2.5}$ Emissions with Primary Controls (tpy)	PM_{10} Pit Escape Factor (%)	$PM_{2.5}$ Pit Escape Factor (%)	Controlled PM_{10} Emissions from the pit (tpy)	Controlled $PM_{2.5}$ Emissions from the pit (tpy)	Control System and Comments
Graders (Operation in Pit)	8	18	3,140	443	51	61	173	20	20	21	34.5	4.16	Water application from passing water trucks is used to further reduce emissions. Source is located in the pit.
Graders (Operation out of Pit)	8	18	785	111	13	61	43	5	100	100	43.2	4.95	Water application from passing water trucks is used to further reduce emissions.

NOTES:
Emissions calculated using methodology outlined in AP-42, Table 11.9-1.
61 percent Control Efficiency for water application in the areas where graders are operated (construction type activities), per Table 3-7 - WRAP Fugitive Dust Handbook.
PM_{10} and $PM_{2.5}$ Pit Escape Factor applied to the calculations and is based on University of Utah study (1996).
Graders primarily operate on the haulroads maintaining surfaces of the roads.
Operation hours in and out of pit and vehicle speed are based on expected mine operations provided by the KUC Mine group.

Hours per year:	8,760
Availability (%):	80
Effective Use of Utilization (%):	56
Hours of operation:	3,924

TABLE B1-25

Bulldozers (Track Dozers)

KUC—Bingham Canyon Mine

Source Name	Silt Content (%)	Moisture Content (%)	Number of Track Dozers	Hours of Operation (hrs/yr)	PM_{10} Emission Factor (lbs/hr)	$PM_{2.5}$ Emission Factor (lbs/hr)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Primary Control Efficiency (%)	PM_{10} Emissions with Primary Controls (tpy)	$PM_{2.5}$ Emissions with Primary Controls (tpy)	PM_{10} Pit Escape Factor (%)	$PM_{2.5}$ Pit Escape Factor (%)	Controlled PM_{10} Emissions from the pit (tpy)	Controlled $PM_{2.5}$ Emissions from the pit (tpy)	Control System and Comments
Track dozers (Operation in Pit)	4	4	26	2,137	0.86	0.52	24	14	61	9.33	5.65	20	21	1.9	1.19	Water application from passing water trucks is used to further reduce emissions. Source is located in the pit.
Track dozers (Operation out of Pit)	4	4	26	916	0.86	0.52	10	6	61	4.00	2.42	100	100	4.0	2.42	Water application from passing water trucks is used to further reduce emissions. Source is located in the pit.

NOTES:

Emission factors estimated using methodology outlined in AP-42, Table 11.9-1.

61 percent Control Efficiency for water application in the areas where dozers are operated (construction type activities), per Table 3-7 - WRAP Fugitive Dust Handbook.

PM_{10} and $PM_{2.5}$ Pit Escape Factor applied to the calculations and is based on University of Utah study (1996).

Wind speed and moisture content data based on historical data.

Dozers operate in the pit, on the haulroads and in waste rock disposal areas performing “cleanup” operations.

Operations in and out of pit are based on expected mine operations provided by the KUC Mine group.

EPA default silt content for Utah was applied.

Hours per year:	8,760
Availability (%):	85
Effective Use of Utilization (%):	41
Hours of Operation:	3,053

TABLE B1-26

Wheeled Dozers

KUC—Bingham Canyon Mine

Source Name	Silt Content (%)	Moisture Content (%)	Number of Wheeled Dozers	Hours of Operation (hrs/yr)	PM_{10} Emission Factor (lbs/hr)	$PM_{2.5}$ Emission Factor (lbs/hr)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Primary Control Efficiency (%)	PM_{10} Emissions with Primary Controls (tpy)	$PM_{2.5}$ Emissions with Primary Controls (tpy)	PM_{10} Pit Escape Factor (%)	$PM_{2.5}$ Pit Escape Factor (%)	Controlled PM_{10} Emissions from the pit (tpy)	Controlled $PM_{2.5}$ Emissions from the pit (tpy)	Control System and Comments
Rubber Tire Dozers	4	4	11	3,193	0.86	0.52	15.1	9.2	61	5.9	3.6	20	21	1.2	0.75	Water application from passing water trucks is used to further reduce emissions. Source is located in the pit.

NOTES:

Emission factors estimated using methodology outlined in AP-42, Table 11.9-1.

61 percent Control Efficiency for water application in the areas where dozers are operated (construction type activities), per Table 3-7 - WRAP Fugitive Dust Handbook.

PM_{10} and $PM_{2.5}$ Pit Escape Factor applied to the calculations and is based on University of Utah study (1996).

Wind speed and moisture content data based on historical data.

Dozers operate in the pit, on the haulroads and in waste rock disposal areas performing “cleanup” operations.

EPA default silt content for Utah was applied.

Hours per year:	8,760
Availability (%):	81
Effective Use of Utilization (%):	45
Hours of Operation:	3,193

TABLE B1-27
Drilling with Water Injection
KUC—Bingham Canyon Mine

Source Name	PM Emission Factor (lbs/hole)	PM_{10} Emission Factor (lbs/hole)	$PM_{2.5}$ Emission Factor (lbs/hole)	Number of Holes (holes/yr)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Primary Control Efficiency (%)	PM_{10} Emissions with Primary Controls (tpy)	$PM_{2.5}$ Emissions with Primary Controls (tpy)	PM_{10} Pit Escape Factor (%)	$PM_{2.5}$ Pit Escape Factor (%)	Controlled PM_{10} Emissions from the pit (tpy)	Controlled $PM_{2.5}$ Emissions from the pit (tpy)	Control System and Comments
Drilling with Water Injection	1.3	0.615	0.093	90,000	27.7	4.2	90	2.77	0.42	20	21	0.6	0.09	Water injection at 90% efficiency. Source is located in the pit.

NOTES:
PM Emission factor obtained from AP-42, Table 11.9-4. Ratio of transfer particle size multipliers in AP 42, Fifth Edition, Table 13.2.4 (EPA, 2006), assume PM_{10} to be 47% of PM and $PM_{2.5}$ to be 15% of PM_{10}.
PM_{10} and $PM_{2.5}$ Pit Escape Factor applied to the calculations and is based on University of Utah study (1996).
The control efficiency listed is based on previous determinations of BACT by UDAQ. This control efficiency has been applied in the 1994 SIP and 2005 SIP calculations and modeling.
Number of holes drilled per year proved by the KUC mine group.

TABLE B1-28
Blasting with Minimized Area
KUC—Bingham Canyon Mine

Source Name	Blasting Area (ft^2)	PM_{10} Emission Factor (lbs/blast)	$PM_{2.5}$ Emission Factor (lbs/blast)	Blasts per Year	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Primary Control Efficiency (%)	PM_{10} Emissions with Primary Controls (tpy)	$PM_{2.5}$ Emissions with Primary Controls (tpy)	PM_{10} Pit Escape Factor (%)	$PM_{2.5}$ Pit Escape Factor (%)	Controlled PM_{10} Emissions from the pit (tpy)	Controlled $PM_{2.5}$ Emissions from the pit (tpy)	Control System and Comments	NH_3 Emission Factor (lbs/blast)	Uncontrolled NH_3 Emissions (tpy)	Control Efficiency (%)	Controlled NH_3 Emissions (toy)	Control System and Comments
Blasting with Minimized Area	57,500	100.4	5.8	1,100	55.2	3.2	0	55.2	3.2	20	21	11.0	0.67	Source is located in the pit.	4.6	2.5	0	2.5	No controls.

NOTES:
Emission factors for PM_{10} and $PM_{2.5}$ obtained from AP-42, Table 11.9-1.
Emission factor for Ammonia based on a historical Industrial Hygiene assessment completed onsite.
PM_{10} and $PM_{2.5}$ Pit Escape Factor applied to the calculations and is based on University of Utah study (1996).
Blasting Area and Blasts per Year are provided by the KUC mine group.

TABLE B1-29
Tertiary Crushing
KUC—Bingham Canyon Mine

Source Name	Transient Process Rate (tpy)	Uncontrolled PM_{10} Emissions (tpy)	PM_{10} Emissions (tpy)	$PM_{2.5}$ Emissions (tpy)	PM_{10} Pit Escape Factor (%)	$PM_{2.5}$ Pit Escape Factor (%)	Controlled PM_{10} Emissions from the pit (tpy)	Controlled $PM_{2.5}$ Emissions from the pit (tpy)	Control System and Comments
Tertiary Crushing	3,150,000	3.78	0.85	0.16	20	21	0.17	0.03	Source is located in the pit.

Emission Factors:

Emission Factor (lbs/ton)	0.0024	For tertiary crushing - uncontrolled (lbs of PM_{10} per ton of material handled)
Emission Factor (lbs/ton)	0.00054	For tertiary crushing - controlled (lbs of PM_{10} per ton of material handled)
Emission Factor (lbs/ton)	0.00010	For tertiary crushing - controlled (lbs of $PM_{2.5}$ per ton of material handled)

NOTES:
Emission factors for PM_{10} and $PM_{2.5}$ obtained from AP-42, Table 11.19-2-2.
Transient Process Rate information obtained from the 2005 NOI submitted to UDAQ.
PM_{10} and $PM_{2.5}$ Pit Escape Factor applied to the calculations and is based on University of Utah study (1996).

TABLE B1-30
Screening
KUC—Bingham Canyon Mine

Source Name	Transient Process Rate (tpy)	Uncontrolled PM_{10} Emissions (tpy)	PM_{10} Emissions (tpy)	$PM_{2.5}$ Emissions (tpy)	PM_{10} Pit Escape Factor (%)	$PM_{2.5}$ Pit Escape Factor (%)	Controlled PM_{10} Emissions from the pit (tpy)	Controlled $PM_{2.5}$ Emissions from the pit (tpy)	Control System and Comments
Screening	3,150,000	13.70	1.17	0.08	20	21	0.23	0.02	Source is located in the pit.

Emission Factors:

Emission Factor (lbs/ton)	0.0087	For screening - uncontrolled (lbs of PM_{10} per ton of material handled)
Emission Factor (lbs/ton)	0.00074	For screening - controlled (lbs of PM_{10} per ton of material handled)
Emission Factor (lbs/ton)	0.00005	For screening - controlled (lbs of $PM_{2.5}$ per ton of material handled)

NOTES:
Emission factors for PM_{10} and $PM_{2.5}$ obtained from AP-42, Table 11.19-2-2.
Transient Process Rate information obtained from the 2005 NOI submitted to UDAQ.
PM_{10} and $PM_{2.5}$ Pit Escape Factor applied to the calculations and is based on University of Utah study (1996).

TABLE B1-31
Transfer Points
KUC—Bingham Canyon Mine

Source Name	Transient Process Rate (tpy)	Number of Transfer Points	PM_{10} Emissions (tpy)	$PM_{2.5}$ Emissions (tpy)	PM_{10} Pit Escape Factor (%)	$PM_{2.5}$ Pit Escape Factor (%)	Controlled PM_{10} Emissions from the pit (tpy)	Controlled $PM_{2.5}$ Emissions from the pit (tpy)	Control System and Comments
Transfer Points	3,150,000	10	0.72	0.20	20	21	0.14	0.04	Source is located in the pit.

Emission Factors:

Emission Factor (lbs/ton)	0.000046	For controlled transfer points (lbs of PM_{10} per ton of material handled)
Emission Factor (lbs/ton)	0.000013	For controlled transfer points (lbs of $PM_{2.5}$ per ton of material handled)

NOTES:
Emission factors for PM_{10} and $PM_{2.5}$ obtained from AP-42, Table 11.19-2-2 for controlled transfer points.
Transient Process Rate information obtained from the 2005 NOI submitted to UDAQ.
PM_{10} and $PM_{2.5}$ Pit Escape Factor applied to the calculations and is based on University of Utah study (1996).

TABLE B1-32
SX/EW Copper Extraction
KUC—Bingham Canyon Mine

Source Name	VOC Emissions (tpy)
SX/EW Copper Extraction	5.37

Summary of Allowable VOC Emissions (tpy)

	Mixer/Settlers	Aqueous Flows	Tanks	Total
Proposed	2.92	2.38	0.07	5.37

Organic Solution Used

	Diluent				Extractant		
	Constituent	**Concentration**	**Spec. Gravity**	**Boiling Range**	**Constituent**	**Concentration**	**Spec. Gravity**
Proposed	SX-12 Diluent	96%	0.81 - 0.83	187–274°C	LIX 984N	4%	0.915

Specific gravity for of the diluent was obtained from the MSDS of the diluent.

Mixers/Settlers

	surface area (ft^2)	pan rate (ft/24-hr day)		density (lb/gal)	time (hrs)	Control (%)		VOC (tpy)
Proposed Plant								
Extraction	550	0.00142	(a)	6.84	8,760	80%	(b)	1.46
Strip	550	0.00142	(a)	6.84	8,760	80%		1.46
Total	**1100**							**2.92**

VOC (tpy) = ((surface area(ft^2))*(evap rate(ft/day))*(7.48 gal/ft^3)*(density(lb/gal))*(operating hrs/yr))(1 - control eff)/((24 hrs)*(2000 lb/ton))

(a) From Emission Inventory
(b) Control eff of 80% for proposed plant, to be achieved by covers in place except during inspection, sampling, and adjustment.
(c) Existing Pilot Plant mixer/settlers were not covered.

Volatilization from Aqueous Flows

	avg flow (gpm)	TPH Conc (mg/L)		operating (hrs)	throughput gal/yr		Est Evap		VOC (tpy)	
Proposed Plant (a)										
Raffinate	650.00	5.00	(b)	8,760	341,640,000	<	33%	(c)	2.38	
Electrolyte Circuit									0.00	(d)
Total									**2.38**	

TABLE B1-32
SX/EW Copper Extraction
KUC—Bingham Canyon Mine

VOC (tpy) = (flow (gpm))*(TPH Conc (mg/L))*(3.79 L/gal)*(60 min/hr)*(operating hrs/yr))/((453597 mg/lb)*(2000 lb/ton))

(a) The proposed plant will take Cu-bearing meteoric drainage from waste rock once through. Tailwater (raffinate) from the extraction settler in SX will go to the Large Bingham Reservoir, then to Copperton Concentrator as makeup water, and then to the tailings impoundment.
(b) Because the solutions are mixed in agitation tanks for 3 minutes, organic concentration averaged 5 ppm in raffinate leaving the extractor settler in the pilot plant, although the solubility is less ("negligible" according to the MSDS). 5 ppm is the detection limit using centrifugal methods that are standard in the industry.
(c) It is estimated that less than a third of the residual organic in the raffinate from the proposed plant will evaporate, some will biodegrade, & some will stay in the tailings impoundment. Note the high boiling range of the diluent.
(d) No emission from the electrolyte circuit because it is contained in tanks and pipes.
(e) The existing pilot plant took PLS from heap leaching, and recirculated the raffinate back to the heaps for further leaching.
(f) A small percentage of the residual organic in the raffinate from the Pilot Plant evaporated when it was sprayed on the heaps, some biodegraded, but the large majority returned to the process in PLS. Note the high boiling range of the diluent.
(g) Emission from volatilization in aqueous flows was apparently not included when the Pilot Plant was permitted, so current allowable for this source is 0.

Organic Surge Tanks and Organic Holding Tanks

	No. Tanks	Tank Volume (gal)	Total Volume (gal)	VOC Emission (tpy)	
Pilot (calc)	2	3300	6,600	0.04	from Emission Inventory
Proposed	4	3000	12,000	0.07	Estimated by volume ratio

TABLE B1-33
Electrowinning
KUC—Bingham Canyon Mine
(From 2008 Mine AO Modification NOI)

	Exhaust Gas H_2SO_4 Concentration (grains/dscf)	Volume Flow Rate (acfm)	Volume Flow Rate (dscfm)		Control	Operating Hours	H_2SO_4 Emission (tpy)	H_2SO_4 Emission (lb/hr)
Proposed	0.004	8,000	6,377		Surfactant, covers, and	8,760	0.96	0.22
			52.1	T(act)	Mist Eliminator			
			10%	ø				
			12.58	P(act)				
			14.7	P(std)				
			70	T(std)				

Existing Pilot Plant	Acid Mist emissions were not included in the AO at the time of permitting.	0
Net change in permitted emissions		0.96

There were two Pilot Plant electrowinning cells, each the same size as one of the four in the proposed plant, but their acid mist emissions were controlled only by use of chemical mist suppression (surfactant). Therefore, acid mist emissions are estimated to have been greater than those of the proposed plant.

Net change in actual emissions: Unquantified, but < 0

H_2SO_4 Emission (tpy)
= (H_2SO_4 concentration(grains/dscf) x (volume flow(dscfm)) x 60 min/hr x annual operating time (hours)/(7000 grains/lb x 2000 lb/ton)

Notes:

TABLE B1-34

LPG Generators

KUC—Bingham Canyon Mine

Location	Model	Max Power Rating (bhp)	Max Power Rating (kW)	Max Power Rating (mmBtu/hr)	Usage (hr/yr)		Emission (tpy)
Production Control Building	Kohler 60RZG	105	78	0.27	500		
						$PM_{10} = PM_{2.5}$	0.0006
						SO_2	0.00004
						NO_x	0.347
						CO	1.557
						Total HC	0.058
Communication 6190	Kohler 45RZG	75	56	0.19	500		
						$PM_{10} = PM_{2.5}$	0.0005
						SO_2	0.00003
						NO_x	0.285
						CO	1.115
						Total HC	0.042
Lark Gate	Olympian G100	160	119	0.41	500	$PM_{10} = PM_{2.5}$	0.0010
						SO_2	0.00003
						NO_x	0.214
						CO	6.476
						Total HC	0.058
Galena Gulch	Kohler 35RZG	72	54	0.18	500		
						$PM_{10} = PM_{2.5}$	0.0004
						SO_2	0.00003
						NO_x	0.266
						CO	1.246
						Total HC	0.040
Total						$PM_{10} = PM_{2.5}$	0.0025
						SO_2	0.0001
						NO_x	1.1117
						CO	10.3935
						Total HC	0.1966

NOTES:

Emissions data obtained from previously submitted NOIs (2005-12-21 and 2008-05-12).

TABLE B1-35
Metal HAP Emissions (from dust)
KUC—Bingham Canyon Mine

PM_{10} Emissions (tpy) 230 [Includes PM_{10} emissions from point and fugitive sources - excludes lime bins]

Metal HAP	Concentration (mg/kg)	HAP Emissions (tpy)
Sb	3	0.001
As	37	0.009
Be	1	0.000
Cd	1	0.000
Cr	15	0.003
Co	8	0.002
Pb	76	0.018
Mn	190	0.044
Ni	21	0.005
Se	15	0.003

Notes:
Metal HAP concentration based on ore and waste rock sampling at BCM

TABLE B1-36

2011–2029 Haul Truck Emissions—260 Mtpy

KUC—Bingham Canyon Mine

Emissions Summary (tpy)	Maximum Annual
HC	259
CO	1400
NO_x	5134
SO_2	5.78
PM_{10}	191
$PM_{2.5}$	186

$PM_{2.5}$ calculated as 97% of PM_{10} emissions, per NONROAD guidance

Estimated Number of Trucks in Operation

Tier Information	Engine		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
CAT 793C Fleet (2337 hp)	Tier 0		8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT 793D Fleet (2415 hp)	Tier 1		29	29	29	29	29	23	29	23	12	0	0	0	0	0	0	0	0	0
	Tier 2		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 4t		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 4f		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT 795F Fleet (3440 hp)	Tier 1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 2		2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 4t		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 4f		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KOM Fleet (3500 hp)	Tier 1		25	30	30	26	29	27	22	27	20	0	0	0	0	0	0	0	0	0
	Tier 2		11	41	47	47	47	47	47	47	47	44	12	9	19	30	28	4	7	5
	Tier 4t		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 4f		0	0	0	0	29	29	29	29	29	29	29	16	14	15	15	29	27	29
Total Truck s			67	100	106	102	134	126	127	126	108	73	41	25	33	45	43	33	34	34

It is assumed that all trucks will be repowered in kind every 3 years (~20,000 hours of operation).

Estimated Number of Operational Hours (in thousands)

Tier Information	Engine		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
CAT 793C Fleet (2337 hp)	Tier 0		46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT 793D Fleet (2415 hp)	Tier 1		203	203	203	203	203	161	203	161	84	0	0	0	0	0	0	0	0	0
	Tier 2		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 4t		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 4f		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT 795F Fleet (3440 hp)	Tier 1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 2		12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 4t		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 4f		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KOM Fleet (3500 hp)	Tier 1		179	215	215	186	207	193	157	193	143	0	0	0	0	0	0	0	0	0
	Tier 2		81	301	336	336	336	336	336	336	336	315	86	64	136	215	200	29	50	36
	Tier 4t		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tier 4f		0	0	0	0	213	213	207	207	207	207	207	114	100	107	107	207	193	207
Total Hours			475	719	754	725	960	903	904	897	770	522	293	179	236	322	307	236	243	243

Emission Factors by Tier (g/hp-hr)	Tier 0	Tier 1	Tier 2	Tier 4t	Tier 4f
HC	0.75	0.31	0.18	0.29	0.13
CO	4.90	1.29	1.29	0.88	0.88
NOx	8.15	5.99	3.93	2.41	2.41
SO2	0.0049	0.0049	0.0049	0.0049	0.0049
PM10	0.64	0.26	0.15	0.02	0.02

All Age Factors assumed to be equal to 1.

Hydrocarbon emission factors for tier 4f represent the EPA proposed emission limits, and were not calculated using NONROAD guidance.

All emission factors represent the lesser of EPA emission limits and factors calculated using EPA NONROAD methodology.

TABLE B1-36
2011–2029 Haul Truck Emissions—260 Mtpy
KUC—Bingham Canyon Mine

Emissions by Truck Type (tpy)			2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
CAT 793C Fleet (2337 hp)	HC		30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	CO		197	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	NO_x		328	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SO_2		0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	PM_{10}		26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CAT 793D Fleet (2415 hp)	HC		57	57	57	57	57	45	57	45	24	-	-	-	-	-	-	-	-	-
	CO		237	237	237	237	237	188	237	188	98	-	-	-	-	-	-	-	-	-
	NO_x		1100	1100	1100	1100	1100	872	1100	872	455	-	-	-	-	-	-	-	-	-
	SO_2		0.9	0.9	0.9	0.9	0.9	0.7	0.9	0.7	0.4	-	-	-	-	-	-	-	-	-
	PM_{10}		48	48	48	48	48	38	48	38	20	-	-	-	-	-	-	-	-	-
CAT 795F Fleet (3440 hp)	HC		3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	CO		20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	NO_x		61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SO_2		0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	PM_{10}		2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KOM Fleet (3500 hp)	HC		92.2	159.2	167.4	155.8	202.3	196.4	180.8	195.4	175.0	111.5	57.1	35.5	50.0	70.0	66.6	43.5	46.1	45.2
	CO		438	871	930	881	1164	1139	1072	1133	1048	770	384	241	345	486	462	288	307	300
	NO_x		1820	3238	3416	3192	4034	3922	3623	3904	3511	2278	1098	694	1017	1445	1371	803	869	840
	SO_2		1.68	3.33	3.56	3.37	4.87	4.78	4.51	4.74	4.42	3.36	1.88	1.15	1.52	2.07	1.98	1.51	1.56	1.56
	PM_{10}		77.9	134.1	141.0	131.1	142.8	137.9	125.4	137.8	120.5	66.8	21.3	15.1	29.1	44.8	42.0	9.9	13.9	11.4
Total	HC		182	216	225	213	259	242	238	241	199	111	57	36	50	70	67	44	46	45
	CO		892	1108	1166	1118	1400	1327	1309	1320	1146	770	384	241	345	486	462	288	307	300
	NO_x		3309	4337	4516	4292	5134	4794	4723	4776	3966	2278	1098	694	1017	1445	1371	803	869	840
	SO_2		2.9	4.2	4.5	4.3	5.8	5.5	5.4	5.5	4.8	3.4	1.9	1.1	1.5	2.1	2.0	1.5	1.6	1.6
	PM_{10}		154	182	189	179	191	176	174	176	141	67	21	15	29	45	42	10	14	11

Calculation Data

	NONROAD Equipment SCC
Haul Truck	2270002051

All tables and factors are from "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling--Compression-Ignition", EPA, 2004, unless otherwise noted.

Table A2 Zero-Hour, Steady-State Emission Factors for Nonroad CI Engines (>750 hp)

	BSFC	HC	CO	NO_x	PM_{10}
T0	0.367	0.68	2.7	8.38	0.402
T1	0.367	0.2861	0.7642	6.1525	0.1934
T2	0.367	0.1669	0.7642	4.1	0.1316
T4t	0.367	0.2815	0.7642	2.392	0.069
T4f	0.0367	0.1314	0.7642	2.392	0.069

Table A3 Transient Adjustment Factors by Equipment Type for Nonroad CI Equipment

SCC	Cycle	TAF Assign.	HC	CO	NO_x	PM_{10}	BSFC
2270002051	Crawler	Hi LF	1.05	1.53	0.95	1.23	1.01

TAFs are not applied to the emission factors for Tier 4 engines

Table A4 Deterioration Factors for Nonroad Diesel Engines (A)

Pollutant	T0	T1	T2	T3+
HC	0.047	0.036	0.034	0.027
CO	0.185	0.101	0.101	0.151
NO_x	0.024	0.024	0.009	0.008
PM_{10}	0.473	0.473	0.473	0.473

Sulfur Content of Diesel Fuel

sulfur conversion	7.0	grams PM sulfate/gram Sulfur		
soxcnv	0.02247	grams PM sulfur/gram fuel consumed		
default (soxbas)	3300	ppm	0.33	wt %
Diesel Sulfur Conc. (soxdsl)	15	ppm	0.0015	wt %

TABLE B1-36
2011–2029 Haul Truck Emissions—260 Mtpy
KUC—Bingham Canyon Mine

Engine Life at Full Load

7000 hrs

Engine life from Table 1 of "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling", EPA, 2004.

Load Factor

0.34

Load factor estimated by KUC using BCM haul truck data.

TABLE B1-37
2011–2029 Mobile Support Equipment Emissions—260 Mtpy
KUC—Bingham Canyon Mine

Emissions Summary (tpy)	Maximum Annual
HC	43
CO	272
NO_x	695
SO_2	0.78
PM_{10}	36
$PM_{2.5}$	35

Hydrocarbon Emissions (tpy)				2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
TRACK DOZERS - CAT D10																					
NOT TIER RATED (Existing)	580	0		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 1 (Existing)	613	1		0.75	0.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (Existing)	661	2		0.92	0.92	0.92	0.92	0.92	0.92	0.61	-	-	-	-	-	-	-	-	-	-	-
TIER 3 (Existing, New and Replacements)	646	3		3.93	4.84	5.75	5.75	5.75	5.75	5.75	5.75	5.45	4.54	3.03	2.42	1.51	1.21	0.30	0.30	0.30	0.30
TIER 4F (New and Replacements)	646	4F		-	-	-	-	-	-	-	-	-	-	-	-	0.67	1.11	1.78	1.78	1.78	1.78
TRACK DOZERS - CAT D11																					
NOT TIER RATED (Existing)	850	0		4.27	2.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 1 (Existing)	936	1		0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	-	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	936	4T		0.61	1.21	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	1.82	1.21	1.21	-	-
TIER 4F (New and Replacements)	936	4F		-	-	-	-	-	-	-	-	-	-	-	-	-	0.28	0.57	0.57	0.57	0.57
GRADERS - CAT 16																					
TIER 1 (Existing)	289	1		0.62	0.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (Existing)	299	2		0.96	0.96	0.96	0.64	0.64	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 3 (Existing)	297	3		0.94	0.94	0.94	0.94	0.94	0.94	0.19	-	-	-	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	297	4T		0.13	0.38	0.51	0.64	0.64	0.64	0.64	0.64	0.64	0.51	0.26	-	-	-	-	-	-	-
TIER 4F (New and Replacements)	297	4F		-	-	-	-	0.13	0.38	0.90	1.02	1.02	1.02	1.28	1.41	1.41	1.41	1.41	1.41	1.41	1.41
GRADERS - CAT 24																					
NOT TIER RATED (Existing)	540	0		2.32	2.32	2.32	2.32	2.32	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (Existing)	533	2		0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	-	-	-	-	-	-	-	-
TIER 4F (Replacements)	533	4F		-	-	-	-	-	0.41	0.41	0.41	0.41	0.41	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
RTDS - CAT 834																					
834B - NOT TIER RATED (Existing)	487	0		2.09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
834G - NOT TIER RATED (Existing)	487	0		1.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 3 (Existing)	525	3		0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.54	0.54	-	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	525	4T		0.20	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.41	-	-	-	-	-	-	-
TIER 4F (Replacements)	525	4F		-	-	-	-	-	-	-	0.20	0.20	0.20	0.41	0.82	0.82	0.82	0.82	0.82	0.82	0.82
RTDS - CAT 854																					
TIER 1 (Existing)	880	1		0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	-	-	-	-	-	-	-	-	-	-
FEL - KOMATSU																					
WA500 - TIER 1 (Existing)	235	1		0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	-	-	-	-	-	-	-	-	-
WA600 - TIER 3 (Existing)	396	3		0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.14	-	-	-	-	-	-	-
WA600 - TIER 4F (Replacements)	396	4F		-	-	-	-	-	-	-	-	-	-	0.10	0.21	0.21	0.21	0.21	0.21	0.21	0.21
WA700 - TIER 1 (Existing)	502	1		0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	-	-	-	-	-	-	-
FEL - CAT 992																					
TIER 2 (Existing)	800	2		0.57	0.57	0.57	0.57	0.57	0.57	0.28	-	-	-	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	801	4T		-	-	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
TIER 4F (Replacements)	801	4F		-	-	-	-	-	-	0.21	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
PRODUCTION FEL - KOM WA1200																					
TIER 1 (Existing)	1,782	1		1.47	1.47	1.47	1.47	1.47	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 4F (Replacements)	1,782	4F		-	-	-	-	-	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64
TRACKHOES - CAT 330																					
TIER 2 (Existing)	264	2		0.12	0.12	0.12	0.12	0.12	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 4F (Replacements)	268	4F		-	-	-	-	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
TRACKHOES - CAT 385																					
TIER 3 (Existing)	523	3		0.26	0.26	0.26	0.13	0.13	0.13	-	-	-	-	-	-	-	-	-	-	-	-
TIER 4A (Replacements)	523	4T		-	-	-	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	-	-	-	-	-	-
TIER 4F (Replacements)	523	4F		-	-	-	-	-	-	0.10	0.10	0.10	0.10	0.10	0.10	0.20	0.20	0.20	0.20	0.20	0.20
TRACKHOES - KOMATSU																					
PC800 - TIER 1 (Existing)	323	1		0.20	0.20	0.20	0.20	0.10	0.10	0.10	0.10	0.10	-	-	-	-	-	-	-	-	-
PC800 - TIER 4F (Replacements)	323	4F		-	-	-	-	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	-	-
PC400 - TIER 1 (Existing)	246	1		0.12	0.12	0.12	0.12	0.12	0.12	-	-	-	-	-	-	-	-	-	-	-	-

TABLE B1-37
2011–2029 Mobile Support Equipment Emissions—260 Mtpy
KUC—Bingham Canyon Mine

WATER TRUCKS																					
CAT 789 (Existing)	1,900	0		2.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CAT 793C - TIER 1 (Existing)	2,300	1		2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29
CAT 793D - TIER 2 (New and Replaceme	2,415	2		1.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
HYDRAULIC SHOVELS																					
O&K RH 200, (NOT CERT)	2,100	0		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O&K RH 200, (TIER 1)	2,520	1		7.32	7.25	7.17	7.14	7.10	7.06	7.03	6.99	6.95	3.66	3.66	3.59	3.59	3.55	3.55	3.51	3.51	3.48
CONSTRUCTION TRUCKS																					
KOM 785-7 TIER 1 (Existing)	1,200	1		3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01
DIESEL DRILLS - P&H																					
TIER 1 (Existing)	1,100	1		0.86	0.86	0.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (during T4I) (Replacements)	1,100	2		-	-	0.26	0.52	0.52	0.52	0.51	0.51	0.51	0.51	0.50	0.25	0.25	0.25	0.17	0.16	0.16	0.16
DIESEL DRILLS - ATLAS COPCO																					
TIER 2 (Existing)	750	2		0.90	0.90	0.90	0.89	0.89	0.89	0.66	0.44	0.33	-	-	-	-	-	-	-	-	-
TIER 2 (during T4I) (New)	750	2		0.23	0.46	0.46	0.45	0.45	0.45	0.45	0.45	0.37	0.26	0.12	-	-	-	-	-	-	-
TIER 4F (Replacements)	750	4F		-	-	-	-	-	-	-	0.20	0.34	0.34	0.34	0.25	0.22	0.28	0.29	0.28	0.28	0.28
TOTAL				**43.0**	**39.3**	**38.3**	**38.0**	**38.0**	**34.8**	**33.8**	**32.9**	**31.7**	**25.5**	**23.5**	**22.0**	**21.6**	**21.5**	**20.8**	**20.8**	**19.5**	**19.5**

Carbon Monoxide Emissions (tpy)				**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**
TRACK DOZERS - CAT D10	**HP**	**Tier**																			
NOT TIER RATED (Existing)	580	0		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 1 (Existing)	613	1		10.51	3.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (Existing)	661	2		11.34	11.34	11.34	11.34	11.34	11.34	7.56	-	-	-	-	-	-	-	-	-	-	-
TIER 3 (Existing, New and Replacements)	646	3		50.20	61.78	73.36	73.36	73.36	73.36	73.36	73.36	69.50	57.92	38.61	30.89	19.31	15.44	3.86	3.86	3.86	3.86
TIER 4F (New and Replacements)	646	4F		-	-	-	-	-	-	-	-	-	-	-	-	0.76	1.26	2.02	2.02	2.02	2.02
TRACK DOZERS - CAT D11																					
NOT TIER RATED (Existing)	850	0		27.93	18.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 1 (Existing)	936	1		2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	-	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	936	4T		0.18	0.37	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.55	0.37	0.37	-	-
TIER 4F (New and Replacements)	936	4F		-	-	-	-	-	-	-	-	-	-	-	-	-	0.18	0.37	0.37	0.37	0.37
GRADERS - CAT 16																					
TIER 1 (Existing)	289	1		2.33	1.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (Existing)	299	2		3.61	3.61	3.61	2.41	2.41	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 3 (Existing)	297	3		6.25	6.25	6.25	6.25	6.25	6.25	1.25	-	-	-	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	297	4T		0.08	0.25	0.33	0.41	0.41	0.41	0.41	0.41	0.41	0.33	0.16	-	-	-	-	-	-	-
TIER 4F (New and Replacements)	297	4F		-	-	-	-	0.08	0.25	0.57	0.66	0.66	0.66	0.82	0.90	0.90	0.90	0.90	0.90	0.90	0.90
GRADERS - CAT 24																					
NOT TIER RATED (Existing)	540	0		15.21	15.21	15.21	15.21	15.21	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (Existing)	533	2		2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	-	-	-	-	-	-	-	-
TIER 4F (Replacements)	533	4F		-	-	-	-	-	0.30	0.30	0.30	0.30	0.30	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44
RTDS - CAT 834																					
834B - NOT TIER RATED (Existing)	487	0		13.72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
834G - NOT TIER RATED (Existing)	487	0		6.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 3 (Existing)	525	3		6.72	6.72	6.72	6.72	6.72	6.72	6.72	4.48	4.48	-	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	525	4T		0.15	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.29	-	-	-	-	-	-	-
TIER 4F (Replacements)	525	4F		-	-	-	-	-	-	-	0.15	0.15	0.15	0.29	0.58	0.58	0.58	0.58	0.58	0.58	0.58
RTDS - CAT 854																					
TIER 1 (Existing)	880	1		3.26	3.26	3.26	3.26	3.26	3.26	3.26	3.26	-	-	-	-	-	-	-	-	-	-
FEL - KOMATSU																					
WA500 - TIER 1 (Existing)	235	1		0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	-	-	-	-	-	-	-	-	-
WA600 - TIER 3 (Existing)	396	3		2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	1.15	-	-	-	-	-	-	-
WA600 - TIER 4F (Replacements)	502	4F		-	-	-	-	-	-	-	-	-	-	0.10	0.19	0.19	0.19	0.19	0.19	0.19	0.19
WA700 - TIER 1 (Existing)	396	1		1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	-	-	-	-	-	-	-
FEL - CAT 992																					
TIER 2 (Existing)	800	2		4.03	4.03	4.03	4.03	4.03	4.03	2.02	-	-	-	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	801	4T		-	-	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
TIER 4F (Replacements)	801	4F		-	-	-	-	-	-	0.14	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27
PRODUCTION FEL - KOM WA1200																					
TIER 1 (Existing)	1,782	1		6.07	6.07	6.07	6.07	6.07	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 4F (Replacements)	1,782	4F		-	-	-	-	-	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41
TRACKHOES - CAT 330																					
TIER 2 (Existing)	264	2		0.47	0.47	0.47	0.47	0.47	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 4F (Replacements)	268	4F		-	-	-	-	-	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03

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TRACKHOES - CAT 385																					
TIER 3 (Existing)	523	3		2.18	2.18	2.18	1.09	1.09	1.09	-	-	-	-	-	-	-	-	-	-	-	-
TIER 4A (Replacements)	523	4T		-	-	-	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	-	-	-	-	-	-
TIER 4F (Replacements)	523	4F		-	-	-	-	-	-	0.07	0.07	0.07	0.07	0.07	0.07	0.14	0.14	0.14	0.14	0.14	0.14
TRACKHOES - KOMATSU																					
PC800 - TIER 1 (Existing)	323	1		2.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	-	-	-	-	-	-	-	-	-
PC800 - TIER 4F (Replacements)	323	4F		-	-	-	-	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	-	-
PC400 - TIER 1 (Existing)	246	1		0.44	0.44	0.44	0.44	0.44	0.44	-	-	-	-	-	-	-	-	-	-	-	-
WATER TRUCKS																					
CAT 789 (Existing)	1,900	0		14.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CAT 793C - TIER 1 (Existing)	2,300	1		9.46	9.46	9.46	9.46	9.46	9.46	9.46	9.46	9.46	9.46	9.46	9.46	9.46	9.46	9.46	9.46	9.46	9.46
CAT 793D - TIER 2 (New and Replaceme	2,415	2		9.94	19.88	19.88	19.88	19.88	19.88	19.88	19.88	19.88	19.88	19.88	19.88	19.88	19.88	19.88	19.88	19.88	19.88
HYDRAULIC SHOVELS																					
O&K RH 200, (NOT CERT)	2,100	0		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O&K RH 200, (TIER 1)	2,520	1		30.28	29.98	29.67	29.52	29.37	29.22	29.07	28.92	28.77	15.14	15.14	14.84	14.84	14.69	14.69	14.53	14.53	14.38
CONSTRUCTION TRUCKS																					
KOM 785-7 TIER 1 (Existing)	1,200	1		12.44	12.44	12.44	12.44	12.44	12.44	12.44	12.44	12.44	12.44	12.44	12.44	12.44	12.44	12.44	12.44	12.44	12.44
DIESEL DRILLS - P&H																					
TIER 1 (Existing)	1,100	1		3.56	3.56	1.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (during T4I) (Replacements)	1,100	2		-	-	1.85	3.69	3.69	3.69	3.62	3.62	3.62	3.62	3.56	1.78	1.78	1.78	1.19	1.16	1.16	1.16
DIESEL DRILLS - ATLAS COPCO																					
TIER 2 (Existing)	750	2		6.42	6.42	6.42	6.36	6.30	6.30	4.72	3.15	2.31	-	-	-	-	-	-	-	-	-
TIER 2 (during T4I) (New)	750	2		1.64	3.27	3.27	3.21	3.21	3.21	3.21	3.21	2.62	1.84	0.82	-	-	-	-	-	-	-
TIER 4F (Replacements)	750	4F		-	-	-	-	-	-	-	0.13	0.22	0.22	0.22	0.16	0.15	0.18	0.19	0.18	0.18	0.18
TOTAL				**272**	**242**	**231**	**229**	**228**	**204**	**191**	**176**	**168**	**131**	**107**	**93.4**	**82.5**	**79.0**	**67.6**	**67.4**	**67.0**	**66.9**

Oxides of Nitrogen Emissions (tpy)				**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**
TRACK DOZERS - CAT D10	**HP**	**Tier**																			
NOT TIER RATED (Existing)	580	0		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 1 (Existing)	613	1		26.6	8.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (Existing)	661	2		19.9	19.9	19.9	19.9	19.9	19.9	13.3	-	-	-	-	-	-	-	-	-	-	-
TIER 3 (Existing, New and Replacements)	646	3		51.4	63.3	75.1	75.1	75.1	75.1	75.1	75.1	71.2	59.3	39.5	31.6	19.8	15.8	4.0	4.0	4.0	4.0
TIER 4F (New and Replacements)	646	4F		-	-	-	-	-	-	-	-	-	-	-	-	1.4	2.3	3.7	3.7	3.7	3.7
TRACK DOZERS - CAT D11																					
NOT TIER RATED (Existing)	850	0		46.5	31.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 1 (Existing)	936	1		12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	-	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	936	4T		5.0	10.1	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	15.1	10.1	10.1	-	-
TIER 4F (New and Replacements)	936	4F		-	-	-	-	-	-	-	-	-	-	-	-	-	5.0	10.1	10.1	10.1	10.1
GRADERS - CAT 16																					
TIER 1 (Existing)	289	1		10.0	5.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (Existing)	299	2		11.0	11.0	11.0	7.3	7.3	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 3 (Existing)	297	3		11.4	11.4	11.4	11.4	11.4	11.4	2.3	-	-	-	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	297	4T		2.4	7.2	9.6	12.0	12.0	12.0	12.0	12.0	12.0	9.6	4.8	-	-	-	-	-	-	-
TIER 4F (New and Replacements)	297	4F		-	-	-	-	0.3	0.8	1.8	2.1	2.1	2.1	2.6	2.9	2.9	2.9	2.9	2.9	2.9	2.9
GRADERS - CAT 24																					
NOT TIER RATED (Existing)	540	0		25.3	25.3	25.3	25.3	25.3	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (Existing)	533	2		6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	-	-	-	-	-	-	-	-
TIER 4F (Replacements)	533	4F		-	-	-	-	-	0.9	0.9	0.9	0.9	0.9	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
RTDS - CAT 834																					
834B - NOT TIER RATED (Existing)	487	0		22.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
834G - NOT TIER RATED (Existing)	487	0		11.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 3 (Existing)	525	3		10.8	10.8	10.8	10.8	10.8	10.8	10.8	7.2	7.2	-	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	525	4T		3.8	15.2	15.2	15.2	15.2	15.2	15.2	15.2	15.2	15.2	7.6	-	-	-	-	-	-	-
TIER 4F (Replacements)	525	4F		-	-	-	-	-	-	-	0.4	0.4	0.4	0.8	1.7	1.7	1.7	1.7	1.7	1.7	1.7
RTDS - CAT 854																					
TIER 1 (Existing)	880	1		15.2	15.2	15.2	15.2	15.2	15.2	15.2	15.2	-	-	-	-	-	-	-	-	-	-
FEL - KOMATSU																					
WA500 - TIER 1 (Existing)	235	1		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	-	-	-	-	-	-	-	-	-
WA600 - TIER 3 (Existing)	396	3		3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	1.9	-	-	-	-	-	-	-
WA600 - TIER 4F (Replacements)	502	4F		-	-	-	-	-	-	-	-	-	-	0.3	0.5	0.5	0.5	0.5	0.5	0.5	0.5
WA700 - TIER 1 (Existing)	396	1		4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	-	-	-	-	-	-	-
FEL - CAT 992																					
TIER 2 (Existing)	800	2		12.3	12.3	12.3	12.3	12.3	12.3	6.2	-	-	-	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	801	4T		-	-	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
TIER 4F (Replacements)	801	4F		-	-	-	-	-	-	3.8	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6

TABLE B1-37
2011–2029 Mobile Support Equipment Emissions—260 Mtpy
KUC—Bingham Canyon Mine

PRODUCTION FEL - KOM WA1200																					
TIER 1 (Existing)	1,782	1		28.2	28.2	28.2	28.2	28.2	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 4F (Replacements)	1,782	4F		-	-	-	-	-	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4
TRACKHOES - CAT 330																					
TIER 2 (Existing)	264	2		1.4	1.4	1.4	1.4	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 4F (Replacements)	268	4F		-	-	-	-	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
TRACKHOES - CAT 385																					
TIER 3 (Existing)	523	3		3.5	3.5	3.5	1.8	1.8	1.8	-	-	-	-	-	-	-	-	-	-	-	-
TIER 4A (Replacements)	523	4T		-	-	-	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	-	-	-	-	-	-
TIER 4F (Replacements)	523	4F		-	-	-	-	-	-	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.4
TRACKHOES - KOMATSU																					
PC800 - TIER 1 (Existing)	323	1		5.3	5.3	5.3	5.3	2.7	2.7	2.7	2.7	2.7	-	-	-	-	-	-	-	-	-
PC800 - TIER 4F (Replacements)	323	4F		-	-	-	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-	-
PC400 - TIER 1 (Existing)	246	1		1.9	1.9	1.9	1.9	1.9	1.9	-	-	-	-	-	-	-	-	-	-	-	-
WATER TRUCKS																					
CAT 789 (Existing)	1,900	0		24.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CAT 793C - TIER 1 (Existing)	2,300	1		44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0
CAT 793D - TIER 2 (New and Replaceme	2,415	2		30.3	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7
HYDRAULIC SHOVELS																					
O&K RH 200, (NOT CERT)	2,100	0		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O&K RH 200, (TIER 1)	2,520	1		140.8	139.4	138.0	137.3	136.6	135.9	135.2	134.4	133.7	70.4	70.4	69.0	69.0	68.3	68.3	67.6	67.6	66.9
CONSTRUCTION TRUCKS																					
KOM 785-7 TIER 1 (Existing)	1,200	1		57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9
DIESEL DRILLS - P&H																					
TIER 1 (Existing)	1,100	1		16.5	16.5	8.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (during T4I) (Replacements)	1,100	2		-	-	5.6	11.3	11.3	11.3	11.1	11.1	11.1	11.1	10.9	5.4	5.4	5.4	3.6	3.6	3.6	3.6
DIESEL DRILLS - ATLAS COPCO																					
TIER 2 (Existing)	750	2		19.6	19.6	19.6	19.4	19.2	19.2	14.4	9.6	7.1	-	-	-	-	-	-	-	-	-
TIER 2 (during T4I) (New)	750	2		5.0	10.0	10.0	9.8	9.8	9.8	9.8	9.8	8.0	5.6	2.5	-	-	-	-	-	-	-
TIER 4F (Replacements)	750	4F		-	-	-	-	-	-	-	3.6	6.1	6.1	6.0	4.5	4.0	5.0	5.3	4.9	4.9	4.9
TOTAL				**695**	**665**	**644**	**641**	**638**	**588**	**561**	**539**	**517**	**405**	**363**	**327**	**312**	**309**	**297**	**296**	**286**	**285**

Sulfur Dioxide Emissions (tpy)				**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**
TRACK DOZERS - CAT D10	**HP**	**Tier**																			
NOT TIER RATED (Existing)	580	0		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 1 (Existing)	613	1		0.0232	0.0077	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (Existing)	661	2		0.0250	0.0250	0.0250	0.0250	0.0250	0.0250	0.0167	-	-	-	-	-	-	-	-	-	-	-
TIER 3 (Existing, New and Replacements)	646	3		0.1058	0.1302	0.1546	0.1546	0.1546	0.1546	0.1546	0.1546	0.1465	0.1220	0.0814	0.0651	0.0407	0.0325	0.0081	0.0081	0.0081	0.0081
TIER 4F (New and Replacements)	646	4F		-	-	-	-	-	-	-	-	-	-	-	-	0.0242	0.0403	0.0645	0.0645	0.0645	0.0645
TRACK DOZERS - CAT D11																					
NOT TIER RATED (Existing)	850	0		0.0280	0.0187	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 1 (Existing)	936	1		0.0103	0.0103	0.0103	0.0103	0.0103	0.0103	0.0103	0.0103	0.0103	-	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	936	4T		0.0102	0.0204	0.0408	0.0408	0.0408	0.0408	0.0408	0.0408	0.0408	0.0408	0.0408	0.0408	0.0408	0.0306	0.0204	0.0204	-	-
TIER 4F (New and Replacements)	936	4F		-	-	-	-	-	-	-	-	-	-	-	-	-	0.0102	0.0204	0.0204	0.0204	0.0204
GRADERS - CAT 16																					
TIER 1 (Existing)	289	1		0.0091	0.0045	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (Existing)	299	2		0.0141	0.0141	0.0141	0.0094	0.0094	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 3 (Existing)	297	3		0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0047	-	-	-	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	297	4T		0.0046	0.0139	0.0185	0.0232	0.0232	0.0232	0.0232	0.0232	0.0232	0.0185	0.0093	-	-	-	-	-	-	-
TIER 4F (New and Replacements)	297	4F		-	-	-	-	0.0046	0.0139	0.0324	0.0370	0.0370	0.0370	0.0463	0.0509	0.0509	0.0509	0.0509	0.0509	0.0509	0.0509
GRADERS - CAT 24																					
NOT TIER RATED (Existing)	540	0		0.0153	0.0153	0.0153	0.0153	0.0153	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (Existing)	533	2		0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	-	-	-	-	-	-	-	-
TIER 4F (Replacements)	533	4F		-	-	-	-	-	0.0150	0.0150	0.0150	0.0150	0.0150	0.0224	0.0224	0.0224	0.0224	0.0224	0.0224	0.0224	0.0224
RTDS - CAT 834																					
834B - NOT TIER RATED (Existing)	487	0		0.0138	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
834G - NOT TIER RATED (Existing)	487	0		0.0069	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 3 (Existing)	525	3		0.0223	0.0223	0.0223	0.0223	0.0223	0.0223	0.0223	0.0149	0.0149	-	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	525	4T		0.0074	0.0295	0.0295	0.0295	0.0295	0.0295	0.0295	0.0295	0.0295	0.0295	0.0147	-	-	-	-	-	-	-
TIER 4F (Replacements)	525	4F		-	-	-	-	-	-	-	0.0074	0.0074	0.0074	0.0147	0.0295	0.0295	0.0295	0.0295	0.0295	0.0295	0.0295
RTDS - CAT 854																					
TIER 1 (Existing)	880	1		0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	-	-	-	-	-	-	-	-	-	-

TABLE B1-37
2011–2029 Mobile Support Equipment Emissions—260 Mtpy
KUC—Bingham Canyon Mine

FEL - KOMATSU																				
WA500 - TIER 1 (Existing)	235	1		0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	-	-	-	-	-	-	-	-
WA600 - TIER 3 (Existing)	396	3		0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	0.0038	-	-	-	-	-	-	-
WA600 - TIER 4F (Replacements)	502	4F		-	-	-	-	-	-	-	-	-	-	0.0048	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096
WA700 - TIER 1 (Existing)	396	1		0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	-	-	-	-	-	-	-
FEL - CAT 992																				
TIER 2 (Existing)	800	2		0.0154	0.0154	0.0154	0.0154	0.0154	0.0154	0.0077	-	-	-	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	801	4T		-	-	0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	0.0076
TIER 4F (Replacements)	801	4F		-	-	-	-	-	-	0.0076	0.0153	0.0153	0.0153	0.0153	0.0153	0.0153	0.0153	0.0153	0.0153	0.0153	0.0153
PRODUCTION FEL - KOM WA1200																				
TIER 1 (Existing)	1,782	1		0.0232	0.0232	0.0232	0.0232	0.0232	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 4F (Replacements)	1,782	4F		-	-	-	-	-	0.0230	0.0230	0.0230	0.0230	0.0230	0.0230	0.0230	0.0230	0.0230	0.0230	0.0230	0.0230	0.0230
TRACKHOES - CAT 330																				
TIER 2 (Existing)	264	2		0.0018	0.0018	0.0018	0.0018	0.0018	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 4F (Replacements)	268	4F		-	-	-	-	-	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018
TRACKHOES - CAT 385																				
TIER 3 (Existing)	523	3		0.0072	0.0072	0.0072	0.0036	0.0036	0.0036	-	-	-	-	-	-	-	-	-	-	-	-
TIER 4A (Replacements)	523	4T		-	-	-	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072	-	-	-	-	-	-
TIER 4F (Replacements)	523	4F		-	-	-	-	-	-	0.0036	0.0036	0.0036	0.0036	0.0036	0.0036	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072
TRACKHOES - KOMATSU																				
PC800 - TIER 1 (Existing)	323	1		0.0045	0.0045	0.0045	0.0045	0.0022	0.0022	0.0022	0.0022	0.0022	-	-	-	-	-	-	-	-	-
PC800 - TIER 4F (Replacements)	323	4F		-	-	-	-	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	-	-
PC400 - TIER 1 (Existing)	246	1		0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	-	-	-	-	-	-	-	-	-	-	-	-
WATER TRUCKS																				
CAT 789 (Existing)	1,900	0		0.0149	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CAT 793C - TIER 1 (Existing)	2,300	1		0.0362	0.0362	0.0362	0.0362	0.0362	0.0362	0.0362	0.0362	0.0362	0.0362	0.0362	0.0362	0.0362	0.0362	0.0362	0.0362	0.0362	0.0362
CAT 793D - TIER 2 (New and Replaceme	2,415	2		0.0380	0.0760	0.0760	0.0760	0.0760	0.0760	0.0760	0.0760	0.0760	0.0760	0.0760	0.0760	0.0760	0.0760	0.0760	0.0760	0.0760	0.0760
HYDRAULIC SHOVELS																				
O&K RH 200, (NOT CERT)	2,100	0		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O&K RH 200, (TIER 1)	2,520	1		0.1158	0.1146	0.1134	0.1129	0.1123	0.1117	0.1111	0.1106	0.1100	0.0579	0.0579	0.0567	0.0567	0.0561	0.0561	0.0556	0.0556	0.0550

CONSTRUCTION TRUCKS																				
KOM 785-7 TIER 1 (Existing)	1,200	1		0.0476	0.0476	0.0476	0.0476	0.0476	0.0476	0.0476	0.0476	0.0476	0.0476	0.0476	0.0476	0.0476	0.0476	0.0476	0.0476	0.0476	0.0476
DIESEL DRILLS - P&H																				
TIER 1 (Existing)	1,100	1		0.0136	0.0136	0.0068	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (during T4I) (Replacements)	1,100	2		-	-	0.0071	0.0141	0.0141	0.0141	0.0139	0.0139	0.0139	0.0139	0.0136	0.0068	0.0068	0.0068	0.0045	0.0045	0.0045	0.0045
DIESEL DRILLS - ATLAS COPCO																				
TIER 2 (Existing)	750	2		0.0246	0.0246	0.0246	0.0243	0.0241	0.0241	0.0181	0.0120	0.0089	-	-	-	-	-	-	-	-	-
TIER 2 (during T4I) (New)	750	2		0.0063	0.0125	0.0125	0.0123	0.0123	0.0123	0.0123	0.0123	0.0100	0.0070	0.0031	-	-	-	-	-	-	-
TIER 4F (Replacements)	750	4F		-	-	-	-	-	-	-	0.0072	0.0124	0.0124	0.0122	0.0091	0.0081	0.0101	0.0106	0.0099	0.0099	0.0099
TOTAL				**0.70**	**0.75**	**0.77**	**0.78**	**0.78**	**0.78**	**0.76**	**0.75**	**0.72**	**0.60**	**0.55**	**0.51**	**0.51**	**0.52**	**0.51**	**0.51**	**0.49**	**0.49**

Particulate Matter (PM_{10}) Emissions (tpy)				**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**

TRACK DOZERS - CAT D10	**HP**	**Tier**																			
NOT TIER RATED (Existing)	580	0		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 1 (Existing)	613	1		1.4668	0.4889	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (Existing)	661	2		0.7686	0.7686	0.7686	0.7686	0.7686	0.7686	0.5124	-	-	-	-	-	-	-	-	-	-	-
TIER 3 (Existing, New and Replacements)	646	3		3.2549	4.0060	4.7571	4.7571	4.7571	4.7571	4.7571	4.7571	4.5068	3.7556	2.5038	2.0030	1.2519	1.0015	0.2504	0.2504	0.2504	0.2504
TIER 4F (New and Replacements)	646	4F		-	-	-	-	-	-	-	-	-	-	-	-	0.0496	0.0826	0.1322	0.1322	0.1322	0.1322
TRACK DOZERS - CAT D11																					
NOT TIER RATED (Existing)	850	0		3.6602	2.4401	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 1 (Existing)	936	1		0.5519	0.5519	0.5519	0.5519	0.5519	0.5519	0.5519	0.5519	0.5519	-	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	936	4T		0.0327	0.0654	0.1309	0.1309	0.1309	0.1309	0.1309	0.1309	0.1309	0.1309	0.1309	0.1309	0.1309	0.0982	0.0654	0.0654	-	-
TIER 4F (New and Replacements)	936	4F		-	-	-	-	-	-	-	-	-	-	-	-	-	0.0327	0.0654	0.0654	0.0654	0.0654
GRADERS - CAT 16																					
TIER 1 (Existing)	289	1		0.6834	0.3417	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (Existing)	299	2		0.4346	0.4346	0.4346	0.2897	0.2897	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 3 (Existing)	297	3		0.7194	0.7194	0.7194	0.7194	0.7194	0.7194	0.1439	-	-	-	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	297	4T		0.0095	0.0285	0.0380	0.0475	0.0475	0.0475	0.0475	0.0475	0.0475	0.0380	0.0190	-	-	-	-	-	-	-
TIER 4F (New and Replacements)	297	4F		-	-	-	-	0.0095	0.0285	0.0665	0.0760	0.0760	0.0760	0.0949	0.1044	0.1044	0.1044	0.1044	0.1044	0.1044	0.1044
GRADERS - CAT 24																					
NOT TIER RATED (Existing)	540	0		1.9931	1.9931	1.9931	1.9931	1.9931	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (Existing)	533	2		0.2324	0.2324	0.2324	0.2324	0.2324	0.2324	0.2324	0.2324	0.2324	0.2324	-	-	-	-	-	-	-	-
TIER 4F (Replacements)	533	4F		-	-	-	-	-	0.0307	0.0307	0.0307	0.0307	0.0307	0.0460	0.0460	0.0460	0.0460	0.0460	0.0460	0.0460	0.0460

TABLE B1-37
2011–2029 Mobile Support Equipment Emissions—260 Mtpy
KUC—Bingham Canyon Mine

RTDS - CAT 834																				
834B - NOT TIER RATED (Existing)	487	0		1.7975	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
834G - NOT TIER RATED (Existing)	487	0		0.8987	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 3 (Existing)	525	3		0.6867	0.6867	0.6867	0.6867	0.6867	0.6867	0.6867	0.4578	0.4578	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	525	4T		0.0151	0.0604	0.0604	0.0604	0.0604	0.0604	0.0604	0.0604	0.0604	0.0604	0.0302	-	-	-	-	-	-	-
TIER 4F (Replacements)	525	4F		-	-	-	-	-	-	-	0.0151	0.0151	0.0151	0.0302	0.0604	0.0604	0.0604	0.0604	0.0604	0.0604	0.0604
RTDS - CAT 854																				
TIER 1 (Existing)	880	1		0.6672	0.6672	0.6672	0.6672	0.6672	0.6672	0.6672	0.6672	-	-	-	-	-	-	-	-	-	-
FEL - KOMATSU																				
WA500 - TIER 1 (Existing)	235	1		0.1702	0.1702	0.1702	0.1702	0.1702	0.1702	0.1702	0.1702	0.1702	0.1702	-	-	-	-	-	-	-	-
WA600 - TIER 3 (Existing)	396	3		0.2350	0.2350	0.2350	0.2350	0.2350	0.2350	0.2350	0.2350	0.2350	0.2350	0.1175	-	-	-	-	-	-	-
WA600 - TIER 4F (Replacements)	502	4F		-	-	-	-	-	-	-	-	-	-	0.0098	0.0197	0.0197	0.0197	0.0197	0.0197	0.0197	0.0197
WA700 - TIER 1 (Existing)	396	1		0.2147	0.2147	0.2147	0.2147	0.2147	0.2147	0.2147	0.2147	0.2147	0.2147	0.2147	-	-	-	-	-	-	-
FEL - CAT 992																				
TIER 2 (Existing)	800	2		0.4747	0.4747	0.4747	0.4747	0.4747	0.4747	0.2374	-	-	-	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	801	4T		-	-	0.0245	0.0245	0.0245	0.0245	0.0245	0.0245	0.0245	0.0245	0.0245	0.0245	0.0245	0.0245	0.0245	0.0245	0.0245	0.0245
TIER 4F (Replacements)	801	4F		-	-	-	-	-	-	0.0245	0.0490	0.0490	0.0490	0.0490	0.0490	0.0490	0.0490	0.0490	0.0490	0.0490	0.0490
PRODUCTION FEL - KOM WA1200																				
TIER 1 (Existing)	1,782	1		1.2423	1.2423	1.2423	1.2423	1.2423	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 4F (Replacements)	1,782	4F		-	-	-	-	-	0.0736	0.0736	0.0736	0.0736	0.0736	0.0736	0.0736	0.0736	0.0736	0.0736	0.0736	0.0736	0.0736
TRACKHOES - CAT 330																				
TIER 2 (Existing)	264	2		0.0563	0.0563	0.0563	0.0563	0.0563	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 4F (Replacements)	268	4F		-	-	-	-	-	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038
TRACKHOES - CAT 385																				
TIER 3 (Existing)	523	3		0.2230	0.2230	0.2230	0.1115	0.1115	0.1115	-	-	-	-	-	-	-	-	-	-	-	-
TIER 4A (Replacements)	523	4T		-	-	-	0.0147	0.0147	0.0147	0.0147	0.0147	0.0147	0.0147	0.0147	0.0147	-	-	-	-	-	-
TIER 4F (Replacements)	523	4F		-	-	-	-	-	-	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0147	0.0147	0.0147	0.0147	0.0147	0.0147
TRACKHOES - KOMATSU																				
PC800 - TIER 1 (Existing)	323	1		0.2516	0.2516	0.2516	0.2516	0.1258	0.1258	0.1258	0.1258	0.1258	-	-	-	-	-	-	-	-	-
PC800 - TIER 4F (Replacements)	323	4F		-	-	-	-	0.0045	0.0045	0.0045	0.0045	0.0045	0.0045	0.0045	0.0045	0.0045	0.0045	0.0045	0.0045	-	-
PC400 - TIER 1 (Existing)	246	1		0.1280	0.1280	0.1280	0.1280	0.1280	0.1280	-	-	-	-	-	-	-	-	-	-	-	-
WATER TRUCKS																				
CAT 789 (Existing)	1,900	0		1.9480	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CAT 793C - TIER 1 (Existing)	2,300	1		1.9375	1.9375	1.9375	1.9375	1.9375	1.9375	1.9375	1.9375	1.9375	1.9375	1.9375	1.9375	1.9375	1.9375	1.9375	1.9375	1.9375	1.9375
CAT 793D - TIER 2 (New and Replaceme	2,415	2		1.1700	2.3400	2.3400	2.3400	2.3400	2.3400	2.3400	2.3400	2.3400	2.3400	2.3400	2.3400	2.3400	2.3400	2.3400	2.3400	2.3400	2.3400
HYDRAULIC SHOVELS																				
O&K RH 200, (NOT CERT)	2,100	0		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O&K RH 200, (TIER 1)	2,520	1		6.1987	6.1367	6.0747	6.0437	6.0127	5.9817	5.9507	5.9197	5.8888	3.0993	3.0993	3.0374	3.0374	3.0064	3.0064	2.9754	2.9754	2.9444
CONSTRUCTION TRUCKS																				
KOM 785-7 TIER 1 (Existing)	1,200	1		2.5474	2.5474	2.5474	2.5474	2.5474	2.5474	2.5474	2.5474	2.5474	2.5474	2.5474	2.5474	2.5474	2.5474	2.5474	2.5474	2.5474	2.5474
DIESEL DRILLS - P&H																				
TIER 1 (Existing)	1,100	1		0.7282	0.7282	0.3641	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (during T4I) (Replacements)	1,100	2		-	-	0.2173	0.4346	0.4346	0.4346	0.4267	0.4267	0.4267	0.4267	0.4188	0.2094	0.2094	0.2094	0.1396	0.1370	0.1370	0.1370
DIESEL DRILLS - ATLAS COPCO																				
TIER 2 (Existing)	750	2		0.7558	0.7558	0.7558	0.7485	0.7412	0.7412	0.5559	0.3706	0.2725	-	-	-	-	-	-	-	-	-
TIER 2 (during T4I) (New)	750	2		0.1926	0.3852	0.3852	0.3779	0.3779	0.3779	0.3779	0.3779	0.3089	0.2162	0.0963	-	-	-	-	-	-	-
TIER 4F (Replacements)	750	4F		-	-	-	-	-	-	-	0.0232	0.0397	0.0397	0.0390	0.0292	0.0260	0.0325	0.0341	0.0318	0.0318	0.0318
TOTAL				**36.3**	**31.3**	**28.7**	**28.3**	**28.1**	**24.6**	**23.2**	**21.9**	**20.8**	**15.6**	**13.9**	**12.6**	**11.9**	**11.7**	**10.9**	**10.9**	**10.8**	**10.8**

Operation Hours				**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**

TRACK DOZERS - CAT D10	**HP**	**Tier**																			
NOT TIER RATED (Existing)	580	0		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 1 (Existing)	613	1		12,000	4,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (Existing)	661	2		12,000	12,000	12,000	12,000	12,000	12,000	8,000	-	-	-	-	-	-	-	-	-	-	-
TIER 3 (Existing, New and Replacements)	646	3		52,000	64,000	76,000	76,000	76,000	76,000	76,000	76,000	72,000	60,000	40,000	32,000	20,000	16,000	4,000	4,000	4,000	4,000
TIER 4F (New and Replacements)	646	4F		-	-	-	-	-	-	-	-	-	-	-	-	12,000	20,000	32,000	32,000	32,000	32,000
TRACK DOZERS - CAT D11																					
NOT TIER RATED (Existing)	850	0		10,500	7,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 1 (Existing)	936	1		3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	-	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	936	4T		3,500	7,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	10,500	7,000	7,000	-	-
TIER 4F (New and Replacements)	936	4F		-	-	-	-	-	-	-	-	-	-	-	-	-	3,500	7,000	7,000	7,000	7,000

TABLE B1-37
2011–2029 Mobile Support Equipment Emissions—260 Mtpy
KUC—Bingham Canyon Mine

GRADERS - CAT 16																				
TIER 1 (Existing)	289	1		10,000	5,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (Existing)	299	2		15,000	15,000	15,000	10,000	10,000	-	-	-	-	-	-	-	-	-	-	-	-
TIER 3 (Existing)	297	3		25,000	25,000	25,000	25,000	25,000	25,000	5,000	-	-	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	297	4T		5,000	15,000	20,000	25,000	25,000	25,000	25,000	25,000	25,000	20,000	10,000	-	-	-	-	-	-
TIER 4F (New and Replacements)	297	4F		-	-	-	-	5,000	15,000	35,000	40,000	40,000	40,000	50,000	55,000	55,000	55,000	55,000	55,000	55,000
GRADERS - CAT 24																				
NOT TIER RATED (Existing)	540	0		9,000	9,000	9,000	9,000	9,000	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (Existing)	533	2		4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	-	-	-	-	-	-	-
TIER 4F (Replacements)	533	4F		-	-	-	-	-	9,000	9,000	9,000	9,000	9,000	13,500	13,500	13,500	13,500	13,500	13,500	13,500
RTDS - CAT 834																				
834B - NOT TIER RATED (Existing)	487	0		9,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
834G - NOT TIER RATED (Existing)	487	0		4,500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 3 (Existing)	525	3		13,500	13,500	13,500	13,500	13,500	13,500	13,500	9,000	9,000	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	525	4T		4,500	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	9,000	-	-	-	-	-	-
TIER 4F (Replacements)	525	4F		-	-	-	-	-	-	-	4,500	4,500	4,500	9,000	18,000	18,000	18,000	18,000	18,000	18,000
RTDS - CAT 854																				
TIER 1 (Existing)	880	1		4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	-	-	-	-	-	-	-	-	-
FEL - KOMATSU																				
WA500 - TIER 1 (Existing)	235	1		3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	-	-	-	-	-	-	-	-
WA600 - TIER 3 (Existing)	396	3		7,400	7,400	7,400	7,400	7,400	7,400	7,400	7,400	7,400	7,400	3,700	-	-	-	-	-	-
WA600 - TIER 4F (Replacements)	502	4F		-	-	-	-	-	-	-	-	-	-	3,700	7,400	7,400	7,400	7,400	7,400	7,400
WA700 - TIER 1 (Existing)	396	1		3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	-	-	-	-	-	-
FEL - CAT 992																				
TIER 2 (Existing)	800	2		7,400	7,400	7,400	7,400	7,400	7,400	3,700	-	-	-	-	-	-	-	-	-	-
TIER 4A (New and Replacements)	801	4T		-	-	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700
TIER 4F (Replacements)	801	4F		-	-	-	-	-	-	3,700	7,400	7,400	7,400	7,400	7,400	7,400	7,400	7,400	7,400	7,400
PRODUCTION FEL - KOM WA1200																				
TIER 1 (Existing)	1,782	1		5,000	5,000	5,000	5,000	5,000	-	-	-	-	-	-	-	-	-	-	-	-
TIER 4F (Replacements)	1,782	4F		-	-	-	-	-	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
TRACKHOES - CAT 330																				
TIER 2 (Existing)	264	2		2,200	2,200	2,200	2,200	2,200	-	-	-	-	-	-	-	-	-	-	-	-
TIER 4F (Replacements)	268	4F		-	-	-	-	-	2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200
TRACKHOES - CAT 385																				
TIER 3 (Existing)	523	3		4,400	4,400	4,400	2,200	2,200	2,200	-	-	-	-	-	-	-	-	-	-	-
TIER 4A (Replacements)	523	4T		-	-	-	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400	-	-	-	-	-
TIER 4F (Replacements)	523	4F		-	-	-	-	-	-	2,200	2,200	2,200	2,200	2,200	2,200	4,400	4,400	4,400	4,400	4,400
TRACKHOES - KOMATSU																				
PC800 - TIER 1 (Existing)	323	1		4,400	4,400	4,400	4,400	2,200	2,200	2,200	2,200	2,200	-	-	-	-	-	-	-	-
PC800 - TIER 4F (Replacements)	323	4F		-	-	-	-	2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200	-
PC400 - TIER 1 (Existing)	246	1		2,200	2,200	2,200	2,200	2,200	2,200	-	-	-	-	-	-	-	-	-	-	-
WATER TRUCKS																				
CAT 789 (Existing)	1,900	0		2,500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CAT 793C - TIER 1 (Existing)	2,300	1		5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
CAT 793D - TIER 2 (New and Replaceme	2,415	2		5,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
HYDRAULIC SHOVELS																				
O&K RH 200, (NOT CERT)	2,100	0		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O&K RH 200, (TIER 1)	2,520	1		14,600	14,454	14,308	14,235	14,162	14,089	14,016	13,943	13,870	7,300	7,300	7,154	7,154	7,081	7,081	7,008	7,008	6,935
CONSTRUCTION TRUCKS																				
KOM 785-7 TIER 1 (Existing)	1,200	1		12,600	12,600	12,600	12,600	12,600	12,600	12,600	12,600	12,600	12,600	12,600	12,600	12,600	12,600	12,600	12,600	12,600
DIESEL DRILLS - P&H																				
TIER 1 (Existing)	1,100	1		5,300	5,300	2,650	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TIER 2 (during T4I) (Replacements)	1,100	2		-	-	2,750	5,500	5,500	5,500	5,400	5,400	5,400	5,400	5,300	2,650	2,650	2,650	1,767	1,733	1,733	1,733
DIESEL DRILLS - ATLAS COPCO																				
TIER 2 (Existing)	750	2		10,400	10,400	10,400	10,300	10,200	10,200	7,650	5,100	3,750	-	-	-	-	-	-	-	-
TIER 2 (during T4I) (New)	750	2		2,650	5,300	5,300	5,200	5,200	5,200	5,200	5,200	4,250	2,975	1,325	-	-	-	-	-	-
TIER 4F (Replacements)	750	4F		-	-	-	-	-	-	-	3,092	5,300	5,300	5,200	3,900	3,467	4,333	4,550	4,250	4,250	4,250

Material is loaded into haul trucks by shovels. KUC primarily operates electric shovels in addition to the hydraulic shovels included in the emissions calculations.

TABLE B1-37
2011–2029 Mobile Support Equipment Emissions—260 Mtpy
KUC—Bingham Canyon Mine

Emission Factors (g/hp-hr)	Pollutant	Tier 0	Tier 1	Tier 2	Tier 3	Tier 4t	Tier 4f
175–300-hp class	HC	0.75	0.34	0.33	0.20	0.13	0.13
	CO	4.90	1.26	1.26	1.32	0.09	0.09
	NO_x	8.15	5.43	3.83	2.39	2.52	0.28
	SO_2	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049
	PM_{10}	0.64	0.37	0.15	0.15	0.01	0.01
300–600-hp class	HC	0.75	0.22	0.18	0.18	0.13	0.13
	CO	4.90	2.20	1.42	1.48	0.10	0.10
	NO_x	8.15	5.85	4.16	2.39	2.52	0.28
	SO_2	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049
	PM_{10}	0.64	0.28	0.15	0.15	0.01	0.01
600–750-hp class	HC	0.75	0.16	0.18	0.18	0.13	0.13
	CO	4.90	2.24	2.24	2.34	0.15	0.15
	NO_x	8.15	5.66	3.93	2.39	2.52	0.28
	SO_2	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049
	PM_{10}	0.64	0.31	0.15	0.15	0.01	0.01
>750-hp class	HC	0.75	0.31	0.18	NA	0.29	0.13
	CO	4.90	1.29	1.29	NA	0.09	0.09
	NO_x	8.15	5.99	3.93	NA	2.41	2.41
	SO_2	0.0049	0.0049	0.0049	NA	0.0049	0.0049
	PM_{10}	0.64	0.26	0.15	NA	0.02	0.02
All emission factors represent the lesser of EPA emission limits and factors calculated using EPA NONROAD methodology.							

All Age Factors assumed to be equal to 1.

Calculation Data

	NONROAD Equipment SCC
Front-end Loaders	2270002060
Graders	2270002048
Truck Dozers	2270002069
Wheeled Dozers	2270002063

All tables and factors are from "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling--Compression-Ignition", EPA, 2004, unless otherwise noted.

Table A2 Zero-Hour, Steady-State Emission Factors for Nonroad CI Engines (>175 to 300 hp)

	BSFC	HC	CO	NO_x	PM_{10}
T0	0.367	0.68	2.7	8.38	0.402
T1	0.367	0.3085	0.7475	5.5772	0.2521
T2	0.367	0.3085	0.7475	4	0.1316
T3	0.367	0.1836	0.7475	2.5	0.15
T4t	0.367	0.1314	0.075	2.5	0.0092
T4	0.367	0.1314	0.075	0.276	0.0092

Table A2 Zero-Hour, Steady-State Emission Factors for Nonroad CI Engines (>300 to 600 hp)

	BSFC	HC	CO	NO_x	PM_{10}
T0	0.367	0.68	2.7	8.38	0.402
T1	0.367	0.2025	1.306	6.0153	0.2008
T2	0.367	0.1669	0.8425	4.3351	0.1316
T3	0.367	0.1669	0.8425	2.5	0.15
T4t	0.367	0.1314	0.084	2.5	0.0092
T4	0.367	0.1314	0.084	0.276	0.0092

Table A2 Zero-Hour, Steady-State Emission Factors for Nonroad CI Engines (>600 to 750 hp)

	BSFC	HC	CO	NO_x	PM_{10}
T0	0.367	0.68	2.7	8.38	0.402
T1	0.367	0.1473	1.3272	5.8215	0.2201
T2	0.367	0.1669	1.3272	4.1	0.1316
T3	0.367	0.1699	1.3272	2.5	0.15
T4t	0.367	0.1314	0.133	2.5	0.0092
T4	0.367	0.1314	0.133	0.276	0.0092

Table A2 Zero-Hour, Steady-State Emission Factors for Nonroad CI Engines (>750 hp)					
	BSFC	**HC**	**CO**	**NO_x**	**PM_{10}**
T0	0.367	0.68	2.7	8.38	0.402
T1	0.367	0.2861	0.7642	6.1525	0.1934
T2	0.367	0.1669	0.7642	4.1	0.1316
T4t	0.367	0.2815	0.076	2.392	0.069
T4f	0.367	0.1314	0.076	2.392	0.0276

Table A3 Transient Adjustment Factors by Equipment Type for Nonroad CI Equipment

HC	CO	NO_x	PM_{10}	BSFC
1.05	1.53	0.95	1.23	1.01

TAFs are not applied to the emission factors for Tier 4 engines

Table A4 Deterioration Factors for Nonroad Diesel Engines (A)

Pollutant	T0	T1	T2	T3+
HC	0.047	0.036	0.034	0.027
CO	0.185	0.101	0.101	0.151
NO_x	0.024	0.024	0.009	0.008
PM_{10}	0.473	0.473	0.473	0.473

Sulfur Content of Diesel Fuel

sulfur conversion	7.0	grams PM sulfate/gram Sulfur		
soxcnv	0.02247	grams PM sulfur/gram fuel consumed		
default (soxbas)	3300	ppm	0.33	wt %
2010+ (soxdsl)	15	ppm	0.0015	wt %

Load Factor

0.48 RTLoader Cycle Class
0.58 Crawler Cycle Class
0.43 7-cycle average

Load factors from Tables 9 and 10 of "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling", EPA, 2004.

TABLE B1-38
Emissions Summary
KUC—Bingham Canyon Mine

Source ID	Source Description	PM_{10} Emissions (tpy)	$PM_{2.5}$ Emissions (tpy)	Location of Source within Pit Influence Boundary
BCM01	In Pit Crusher	1.55	0.48	Yes
BCM201	New In Pit Crusher	0.68	0.21	Yes
BCM02	C6/C7 Conveyor Transfer Point	1.35	0.40	
BCM03	C7/C8 Conveyor Transfer Point	0.83	0.24	
BCM04	Lime Bin	0.37	0.13	
BCM05	Lime Bin	0.37	0.13	
BCM07	Sample Preparation	0.17	0.05	Yes
SX/EW	Electrowinning (as H_2SO_4)	0.96	0.96	
Total Point Sources:		**6.27**	**2.60**	
BCM1.1	Truck Dump Ore	0.56	0.09	Yes
BCM204	Truck Dump Ore at Crusher	0.56	0.09	Yes
BCM205	Truck Dump Ore at Stockpile	0.56	0.09	Yes
BCM1.2	In-pit enclosed transfer point 1, 2,3	1.68	0.27	Yes
BCM202	New In-pit enclosed transfer point 1, 2,3	1.68	0.27	Yes
BCM203	In-pit enclosed transfer point 4,5	1.12	0.18	Yes
BCM1.3	Conveyor Stacker Transfer Point	2.79	0.42	
BCM1.4	Coarse Ore Stacker (drop to coarse ore storage pile)	2.79	0.42	
BCM1.5	Reclaim Tunnels (Coarse ore reclaim tunnel vent)	2.79	0.42	
BCM1.9	Disturbed Areas	40.6	8.7	Yes
BCM1.13	Coarse Ore Storage Pile	2.09	0.33	Yes
BCM1.16	Front End Loaders	12.38	2.08	Yes
BCM1.17	Truck Loading	1.71	0.27	Yes
BCM1.19	End Dump Trucks (truck dumping of waste)	57.5	8.71	
BCM1.20	Graders	77.7	9.1	Yes
BCM1.21	Track Dozers	5.9	3.6	Yes
BCM1.22	Wheeled Dozers	1.2	0.7	Yes
BCM1.23	Drilling w/Water Injection	0.55	0.09	Yes
BCM1.24	Blasting w/Minimized Area	11.0	0.7	Yes
BCM100	Tertiary Crushing	0.17	0.03	Yes
BCM101	Screening	0.23	0.02	Yes
BCM102	Transfer Points	0.14	0.04	Yes
Total Fugitive Sources:		**225.69**	**36.69**	
Total		**231.00**	**38**	

TABLE B1-39
Truck Offloading Ore at In-pit Crusher (Additional drop point at the new crusher
KUC—Bingham Canyon Mine

Source Name	PM_{10} Aerodynamic Particle Size Multiplier (k)	$PM_{2.5}$ Aerodynamic Particle Size Multiplier (k)	Moisture Content (%)	Wind Speed (mph)	PM_{10} Emission Factor (lbs/ton)	$PM_{2.5}$ Emission Factor (lbs/ton)	Annual Process Rate (tpy)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Primary Control Efficiency (%)	PM_{10} Emissions with Primary Controls (tpy)	$PM_{2.5}$ Emissions with Primary Controls (tpy)	PM_{10} Pit Escape Factor (%)	$PM_{2.5}$ Pit Escape Factor (%)	Controlled PM_{10} Emissions from the pit (tpy)	Controlled $PM_{2.5}$ Emissions from the pit (tpy)	Control System and Comments
Truck Offloading Ore	0.35	0.053	4	7	0.00066	0.00010	85,000,000	27.9	4.2	90	2.79	0.42	20	21	0.56	0.09	Inherent material characteristics and physical enclosures. Source Located in the pit.

NOTES:
Emission factors estimated using methodology in AP-42, Section 13.2.4.
Wind speed and moisture content data based on historical data.
PM_{10} and $PM_{2.5}$ Pit Escape Factor applied to the calculations and is based on University of Utah study (1996).
Characteristics of the ore material, such as large diameter material, and inherent material moisture content of 4 percent, limit dust being generated during the transfer operations.
The control efficiency listed is based on previous determinations of BACT by UDAQ. This control efficiency has been applied in the 1994 SIP and 2005 SIP calculations and modeling.

TABLE B1-40

Truck Offloading Ore at Stockpile

KUC—Bingham Canyon Mine

Source Name	PM_{10} Aerodynamic Particle Size Multiplier (k)	$PM_{2.5}$ Aerodynamic Particle Size Multiplier (k)	Moisture Content (%)	Wind Speed (mph)	PM_{10} Emission Factor (lbs/ton)	$PM_{2.5}$ Emission Factor (lbs/ton)	Annual Process Rate (tpy)	Uncontrolled PM_{10} Emissions (tpy)	Uncontrolled $PM_{2.5}$ Emissions (tpy)	Primary Control Efficiency (%)	PM_{10} Emissions with Primary Controls (tpy)	$PM_{2.5}$ Emissions with Primary Controls (tpy)	PM_{10} Pit Escape Factor (%)	$PM_{2.5}$ Pit Escape Factor (%)	Controlled PM_{10} Emissions from the pit (tpy)	Controlled $PM_{2.5}$ Emissions from the pit (tpy)	Control System and Comments
Truck Offloading Ore	0.35	0.053	4	7	0.00066	0.00010	85,000,000	27.9	4.2	90	2.79	0.42	20	21	0.56	0.09	Inherent material characteristics and source located in the pit.

NOTES:

Emission factors estimated using methodology in AP-42, Section 13.2.4.

Wind speed and moisture content data based on historical data.

PM_{10} and $PM_{2.5}$ Pit Escape Factor applied to the calculations and is based on University of Utah study (1996).

Characteristics of the ore material, such as large diameter material, and inherent material moisture content of 4 percent, limit dust being generated during the transfer operations.

The control efficiency listed is based on previous determinations of BACT by UDAQ. This control efficiency has been applied in the 1994 SIP and 2005 SIP calculations and modeling.

TABLE B1-41
New LPG Generator (Dinkeyville Hill)
KUC—Bingham Canyon Mine

NO_X Emission Factor (g/HP-hr)	6.9	[Vendor Data]
CO Emission Factor (g/HP-hr)	27	[Vendor Data]
THC Emission Factor (g/HP-hr)	1	[Vendor Data]
SO_2 Emission Factor (g/HP-hr)	0.0121	[EPA NONROAD Program]
PM_{10} Emission Factor (g/HP-hr)	0.0557	[EPA NONROAD Program]
$PM_{2.5}$ Emission Factor (g/HP-hr)	0.0557	[EPA NONROAD Program]

	Generator
Engine Rating (HP)	71
Annual Hours of Operations (hrs/yr)	100
NO_X Emissions (lb/hr)	1.1
CO Emissions (lb/hr)	4.24
VOC Emissions (lb/hr)	0.16
SO_2 Emissions (lb/hr)	0.002
PM_{10} Emissions (lb/hr)	0.01
$PM_{2.5}$ Emissions (lb/hr)	0.01
NO_X Emissions (tpy)	0.0542
CO Emissions (tpy)	0.212
VOC Emissions (tpy)	0.01
SO_2 Emissions (tpy)	0.0001
PM_{10} Emissions (tpy)	0.0004
$PM_{2.5}$ Emissions (tpy)	0.0004

Notes:
(1) Emissions of NO_X, CO, and VOC estimated using vendor provided data.
(2) Emissions of SO_2, PM_{10}, and $PM_{2.5}$ estimated using EPA's NONROAD Program