ENERGY FUELS RESOURCES (USA) INC.
DANEROS MINE PROJECT AIR EMISSIONS

Introduction

The Daneros Mine is located in the central portion of the Colorado Plateau in western San Juan County, Utah. The project site is located in Bullseye Canyon, approximately five miles southwest of Fry Canyon. The surface facilities are located on Federal land administered by the Bureau of Land Management (BLM). Mining operations at the facility will include mining ore and development rock from the underground workings and mucking the rock using low-profile diesel loaders. Ore will be hauled to the surface using low-profile diesel haul trucks. Development rock will be hauled to the surface and placed in one of the development rock disposal areas (DRA). Ore will be transported by truck to Energy Fuels' White Mesa Mill located near Blanding, Utah. No on-site physical or chemical mineral processing will take place; therefore no tailings or mineral processing chemicals will be generated or stored on site.

The Mine will consist of three portal areas, including the Daneros, Bullseye, and South portal areas. The Daneros portal currently exists. At the Bullseye and South Portal areas, additional declines into the ore body will be constructed to allow for ore hauling, mine ventilation, and secondary escape routes. Each portal area will have an ore storage pile, DRAs, diesel generators, diesel storage tanks, and mobile surface equipment including front-end loaders, dozers, and haul trucks. The cumulative surface area disturbance will be approximately 46 acres. The total life of mine ore production is expected to be approximately 500,000 tons. The annual ore production will average 25,000 tons per year over the total life of the mine which is expected to be approximately 20 years. The peak annual ore production will not exceed 72,000 tons per year.

The mine is located in an area of the state where utility-supplied power and commercially-available natural gas are unavailable. Therefore, Energy Fuels will generate power using stationary diesel-powered generators. The mine will have 4, 455-kW diesel-fired generators that will be used for primary power. Two of the generators will be located at the Daneros Portal area, one 455-kW generator will be at the Bullseye Portal area. All generators will be synchronized. After underground workings have advanced to connect the Daneros and Bullseye portals, the Bullseye generator will be relocated to the South Portal area. Energy Fuels will also operate a 140-kW auxiliary generator used for mine ventilation and emergency operations.

Air Emissions

Mining-related activities at the Daneros Mine are a source of particulate and gaseous air pollutants. Fugitive dust emissions at the mine are generated by ore and development rock

material handling, vehicle traffic, and ore and development rock storage piles. Gaseous and particulate air contaminant emissions are generated from operation of diesel generators and compressors, mine vents, and vehicle traffic. Diesel fuel storage tanks also produce air emissions. Indirect emissions occurring as a result of Daneros operations but not at the mine site include processing ore at the White Mesa Mill and off-site haul truck emissions (tailpipe emissions and vehicle travel over unpaved public roads).

Air pollutant emissions are classified as criteria pollutants, hazardous air pollutants (HAP), or greenhouse gases (GHG). The criteria air pollutants as defined by EPA include:

- Nitrogen Dioxide (NO_2) – measured as nitrogen oxides (NO_X)
- Carbon Monoxide (CO)
- Ozone (O_3)
- Particulate Matter less than or equal to 10 microns (PM_{10})
- Particulate Matter less than or equal to 2.5 microns ($PM_{2.5}$)
- Sulfur Dioxide (SO_2)
- Lead (Pb)

EPA has also defined 188 HAPs, which are those pollutants that could cause serious human health or environmental effects if released in excessive quantities. A list of HAPs is available on the EPA's web site (http://www.epa.gov/ttn/atw/188polls.html). GHGs are those that have the potential to absorb heat and trap it in the atmosphere. The most common GHGs in the atmosphere are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_20), and fluorinated gases. Potential emissions of criteria pollutants, HAPs, and GHGs were calculated for the Daneros Mine sources. The attached tables summarize the air emission estimates from direct and indirect emissions resulting from operation of the Daneros Mine. Detailed emission calculations are provided on CD ROM.

Generally, emissions have been calculated using engineering design specifications or standard emission calculation equations, such as EPA's Compilation of Air Pollutant Emission Factors (commonly referred to as AP-42). Air emissions were calculated based on both the average annual ore production, and the peak annual ore production. Completing both sets of emission calculations provides an estimate of the average mine-related emissions expected over the life of the mine, as well as the maximum emissions expected to occur over a 1-year period. Descriptions of each emission source type are provided below:

Direct Emissions

Diesel Generator and Compressor Engines: Stationary diesel-powered generators will be used for primary and backup power. Emissions were calculated using manufacturer specifications and EPA emission factors.

Mobile Combustion Engines: Underground and surface mobile equipment will operate during mining. Emissions were calculated primarily using emission factors from EPA's

Nonroad emission model documentation. Pick-up truck emissions were calculated using EPA diesel emission standards for on-highway vehicles. Mobile and nonroad diesel equipment was assumed to comply with EPA's Tier 2 engine emission standards. For these sources, emissions were calculated by taking the emission factor in grams per horsepower-hour (g/hp-hr) and multiplying by the engine horsepower rating. Pick-up truck emission factors are given in grams per mile. Emissions for the pick-up trucks were calculated by multiplying the emission factor by the estimated vehicle miles travelled (VMT) for the pick-up trucks. The pick-up truck VMT was estimated by assuming 4 round trips per day for each portal area.

Underground Blasting: The mine will use Ammonium Nitrate/Fuel Oil (ANFO) for blasting underground seams. Emission factors in pounds per ton explosive were multiplied by the ANFO usage to estimate pollutant emissions. Emission factors were compiled from two sources:

1. *Emission Estimation Technique Manual for Explosives Detonation and Firing Ranges.* National Pollutant Inventory. Tables 2 and 4. March 1999. For gaseous pollutants
2. *WRAP Fugitive Dust Handbook*. Prepared by Countess Environmental. Prepared for the Western Governor's Association. September 2006. Table 11-7. For particulate matter

Wind Erosion: Windblown dust emissions occur when wind speeds reach threshold levels over disturbed surface areas. At the Daneros Mine, disturbed areas subject to wind erosion emissions include ore and development rock storage piles, as well as active topsoil and inert material stockpiles. Emissions were calculated using an emission equation from EPA's AP-42.

Material Handling: Loading, unloading, and moving mined material can generate dust emissions at the mine. Emissions for these activities were calculated using emission factors from EPA's AP-42.

Storage Tanks: Diesel storage tanks emit small amounts of air pollutants from tank breathing losses and during loading/unloading operations. Emissions from the diesel storage tanks at the Daneros Mine were calculated using tank emission equations from EPA's AP-42, as contained in the EPA software Tanks 4.0.9D.

On-site Road Dust: Dust emissions are generated as on-site vehicles travel over unpaved mine roads. Vehicle tires in contact with unpaved surfaces will kick up dust in the wake of the vehicle. Road dust emissions were calculated using an emission equation from EPA's AP-42. Road dust at the mine site will be controlled by periodic application of water and chemical surfactant to the road surfaces.

Indirect Emissions

Off-Site Mobile Source Tailpipe: Several mine vehicles will routinely travel off the mine site. Haul trucks will carry ore from the mine site to the White Mesa Mill; pick-up trucks will travel to various off-site locations, and a motor grader will occasionally grade the unpaved portion of the public access road. Vehicle tailpipe emissions were calculated using EPA diesel emission standards for on-highway vehicles and EPA nonroad emission factors for the motor grader. The mobile diesel equipment was assumed to comply with EPA's Tier 2 engine emission standards. Emissions for these sources were calculated using the same methodology as those for the on-site mobile combustion engines. The pick-up truck VMT was estimated by assuming 4 round trips per day between the mine and Highway 95.

Off-Site Road Dust: Dust emissions are generated from vehicles travelling over the unpaved public road between State Highway 95 and the mine site. The length of this road segment is approximately 12.5 miles. Therefore the round-trip distance for a single vehicle trip is 25 miles. Road dust emissions were calculated using an emission equation from EPA's AP-42. Road dust on the public off-site road will not be controlled by Energy Fuels and therefore no emission control factor was used in the emission calculations.

White Mesa Mill: Ore from the Daneros Mine is transported by haul trucks to the White Mesa Mill for processing. The White Mesa Mill is located east of the mine site near Blanding, Utah. The haul route from the mine to the mill is 65.5 miles with 12.5 miles over unpaved road and 53 miles over a paved road surface. The mill is permitted to process up to 720,720 tons per year of uranium ore and receives ore from several different sources. Based on peak production estimates, the Daneros Mine could contribute between 7 and 10 percent of the total allowable production at the White Mesa Mill. Emission estimates from the mill that are attributable to the Daneros Mine were provided in the *Daneros Mine Project Environmental Assessment* and are included in these emission estimates.

The emission calculations presented in this emission inventory have been revised from the original mine plan using updated calculation techniques. The calculations in the original mine plan used worst-case assumptions that resulted in inflated emissions estimates. The emission calculation techniques have been refined to present a more accurate estimate of emissions. Refinements to the emission calculations include:

- Underground blasting emissions have been updated to use more recent emission factors that better represent emissions from the blasting operations
- Haul road dust emission calculations were updated by calculating the annual number of haul truck trips based on the maximum annual ore production rather than multiplying the assumed daily maximum by 365 days in a year as was done in the original EI

- The unpaved haul road dust emission equation was updated to use a road silt content of 5.8 percent based on AP-42 data for mining operations
- The length of the off-site unpaved haul road was adjusted from 13.2 miles to 12.5 miles based on updated data
- The assumed number of daily trips from miscellaneous vehicles was updated
- The round-trip haul truck weight used in emission factor calculations was updated based on the round-trip weight of the haul trucks to more accurately reflect the round-trip weight of the vehicles

ENERGY FUELS RESOURCES (USA) INC; DANEROS MINE PROJECT
PROJECT AIR EMISSIONS - AVERAGE ANNUAL EMISSIONS BASED ON 25,000 TONS PER YEAR ORE PRODUCTION

Project Emissions Summary - Average Annual Emissions	Project Emissions (tons/year)						
	CO	HC	NO_X	PM_{10}	$PM_{2.5}$	SO_2	CO_2
Direct Project Emissions							
All Diesel Engines (stationary, portable, mobile)	84.0	9.5	90.0	3.2	3.2	0.2	14,335
On-Site Road Dust (controlled)	--	--	--	2.8	0.3	--	--
ANFO (blasting)	78.4	--	24.0	0.07	0.01	4.0	--
Fuel Storage Tanks	--	0.01	--	--	--	--	--
Material Handling	--	--	--	10.4	1.6	--	--
Annual Project Emissions (with 75% on-site road dust control)	162.4	9.5	114.0	16.5	5.1	4.2	14,335
Indirect Project Emissions							
Off-Site Road Dust (uncontrolled)	--	--	--	44.9	4.5	--	--
Off-Site Mobile Source Tailpipe	22.6	1.9	6.2	1.0	1.0	0.01	331
White Mesa Mill (emissions attributable to the Daneros Mine at average annual mine production)	0.4	0.1	1.4	1.2	0.6	0.1	--

Mine Equipment Combustion Emissions - Average Annual Ore Production				Emissions (lbs/hour)						
Type	Calculation Reference	Horsepower	Operation hours per year	CO	HC	NO_X	PM_{10}	$PM_{2.5}$	SO_2	CO_2
Surface Equipment										
Four 455 kW Electric Generators	Caterpillar	610	8760 each	13.989	1.603	13.989	0.404	0.404	0.028	2,970.2
One 140 HP Electric Generator	EPA Tier 4i	140	1,000	1.015	0.055	0.117	0.006	0.006	0.002	198.0
Portable Compressor	EPA Nonroad (2010)	375	1,000	2.149	0.331	3.638	0.124	0.124	0.004	307.4
Haul Trucks	www.dieselnet.com	300	38	10.251	0.860	2.646	0.463	0.463	0.003	122.9
Low-Profile Haul Trucks	EPA Nonroad (2010)	150	537	1.224	0.132	1.488	0.073	0.073	0.002	61.5
10-ton Dump Truck	EPA Nonroad (2010)	300	219	1.720	0.265	2.976	0.146	0.146	0.003	122.9
Motor Grader	EPA Nonroad (2010)	175	67	1.003	0.154	1.736	0.085	0.085	0.002	71.7
Water Truck	EPA Nonroad (2010)	250	117	1.433	0.220	2.480	0.083	0.083	0.003	102.5
Tanker Truck	EPA Nonroad (2010)	250	19	1.433	0.220	2.480	0.083	0.083	0.003	102.5
Front End Loaders	EPA Nonroad (2010)	70	1,040	0.571	0.062	0.802	0.046	0.046	0.001	28.7
Dozer	EPA Nonroad (2010)	150	1,040	1.224	0.132	1.488	0.073	0.073	0.002	61.5
Pick-Up Trucks	www.dieselnet.com	250	93	0.093	0.003	0.004	0.000	0.000	0.003	102.5
Underground Equipment										
Low-Profile haul trucks	EPA Nonroad (2010)	150	12,480	1.22	0.13	1.49	0.07	0.07	0.0016	61.5
3.5 cy diesel loaders	EPA Nonroad (2010)	154	7,488	1.26	0.14	1.53	0.07	0.07	0.0017	63.1
Skid steers	EPA Nonroad (2010)	80	2,496	0.65	0.07	0.92	0.05	0.05	0.001	32.8
Diesel Mantrips/Utility Vehicles	EPA Nonroad (2010)	75	11,232	0.61	0.07	0.86	0.05	0.05	0.0009	30.7
Water Truck	EPA Nonroad (2010)	250	500	1.43	0.22	2.48	0.08	0.08	0.0027	102.5
Exploration Long/Short Hole Machines	EPA Nonroad (2010)	75	2,496	0.61	0.07	0.86	0.05	0.05	0.0009	30.7
Development Drills, Jumbos	EPA Nonroad (2010)	400	1,000	3.26	0.35	3.97	0.19	0.19	0.0043	163.9
			Total Emissions (lbs/hr)	45.2	5.1	45.9	2.2	2.2	0.1	4,737
			Daily Emissions (lbs/day)	1083.7	122.0	1102.7	51.9	51.9	1.6	113,699
			Total Emissions (tons/yr)	84.0	9.5	90.0	3.2	3.2	0.2	14,335

ENERGY FUELS RESOURCES (USA) INC; DANEROS MINE PROJECT
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Blasting Emissions - ANFO - Average Annual Ore Production			Emissions (tons/year)				
	Calculation Reference	ANFO Usage (tons/year)	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
	AP-42, Table 13.3-1	4000	78.40	24.00	4.00	0.07	0.01

Mine Material Handling Emissions - Average Annual Ore Production			lbs/hour		tons/year	
Emission Type	Emission Source Description	Calculation Reference	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Storage Pile Wind Erosion	Daneros Ore Stockpile #1	AP-42, 13.2.5	0.015	0.002	0.064	0.010
	Bullseye Ore Stockpile #2	AP-42, 13.2.5	0.022	0.003	0.096	0.014
	South Ore Stockpile #3	AP-42, 13.2.5	0.449	0.067	1.966	0.295
	Daneros Development Rock Stockpile #1	AP-42, 13.2.5	0.411	0.062	1.799	0.270
	Bullseye Development Rock Stockpile #2	AP-42, 13.2.5	0.204	0.031	0.895	0.134
	Bullseye Development Rock Stockpile #3	AP-42, 13.2.5	0.122	0.018	0.533	0.080
	South Development Rock Stockpile #4	AP-42, 13.2.5	0.919	0.138	4.026	0.604
	Daneros Topsoil Stockpile #1	AP-42, 13.2.5	0.001	0.0002	0.004	0.001
	Bullseye Topsoil Stockpile #2	AP-42, 13.2.5	0.010	0.002	0.046	0.007
	South Topsoil Stockpile #3	AP-42, 13.2.5	0.020	0.003	0.086	0.013
	South Inert Material Stockpile	AP-42, 13.2.5	0.022	0.003	0.094	0.014
Material Handling	Low Profile Haul Truck Unload	AP-42, 13.2.4	0.024	0.004	0.018	0.003
	Front-end Loader Ore Loading	AP-42, 13.2.4	0.006	0.001	0.005	0.001
	Dozer Material Handling	AP-42, 11.9	0.183	0.026	0.803	0.112
		Total Emissions	2.407	0.359	10.435	1.557

Mine Storage Tank Emissions - Average Annual Ore Production			lbs/hour	tons/year
Emission Type	Emission Source Description	Calculation Reference	VOC	VOC
Storage Tanks	Diesel Storage Tanks	AP-42, 7.1, EPA Tanks 4.0.9D	0.002	0.008

Off-Site Highway Vehicle Tailpipe Vehicles - Average Annual Ore Production				Emissions (lbs/hour)						
Type	Calculation Reference	Horsepower	Operation hours per year	CO	HC	NO_X	PM_{10}	$PM_{2.5}$	SO_2	CO_2
Haul Trucks	www.dieselnet.com	300	4,317	61.51	5.16	15.87	2.78	2.78	0.019	246
Motor Grader	EPA Nonroad (2010)	175	520	1.00	0.15	1.74	0.08	0.08	0.002	72
Pick-up Trucks	www.dieselnet.com	250	2,433	0.93	0.03	0.04	0.004	0.004	0.018	38
			Total Emissions (lbs/hr)	63.4	5.3	17.7	2.9	2.9	0.04	356
			Daily Emissions (lbs/day)	1522.5	128.2	423.7	68.8	68.8	0.94	8,545
			Total Emissions (tons/yr)	22.6	1.9	6.2	1.0	1.0	0.01	331

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PROJECT AIR EMISSIONS - AVERAGE ANNUAL EMISSIONS BASED ON 25,000 TONS PER YEAR ORE PRODUCTION

Mine Site Vehicle Dust Emissions from Travelling on Unpaved Roads - Average Annual Ore Production				lbs/hour		tons/year	
Type	Calculation Reference	Horsepower	Vehicle Miles Travelled per year (VMT)	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Haul Trucks	AP-42, 13.2.2	300	563	0.96	0.10	0.16	0.02
Low-Profile Haul Trucks	AP-42, 13.2.2	150	5,367	1.14	0.11	1.31	0.13
Dump Truck	AP-42, 13.2.2	300	2,190	0.13	0.01	0.55	0.06
Pick-Up Trucks	AP-42, 13.2.2	250	3,843	0.09	0.01	0.37	0.04
Motor Grader	AP-42, 13.2.2	175	333	0.02	0.002	0.07	0.01
Water Truck	AP-42, 13.2.2	250	1,167	0.06	0.006	0.26	0.03
Tanker Truck	AP-42, 13.2.2	250	190	0.01	0.001	0.05	0.005
			Total Emissions	2.40	0.24	2.78	0.28

Highway Vehicle Dust Emissions from Off-site Unpaved Roads - Average Annual Ore Production				lbs/hour		tons/year	
Type	Calculation Reference	Horsepower	Vehicle Miles Travelled per year (VMT)	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Haul Trucks	AP-42, 13.2.2	300	25,000	170.85	17.09	28.48	2.85
Pick-Up Trucks	AP-42, 13.2.2	250	36,500	3.25	0.32	14.23	1.42
Motor Grader	AP-42, 13.2.2	175	2,600	0.49	0.05	2.15	0.22
			Total Emissions	174.59	17.46	44.86	4.49

White Mesa Mill; from Daneros Mine Project Environmental Assessment - Average Annual Ore Production		
Pollutant	Allowable Emissions White Mesa Mill (tons/year)	Mill Emission Attributable to Daneros Ore Supply at Average Mine Life Production (tons/year)
CO	10.5	0.4
HC	4.0	0.1
NO_X	39.6	1.4
PM_{10}	34.1	1.2
$PM_{2.5}$	17.1	0.6
SO_2	2.9	0.1

ENERGY FUELS RESOURCES (USA) INC; DANEROS MINE PROJECT
PROJECT AIR EMISSIONS - MAXIMUM ANNUAL EMISSIONS BASED ON 72,000 TONS PER YEAR ORE PRODUCTION

Project Emissions Summary - Peak Annual Emissions	Project Emissions (tons/year)						
	CO	HC	NO_X	PM_{10}	$PM_{2.5}$	SO_2	CO_2
Direct Project Emissions							
All Diesel Engines (stationary, portable, mobile)	85.0	9.6	90.8	3.3	3.3	0.2	14,379
On-Site Road Dust (controlled)	--	--	--	5.5	0.6	--	--
ANFO (blasting)	78.4	--	24.0	0.07	0.01	4.0	--
Fuel Storage Tanks	--	0.01	--	--	--	--	--
Material Handling	--	--	--	10.5	1.6	--	--
Annual Project Emissions (with 75% on-site road dust control)	163.4	9.6	114.8	19.3	5.4	4.2	14,379
Indirect Project Emissions							
Off-Site Road Dust (uncontrolled)	--	--	--	98.4	9.8	--	--
Off-Site Mobile Source Tailpipe	64.2	5.4	16.9	2.9	2.9	0.02	830
White Mesa Mill (emissions attributable to the Daneros Mine at peak mine production)	0.7	0.3	2.8	2.4	1.2	0.2	--

Mine Equipment Combustion Emissions - Peak Annual Ore Production				Emissions (lbs/hour)						
Type	Calculation Reference	Horsepower	Operation hours per year	CO	HC	NO_X	PM_{10}	$PM_{2.5}$	SO_2	CO_2
Surface Equipment										
Four 455 kW Electric Generators	Caterpillar	610	8760 each	13.989	1.603	13.989	0.404	0.404	0.028	2,970.2
One 140 HP Electric Generator	EPA Tier 4i	140	1,000	1.015	0.055	0.117	0.006	0.006	0.002	198.0
Portable Compressor	EPA Nonroad (2010)	375	1,000	2.149	0.331	3.638	0.124	0.124	0.004	307.4
Haul Trucks	www.dieselnet.com	300	108	10.251	0.860	2.646	0.463	0.463	0.003	122.9
Low-Profile Haul Trucks	EPA Nonroad (2010)	150	1,546	1.224	0.132	1.488	0.073	0.073	0.002	61.5
10-ton Dump Truck	EPA Nonroad (2010)	300	219	1.720	0.265	2.976	0.146	0.146	0.003	122.9
Motor Grader	EPA Nonroad (2010)	175	67	1.003	0.154	1.736	0.085	0.085	0.002	71.7
Water Truck	EPA Nonroad (2010)	250	117	1.433	0.220	2.480	0.083	0.083	0.003	102.5
Tanker Truck	EPA Nonroad (2010)	250	19	1.433	0.220	2.480	0.083	0.083	0.003	102.5
Front End Loaders	EPA Nonroad (2010)	70	1,040	0.571	0.062	0.802	0.046	0.046	0.001	28.7
Dozer	EPA Nonroad (2010)	150	1,040	1.224	0.132	1.488	0.073	0.073	0.002	61.5
Pick-Up Trucks	www.dieselnet.com	250	268	0.093	0.003	0.004	0.000	0.000	0.003	102.5
Underground Equipment										
Low-Profile haul trucks	EPA Nonroad (2010)	150	12,480	1.22	0.13	1.49	0.07	0.07	0.0016	61.5
3.5 cy diesel loaders	EPA Nonroad (2010)	154	7,488	1.26	0.14	1.53	0.07	0.07	0.0017	63.1
Skid steers	EPA Nonroad (2010)	80	2,496	0.65	0.07	0.92	0.05	0.05	0.001	32.8
Diesel Mantrips/Utility Vehicles	EPA Nonroad (2010)	75	11,232	0.61	0.07	0.86	0.05	0.05	0.0009	30.7
Water Truck	EPA Nonroad (2010)	250	500	1.43	0.22	2.48	0.08	0.08	0.0027	102.5
Exploration Long/Short Hole Machines	EPA Nonroad (2010)	75	2,496	0.61	0.07	0.86	0.05	0.05	0.0009	30.7
Development Drills, Jumbos	EPA Nonroad (2010)	400	1,000	3.26	0.35	3.97	0.19	0.19	0.0043	163.9
			Total Emissions (lbs/hr)	45.2	5.1	45.9	2.2	2.2	0.1	4,737
			Daily Emissions (lbs/day)	1083.7	122.0	1102.7	51.9	51.9	1.6	113,699
			Total Emissions (tons/yr)	85.0	9.6	90.8	3.3	3.3	0.2	14,379

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PROJECT AIR EMISSIONS - MAXIMUM ANNUAL EMISSIONS BASED ON 72,000 TONS PER YEAR ORE PRODUCTION

Blasting Emissions - ANFO - Peak Annual Ore Production			Emissions (tons/year)				
	Calculation Reference	ANFO Usage (tons/year)	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
	AP-42, Table 13.3-1	4000	78.4	24	4	0.07	0.01

Mine Material Handling Emissions - Peak Annual Ore Production			lbs/hour		tons/year	
Emission Type	Emission Source Description	Calculation Reference	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Storage Pile Wind Erosion	Daneros Ore Stockpile #1	AP-42, 13.2.5	0.015	0.002	0.064	0.010
	Bullseye Ore Stockpile #2	AP-42, 13.2.5	0.022	0.003	0.096	0.014
	South Ore Stockpile #3	AP-42, 13.2.5	0.449	0.067	1.966	0.295
	Daneros Development Rock Stockpile #1	AP-42, 13.2.5	0.411	0.062	1.799	0.270
	Bullseye Development Rock Stockpile #2	AP-42, 13.2.5	0.204	0.031	0.895	0.134
	Bullseye Development Rock Stockpile #3	AP-42, 13.2.5	0.122	0.018	0.533	0.080
	South Development Rock Stockpile #4	AP-42, 13.2.5	0.919	0.138	4.026	0.604
	Daneros Topsoil Stockpile #1	AP-42, 13.2.5	0.001	0.0002	0.004	0.001
	Bullseye Topsoil Stockpile #2	AP-42, 13.2.5	0.010	0.002	0.046	0.007
	South Topsoil Stockpile #3	AP-42, 13.2.5	0.020	0.003	0.086	0.013
	South Inert Material Stockpile	AP-42, 13.2.5	0.022	0.003	0.094	0.014
Material Handling	Low Profile Haul Truck Unload	AP-42, 13.2.4	0.024	0.004	0.052	0.008
	Front-end Loader Ore Loading	AP-42, 13.2.4	0.006	0.001	0.013	0.002
	Dozer Material Handling	AP-42, 11.9	0.183	0.026	0.803	0.112
		Total Emissions	2.407	0.359	10.477	1.564

Mine Storage Tank Emissions - Peak Annual Ore Production			lbs/hour	tons/year
Emission Type	Emission Source Description	Calculation Reference	VOC	VOC
Storage Tanks	Diesel Storage Tanks	AP-42, 7.1, EPA Tanks 4.0.9D	0.002	0.008

Off-Site Highway Vehicle Tailpipe Vehicles - Peak Annual Ore Production				Emissions (lbs/hour)						
Type	Calculation Reference	Horsepower	Operation hours per year	CO	HC	NO_X	PM_{10}	$PM_{2.5}$	SO_2	CO_2
Haul Trucks	www.dieselnet.com	300	12,432	61.51	5.16	15.87	2.78	2.78	0.019	246
Motor Grader	EPA Nonroad (2010)	175	520	1.00	0.15	1.74	0.08	0.08	0.002	72
Pick-up Trucks	www.dieselnet.com	250	2,433	0.93	0.03	0.04	0.004	0.004	0.018	38
			Total Emissions (lbs/hr)	63.4	5.3	17.7	2.9	2.9	0.04	356
			Daily Emissions (lbs/day)	1522.5	128.2	423.7	68.8	68.8	0.94	8,545
			Total Emissions (tons/yr)	64.2	5.4	16.9	2.9	2.9	0.02	830

ENERGY FUELS RESOURCES (USA) INC; DANEROS MINE PROJECT
PROJECT AIR EMISSIONS - MAXIMUM ANNUAL EMISSIONS BASED ON 72,000 TONS PER YEAR ORE PRODUCTION

Mine Site Vehicle Dust Emissions from Travelling on Unpaved Roads - Peak Annual Ore Production				lbs/hour		tons/year	
Type	Calculation Reference	Horsepower	Vehicle Miles Travelled per year (VMT)	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Haul Trucks	AP-42, 13.2.2	300	1,622	0.96	0.10	0.46	0.05
Low-Profile Haul Trucks	AP-42, 13.2.2	150	15,456	3.27	0.33	3.77	0.38
Dump Truck	AP-42, 13.2.2	300	2,190	0.13	0.01	0.55	0.06
Pick-Up Trucks	AP-42, 13.2.2	250	3,843	0.09	0.01	0.37	0.04
Motor Grader	AP-42, 13.2.2	175	333	0.02	0.002	0.07	0.01
Water Truck	AP-42, 13.2.2	250	1,167	0.06	0.006	0.26	0.03
Tanker Truck	AP-42, 13.2.2	250	190	0.01	0.001	0.05	0.005
			Total Emissions	4.53	0.45	5.54	0.55

Highway Vehicle Dust Emissions from Travelling on Off-site Unpaved Roads - Peak Annual Ore Production				lbs/hour		tons/year	
Type	Calculation Reference	Horsepower	Vehicle Miles Travelled per year (VMT)	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Haul Trucks	AP-42, 13.2.2	300	72,000	170.85	17.09	82.01	8.20
Pick-Up Trucks	AP-42, 13.2.2	250	36,500	3.25	0.32	14.23	1.42
Motor Grader	AP-42, 13.2.2	175	2,600	0.49	0.05	2.15	0.22
			Total Emissions	174.59	17.46	98.39	9.84

White Mesa Mill; from Daneros Mine Project Environmental Assessment - Peak Annual Ore Production		
Pollutant	Allowable Emissions White Mesa Mill (tons/year)	Mill Emission Attributable to Daneros Ore Supply at Peak Mine Production (tons/year)
CO	10.5	0.7
HC	4.0	0.3
NO_X	39.6	2.8
PM_{10}	34.1	2.4
$PM_{2.5}$	17.1	1.2
SO_2	2.9	0.2

ENERGY FUELS RESOURCES (USA) INC; DANEROS MINE PROJECT
PROJECT AIR EMISSIONS - MAXIMUM ANNUAL EMISSIONS BASED ON 72,000 TONS PER YEAR ORE PRODUCTION

Air Emission Calculation References and Assumptions	
1. Mine Equipment Combustion Emissions	
	References:
	Caterpillar Diesel Generator Set Specifications. Caterpillar 2011. www.Cat-ElectricPower.com
	Control of Emissions from New and In-Use Nonroad Compression-Ignition Engines; 40 CFR Part 1039
	Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition, U.S. Environmental Proection Agency,
	NR-009d, EPA-420-R-10-118, July 2010.
	Mandatory Greenhouse Gas Reporting; 40 CFR Part 98, Table C-1.
	Assumptions:
	Mobile and nonroad diesel equipment are a minimum of Tier 2 compliant
	Mobile and nonroad emissions are calculated using hours of operation values for mining equipment based on operational requirements.
	Operation hours assumptions are summarized in Tables A-10 and A-11.
2. Blasting Emissions	
	Reference:
	Compilation of Air Pollutant Emission Factors, AP-42, Table 13.3-1. U.S. Environmental Protection Agency, February 1980.
	Assumptions:
	4,000 tons per year ANFO usage
3. Mine Material Handling Emissions	
	References:
	Compilation of Air Pollutant Emission Factors, AP-42, Section 13.2.5. U.S. Environmental Protection Agency, November 2006.
	Compilation of Air Pollutant Emission Factors, AP-42, Section 13.2.4. U.S. Environmental Protection Agency, November 2006.
	Compilation of Air Pollutant Emission Factors, AP-42, Section 11.9. U.S. Environmental Protection Agency, October 1998.
	Assumptions:
	All storage piles are disturbed every day, thus making them subject to wind erosion
	Topsoil handling assumed to be an ongoing activity
4. Mine Storage Tank Emissions	
	Reference:
	Compilation of Air Pollutant Emission Factors, AP-42, Section 7.1. U.S. Environmental Protection Agency, November 2006, EPA Tanks 4.0.9D
5. Off-Site Highway Vehicle Tailpipe Vehicles	
	References:
	Summary of Emission Standards for mobile equipment (www.dieselnet.com/standards), accessed July 2013.
	Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition, U.S. Environmental Proection Agency,
	NR-009d, EPA-420-R-10-118, July 2010.
	Assumptions:
	Pick-up trucks (4) travel to and from the site daily between the mine and the access point to Highway 95.
	Motor grader travels 2 round trips per week along the unpaved access road.
	Haul truck travel calculated assuming 25 ton truck loads.
	Off-site highway vehicle tailpipe emissions are calculated using hours of operation values based on the expected vehicle miles travelled
	for each vehicle type. The operation hours assumptions are summarized in Tables A-12 and A-13.

ENERGY FUELS RESOURCES (USA) INC; DANEROS MINE PROJECT
PROJECT AIR EMISSIONS - MAXIMUM ANNUAL EMISSIONS BASED ON 72,000 TONS PER YEAR ORE PRODUCTION

Air Emission Calculation References and Assumptions - continued	
6. Vehicle Dust Emissions from Travelling on Unpaved Roads	
	Reference:
	Compilation of Air Pollutant Emission Factors, AP-42, Section 13.2.2. U.S. Environmental Protection Agency, November 2006.
	Assumptions:
	Pick-up trucks (4) travel to and from the site daily between the mine and the access point to Highway 95.
	Motor grader travels 2 round trips per week along the unpaved access road.
	Haul truck travel calculated assuming 25 ton truck loads.
	Up to 3 haul truck loads may take place per hour. For average annual production, 1,000 loads per year will be required
	(25,000 tpy/25 tons per load), and for the peak annual production, 2,880 loads per year will be required (72,000 tpy/25 tons per load).
	On-site unpaved roads controlled 75% with water or surfactant application.
	Off-site unpaved access road(Radium King Road) is not controlled with water or surfactant application.

TABLE A-1
ENERGY FUELS RESOURCES (USA) INC. - DANEROS MINE
STOCKPILE EMISSIONS - CRITERIA POLLUTANTS AT PEAK ANNUAL ORE PRODUCTION

Emission Source: **Wind Erosion of Stockpiles (Topsoil, Development Rock, and Ore), AP-42, Section 13.2.5, Industrial Wind Erosion**

Calculation Notes: Wind erosion emissions from stockpiles is calculated as a function of mean wind speed, threshold velocity, number of disturbances per year, the erosion potential, and particle size. The topsoil pile is seeded to mitigate fugitive dust. The ore and waste rock size range is from one to six inches.

Emission Equations:

$\mathbf{E_{uc} = P * A * k * N}$ **grams/year**

$\mathbf{P = 58(u'-u_t)^2 + 25(u'-u_t)}$

$\mathbf{u' = 0.1*u10*(u_s/u_r)}$

$\mathbf{u10 = u(\ln(10/0.005)/\ln(h/0.005))}$

$\mathbf{E_c = E_{uc}\ (100-C)/100}$

Example Calculation Topsoil Stockpile1:

P=58(1.062-1.02)2 + 25(1.062-1.02) = 1.15

u'= 0.1*11.8*(0.90) = 1.062

u10 = 26.4(ln(10/0.005)/ ln(10/0.005)) = 26.4

E_{uc} (PM_{10}) = 1.15 * 279 * 0.5 * 365 = 58,555 grams/year = 0.06 tpy

Where:

E_{uc} =	uncontrolled particle emissions (grams/year)
P =	pile erosion potential (grams/m^2-disturbance)
A =	pile surface area (m^2)
k =	aerodynamic Particle Size Multiplier (dimensionless)
N =	number of pile disturbances in one year (disturbances/year)
u' =	friction velocity (m/s)
u_t =	threshold velocity (m/s) found in AP-42, Table 13.2.5-2
u10 =	corrected fastest mile wind speed (m/s)
u_s/u_r=	ratio of surface wind speed to approach wind speed (unitless)
u =	fastest wind speed for the periods between disturbances (m/s)
h =	anemometer height (m)
E_c =	controlled particle emissions (grams/year)
C =	control efficiency (%)

Data:

k (PM_{10})=	0.5		
k ($PM_{2.5}$)=	0.075		
N =	365	disturbances/year	[assumed piles are disturbed once per day, 365 days/year]
u_t =	1.02	m/s for ore and dev. rock	[assumed threshold friction velocity for scoria, AP-4 13.2.5]
	1.02	m/s for topsoil	[assumed threshold friction velocity for overburden, AP-4 13.2.5]
u_s/u_r=	0.9		[assumed maximum value, taken from AP-42, Section 13.2.5; maximum value will produce maximum emissions]
u =	26.4	miles per hour	[fastest hourly wind speed in 2005 at Canyonlands National Park Island in the Sky meteorological station]
h =	10	m	[assumed anemometer height for Canyonlands National Park Island in the Sky meteorological station]
C =	90	%	[assumed control efficiency for seeding topsoil piles]

TABLE A-1 (Continued)
ENERGY FUELS RESOURCES (USA) INC. - DANEROS MINE
STOCKPILE EMISSIONS - CRITERIA POLLUTANTS

Emissions Estimate:

Pile	Pile Volume (cu. Yds.)	Annual Disturbed Area (ft^2)	Annual Uncontrolled PM_{10} Emissions		Annual Controlled PM_{10} Emissions		Annual Uncontrolled $PM_{2.5}$ Emissions		Annual Controlled $PM_{2.5}$ Emissions	
			(tons/yr)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	(lb/hr)
Daneros Ore Stockpile #1	494	3,000	0.06	0.01	0.06	0.01	0.010	0.002	0.010	0.002
Bullseye Ore Stockpile #2	773	4,500	0.10	0.02	0.10	0.02	0.014	0.003	0.014	0.003
South Ore Stockpile #3	16,940	91,800	1.97	0.45	1.97	0.45	0.295	0.067	0.295	0.067
Daneros Development Rock Stockpile #1	29,000	84,000	1.80	0.41	1.80	0.41	0.270	0.062	0.270	0.062
Bullseye Development Rock Stockpile #2	26,000	41,800	0.90	0.20	0.90	0.20	0.134	0.031	0.134	0.031
Bullseye Development Rock Stockpile #3	16,000	24,900	0.53	0.12	0.53	0.12	0.080	0.018	0.080	0.018
South Development Rock Stockpile #4	432,000	188,000	4.03	0.92	4.03	0.92	0.604	0.138	0.604	0.138
Daneros Topsoil Stockpile #1	3,700	2,100	0.04	0.01	0.00	0.00	0.007	0.002	0.001	0.000
Bullseye Topsoil Stockpile #2	5,000	21,400	0.46	0.10	0.05	0.01	0.069	0.016	0.007	0.002
South Topsoil Stockpile #3	11,800	40,300	0.86	0.20	0.09	0.02	0.129	0.030	0.013	0.003
South Inert Material Stockpile	12,969	44,100	0.94	0.22	0.09	0.02	0.142	0.032	0.014	0.003
TOTAL STORAGE PILE EMISSIONS			**11.69**	**2.67**	**9.61**	**2.19**	**1.75**	**0.40**	**1.44**	**0.33**

Note: It was assumed the entire surface area of a pile will be available for disturbance at any given time.

TABLE A-2
ENERGY FUELS RESOURCES (USA) INC. - DANEROS MINE
GENERATOR EMISSIONS - CRITERIA POLLUTANTS

Emission Factors Source: Manufacturer Data; 40 CFR Part 89
Calculation Notes: The calculations are based on specifications from the generator manufacturer and EPA Tier emission limits as noted.
Emission Equations: Hourly Emissions Per Unit (lbs/hr) = PR * (1.341 hp/kW) * E (g/hp-hr) * (lb/453.6 g)
Hourly Emissions Per Unit (lbs/hr) = E (lbs/gal fuel) * F
Annual emissions (tons/yr) = Hourly Emissions (lbs/hr) * OH * (ton/2000 lbs)
Where: PR = generator power rating (kW)
E = emission factor
F = maximum fuel usage (gal/hr)
OH = annual operating hours (hrs/yr)

Generator	Generator Rating (kW)	Fuel Usage (gal/hr)	Annual Operation Hours (hrs/yr)	Pollutant	Emission Factor per Unit	Units	Emission Factor Source	Emission Rate	
								Hourly Emissions (lb/hr)	Annual Emissions (tons/yr)
455_1 (Daneros Portal)	455	33	8760	CO	2.6	g/hp-hr	Caterpillar Emission Data[1]	3.50	15.32
				NO_X	2.60	g/hp-hr	Caterpillar Emission Data[1]	3.50	15.32
				$PM_{10}/PM_{2.5}$	0.075	g/hp-hr	Caterpillar Emission Data[1,2]	0.10	0.44
				VOC	0.298	g/hp-hr	Caterpillar Emission Data[1,3]	0.40	1.76
				SO_2	2.13E-04	lbs SO_2/gal fuel	Calculation[4]	0.01	0.03
455_2 (Daneros Portal)	455	33	8760	CO	2.6	g/hp-hr	Caterpillar Emission Data[1]	3.50	15.32
				NO_X	2.60	g/hp-hr	Caterpillar Emission Data[1]	3.50	15.32
				$PM_{10}/PM_{2.5}$	0.075	g/hp-hr	Caterpillar Emission Data[1,2]	0.10	0.44
				VOC	0.298	g/hp-hr	Caterpillar Emission Data[1,3]	0.40	1.76
				SO_2	2.13E-04	lbs SO_2/gal fuel	Calculation[4]	0.01	0.03
455_3 (Bullseye/South Portal)	455	33	8760	CO	2.6	g/hp-hr	Caterpillar Emission Data[1]	3.50	15.32
				NO_X	2.60	g/hp-hr	Caterpillar Emission Data[1]	3.50	15.32
				$PM_{10}/PM_{2.5}$	0.075	g/hp-hr	Caterpillar Emission Data[1,2]	0.10	0.44
				VOC	0.298	g/hp-hr	Caterpillar Emission Data[1,3]	0.40	1.76
				SO_2	2.13E-04	lbs SO_2/gal fuel	Calculation[4]	0.01	0.03
455_4 (South Portal)	455	33	8760	CO	2.6	g/hp-hr	Caterpillar Emission Data[1]	3.50	15.32
				NO_X	2.60	g/hp-hr	Caterpillar Emission Data[1]	3.50	15.32
				$PM_{10}/PM_{2.5}$	0.075	g/hp-hr	Caterpillar Emission Data[1,2]	0.10	0.44
				VOC	0.298	g/hp-hr	Caterpillar Emission Data[1,3]	0.40	1.76
				SO_2	2.13E-04	lbs SO_2/gal fuel	Calculation[4]	0.01	0.03
140_1 (Vent area)	132	8.8	1000	CO	2.6	g/hp-hr	EPA Tier 4i	1.01	0.51
				NO_X	0.30	g/hp-hr	EPA Tier 4i	0.12	0.06
				$PM_{10}/PM_{2.5}$	0.015	g/hp-hr	EPA Tier 4i	0.01	0.003
				VOC	0.14	g/hp-hr	EPA Tier 4i	0.05	0.03
				SO_2	2.13E-04	lb/gal	Calculation[4]	0.002	0.001
TOTAL EMISSIONS FOR ALL GENERATORS							**CO**	**15.00**	**61.78**
							NO_X	**14.11**	**61.33**
							$PM_{2.5}/PM_{10}$	**0.41**	**1.77**
							VOC	**1.66**	**7.05**
							SO_2	**0.03**	**0.12**

[1] Engine is certified EPA Tier 4i. Emission factors presented represent 100% load values. According to Caterpillar, these values cannot be directly compared with EPA Tier 4i standards which are based on a weighted cycle.

[2] It was assumed in this analysis that 100% of the PM emission factor comes from PM_{10}.

[3] It was assumed in this analysis that 100% of the Total Unburned Hydrocarbon emission factor comes from VOCs.

[4] Emission factor based on: SO2 (lbs/gal) = (0.0015 Wt% S in fuel) * (7.1 lb fuel/gal fuel) * (64 lb SO2/32 lb S)

TABLE A-3
ENERGY FUELS RESOURCES (USA) INC. - DANEROS MINE
GENERATOR EMISSIONS - GREENHOUSE GAS POLLUTANTS

Emission Source: **GENERATORS; 40 CFR Part 98, Table C-1**
Calculation Notes: Calculations are based on specifications from the generator manufacturer and the EPA GHG Reporting Rule.

Emission Equations: **Annual emissions (metric tons/yr) = 1 x 10^{-3} * Fuel * HHV * EF**
Total Emissions = Emissions per Unit * Number of Units

Where:
1 x 10^{-3} = Conversion from kg to metric tons
Fuel = Mass or volume of fuel combusted per year
HHV = Default high heat value of fuel
EF = Fuel emission factor

Data:	HHV (#2 Fuel Oil) =	0.138	mmBTU/gallon	Operation hours (OH):	OH (455)1 =	8760	hrs/yr
	CO_2 EF =	73.96	kg/mmBTU		OH (455)2 =	8760	hrs/yr
	CH_4 EF =	3.00E-03	kg/mmBTU		OH (455)3 =	8760	hrs/yr
	N_2O EF =	6.00E-04	kg/mmBTU		OH (455)4 =	8760	hrs/yr
Power Rating (PR):	PR (455)1 =	455	kW		OH (140) =	1000	hrs/yr
	PR (455)2 =	455	kW				
	PR (455)3 =	455	kW				
	PR (455)4 =	455	kW				
	PR (140) =	132	kW				
Fuel Usage (F):	F (455)1 =	33	gal/hr				
	F (455)2 =	33	gal/hr				
	F (455)3 =	33	gal/hr				
	F (455)4 =	33	gal/hr				
	F (140) =	9	gal/hr				

Global Warming Potential (GWP)	
CO_2 =	1
CH_4 =	21
N_2O =	310

Emissions Estimate:

Generator	Generator Rating (kW)	Pollutant	Emission Factor per Unit	Units	Emission Factor Source	Annual Emissions (kg/year)	Annual Emissions (metric tons/yr)	Annual Emissions (short tons/yr)
455_1 (South Portal)	455	CO_2	73.96	kg/mmBTU	40 CFR Part 98, Table C-1	2,950,489	2,950	3,252
		CH_4	3.00E-03	kg/mmBTU	40 CFR Part 98, Table C-1	119.7	0.120	0.132
		N_2O	6.00E-04	kg/mmBTU	40 CFR Part 98, Table C-1	23.9	0.024	0.026
455_2 (South Portal)	455	CO_2	73.96	kg/mmBTU	40 CFR Part 98, Table C-1	2,950,489	2,950	3,252
		CH_4	3.00E-03	kg/mmBTU	40 CFR Part 98, Table C-1	119.7	0.120	0.132
		N_2O	6.00E-04	kg/mmBTU	40 CFR Part 98, Table C-1	23.9	0.024	0.026
455_3 (Bullseye/South Portal)	455	CO_2	73.96	kg/mmBTU	40 CFR Part 98, Table C-1	2,950,489	2,950	3,252
		CH_4	3.00E-03	kg/mmBTU	40 CFR Part 98, Table C-1	119.7	0.120	0.132
		N_2O	6.00E-04	kg/mmBTU	40 CFR Part 98, Table C-1	23.9	0.024	0.026
455_4 (South Portal)	455	CO_2	73.96	kg/mmBTU	40 CFR Part 98, Table C-1	2,950,489	2,950	3,252
		CH_4	3.00E-03	kg/mmBTU	40 CFR Part 98, Table C-1	119.7	0.120	0.132
		N_2O	6.00E-04	kg/mmBTU	40 CFR Part 98, Table C-1	23.9	0.024	0.026
140_1 (Vent Area)	132	CO_2	73.96	kg/mmBTU	40 CFR Part 98, Table C-1	89,817	90	99
		CH_4	3.00E-03	kg/mmBTU	40 CFR Part 98, Table C-1	3.6	0.004	0.004
		N_2O	6.00E-04	kg/mmBTU	40 CFR Part 98, Table C-1	0.7	0.001	0.001
TOTAL EMISSIONS FOR ALL GENERATORS					CO_2	**11891774.0**	**11891.8**	**13108.4**
					CH_4	**482.4**	**0.5**	**0.5**
					N_2O	**96.5**	**0.1**	**0.1**
					CO_2e	**11,931,810**	**11,932**	**13,153**

TABLE A-4
ENERGY FUELS RESOURCES (USA) INC. - DANEROS MINE
LOW-PROFILE HAUL TRUCK MATERIAL HANDLING EMISSIONS - CRITERIA POLLUTANTS

Emission Factor Source: **AP-42, Section 13.2.4; "Aggregate Handling and Storage Piles"**

Calculation Notes: Ore and development rock (DR) is hauled to the surface using low-profile diesel haul trucks with capacities ranging from 10 to 20 tons. Ore is unloaded into ore storage areas and DR is unloaded into the development rock areas. It was assumed that all ore and DR produced is transported to the surface (i.e. no amount remains underground).

Emission Equations: Annual Emissions (tons/yr) = E * Pa * (ton/2000 lbs)

Hourly Emissions (lbs/hr) = E * Pd / H

$E = k*0.0032 *[((U/5)^{1.3})/((M/2)^{1.4})]$

Where:
- E = emission factor (lbs/ton)
- Pa = annual production rate (tons/yr)
- Pd = Maximum daily production rate (tons/day)
- H = working hours per year (hrs/yr)
- k = Aerodynamic Particle Size Multiplier (unitless)
- U = mean wind speed (mph)
- M = material moisture content (%)

Data:

k_{PM10} =	0.35 (unitless)	[aerodynamic particle size multiplier for PM_{10}]
$k_{PM2.5}$ =	0.053 (unitless)	[aerodynamic particle size multiplier for $PM_{2.5}$]
U =	6.39 mph	[mean wind speed from Canyonlands National Park]
M_{ore} =	5.5 %	[mean moisture content; based on Denison sample data]
M_{DR} =	3.5 %	[mean moisture content: based on Denison sample data]
H =	24 hrs/day	

E_{ore} (PM_{10}) =	3.74E-04	lbs/ton ore
E_{DR} (PM_{10})=	7.04E-04	lbs/ton rock
E_{ore} ($PM_{2.5}$) =	5.67E-05	lbs/ton ore
E_{DR} ($PM_{2.5}$)=	1.07E-04	lbs/ton rock

Example Calculation: PM_{10} Ore Unloading:
E_{ore} (PM_{10}) = 3.74E-04 * 24,000/2000 = 0.004 tpy

LOW-PROFILE HAUL TRUCK MATERIAL HANDLING EMISSIONS - AVERAGE ANNUAL ORE PRODUCTION

Material Handling	Storage Area	Pa (tons/yr)	Pd (tons/day)	PM_{10} Emissions		$PM_{2.5}$ Emissions	
				Hourly (lbs/hr)	Annual (tons/yr)	Hourly (lbs/hr)	Annual (tons/yr)
Ore Unloading	OS1	8,333	133	0.002	0.002	0.0003	0.000
	OS2	8,333	133	0.002	0.002	0.0003	0.000
	OS3	8,333	133	0.002	0.002	0.0003	0.000
Development Rock Unloading	DRA1	12,500	200	0.006	0.004	0.0009	0.001
	DRA2	6,250	100	0.003	0.002	0.0004	0.000
	DRA3	6,250	100	0.003	0.002	0.0004	0.000
	DRA4	12,500	200	0.006	0.004	0.0009	0.001
Total Emissions				**0.024**	**0.02**	**0.004**	**0.003**

LOW-PROFILE HAUL TRUCK MATERIAL HANDLING EMISSIONS - PEAK ANNUAL ORE PRODUCTION

Material Handling	Storage Area	Pa (tons/yr)	Pd (tons/day)	PM_{10} Emissions		$PM_{2.5}$ Emissions	
				Hourly (lbs/hr)	Annual (tons/yr)	Hourly (lbs/hr)	Annual (tons/yr)
Ore Unloading	OS1	24,000	133	0.002	0.004	0.0003	0.001
	OS2	24,000	133	0.002	0.004	0.0003	0.001
	OS3	24,000	133	0.002	0.004	0.0003	0.001
Development Rock Unloading	DRA1	36,000	200	0.006	0.013	0.0009	0.002
	DRA2	18,000	100	0.003	0.006	0.0004	0.001
	DRA3	18,000	100	0.003	0.006	0.0004	0.001
	DRA4	36,000	200	0.006	0.013	0.0009	0.002
Total Emissions				**0.024**	**0.05**	**0.004**	**0.008**

TABLE A-5
ENERGY FUELS RESOURCES (USA) INC. - DANEROS MINE
FRONT-END LOADER MATERIAL HANDLING EMISSIONS - CRITERIA POLLUTANTS

Emission Factor Source: **AP-42, Section 13.2.4; "Aggregate Handling and Storage Piles"**
Calculation Notes: Front-end loaders are used to move ore from the ore storage areas into haul trucks. Ore storage piles are temporary, and ore is transferred to haul trucks soon after removal from the mine.
Emission Equations: Annual Emissions (tons/yr) = E * Pa * (ton/2000 lbs)
Hourly Emissions (lbs/hr) = E * Pd / H
$E = k*0.0032 *[((U/5)^{1.3})/((M/2)^{1.4})]$

Where:
E = emission factor (lbs/ton)
Pa = annual production rate (tons/yr)
Pd = Maximum daily production rate (tons/day)
H = working hours per year (hrs/yr)
k = Aerodynamic Particle Size Multiplier (unitless)
U = mean wind speed (mph)
M = material moisture content (%)

Data:

k_{PM10} =	0.35 (unitless)	[aerodynamic particle size multiplier for PM_{10}]
$k_{PM2.5}$ =	0.053 (unitless)	[aerodynamic particle size multiplier for $PM_{2.5}$]
U =	6.39 mph	[mean wind speed from Canyonlands National Park]
M_{ore} =	5.5 %	[mean moisture content; based on Denison sample data]
H =	24 hrs/yr	

E_{ore} (PM_{10}) =	3.74E-04	lbs/ton ore
E_{ore} ($PM_{2.5}$) =	5.67E-05	lbs/ton ore

Example Calculation: PM_{10} Ore Unloading:
E_{ore} (PM_{10}) = 3.74E-04 * 24,000/2000 = 0.004 tpy

FRONT-END LOADER MATERIAL HANDLING EMISSIONS - AVERAGE ANNUAL ORE PRODUCTION

Material Handling	Storage Area	Pa (tons/yr)	Pd (tons/day)	PM_{10} Emissions		$PM_{2.5}$ Emissions	
				Hourly (lbs/hr)	Annual (tons/yr)	Hourly (lbs/hr)	Annual (tons/yr)
Ore Loading	OS1	8,333	133.3	0.002	0.002	0.0003	0.000
	OS2	8,333	133.3	0.002	0.002	0.0003	0.000
	OS3	8,333	133.3	0.002	0.002	0.0003	0.000
Total Emissions				**0.006**	**0.005**	**0.0009**	**0.001**

FRONT-END LOADER MATERIAL HANDLING EMISSIONS - PEAK ANNUAL ORE PRODUCTION

Material Handling	Storage Area	Pa (tons/yr)	Pd (tons/day)	PM_{10} Emissions		$PM_{2.5}$ Emissions	
				Hourly (lbs/hr)	Annual (tons/yr)	Hourly (lbs/hr)	Annual (tons/yr)
Ore Loading	OS1	24,000	133.3	0.002	0.004	0.0003	0.001
	OS2	24,000	133.3	0.002	0.004	0.0003	0.001
	OS3	24,000	133.3	0.002	0.004	0.0003	0.001
Total Emissions				**0.006**	**0.013**	**0.0009**	**0.002**

TABLE A-6
ENERGY FUELS RESOURCES (USA) INC. - DANEROS MINE
BULLDOZER MATERIAL HANDLING EMISSIONS - CRITERIA POLLUTANTS

Emission Factor Source: **AP-42, TABLE 11.9-4; "Uncontrolled Particulate Emission Factors for Open Dust Sources at Western Surface Coal Mines"**

Calculation Notes: A bulldozer will be used occasionally at the site for topsoil maintenance work. Once topsoil is placed in the topsoil storage areas, the piles will be seeded and the storage piles will no longer be active. Emissions were conservatively calculated assuming topsoil handli is an ongoing activity.

Emission Equations: Annual PM_{10} emissions (tons/yr) = E * P * (ton/2000 lbs)

Short-term PM_{10} emissions (lbs/hr) = E * P / H

Where:
E = emission factor (lbs/ton)
P = amount of topsoil produced annually (tons/yr)
H = working hours per year (hrs/yr)

Data:
E (PM_{10}) = 0.058 lb PM_{10}/ton topsoil (emission factor given in AP-42 is for TSP and assumed equal to PM_{10})
E ($PM_{2.5}$) = 0.008 lb $PM_{2.5}$/ton topsoil (emission factor is PM_{10} factor scaled by the ratio of $PM_{2.5}/PM_{10}$. The ratio is 0.105/0.75 = 0.14 based on scaling factors provided in AP-42, Table 11.9-1).
H = 8760 hrs/yr

Material	Storage Area	P (tons/yr)	PM_{10} Emissions		$PM_{2.5}$ Emissions	
			Hourly (lbs/hr)	Annual (tons/yr)	Hourly (lbs/hr)	Annual (tons/yr)
Topsoil	TS1	4,995	0.03	0.14	0.005	0.02
Topsoil	TS2	6,750	0.04	0.20	0.006	0.03
Topsoil	TS3	15,930	0.11	0.46	0.01	0.06
Total Topsoil Stripping Emissions			**0.18**	**0.80**	**0.03**	**0.11**

TABLE A-7
ENERGY FUELS RESOURCES (USA) INC. - DANEROS MINE
FUGITIVE UNPAVED ROAD EMISSIONS FROM VEHICLE TRAFFIC - CRITERIA POLLUTANTS - AVERAGE ANNUAL ORE PRODUCTION

Emission Factor Source: **AP-42, Section 13.2.2; "Unpaved Roads"**

Calculation Notes: Emissions of PM_{10} and $PM_{2.5}$ were calculated for on-site vehicle traffic by calculating an emission factor for each vehicle type and multiplying by the vehicle miles traveled (VMT) for each vehicle. Access to the mine is via unpaved, county maintained roads. Route CR D0029 traverses the proposed stockpiles and therefore will be restricted to the public across the mine site for safety purposes. Existing and proposed on-site roads will be used for travel between the portals and stockpiles. In most cases, the VMT is calculated by taking the frequency of use and multiplying by the quantity of material hauled divided by the capacity of the vehicle. The product is then multiplied by the haul road distance times two, to accommodate round-trips. When the VMT is not dependant on the amount of material being hauled (such as a pickup truck), the annual VMT is determined by multiplying the distance traveled per trip by an average number of trips per year. Dust suppression methods are applied to all regularly traveled on-site roadways as needed.

Emission Equations:

$$\mathbf{E_{uc} = k * (s/12)^a * (W/3)^b; \quad W = VW + (VC/2)}$$

$$\mathbf{E_c = E_{uc} * [(100 - C) / 100]}$$

Where:
- E_{uc} = uncontrolled emission factor (lbs/VMT)
- k = Aerodynamic Particle Size Multiplier (unitless)
- s = surface material silt content (%)
- a = particle size multiplier constant (unitless)
- W = mean vehicle weight (tons)
- b = particle size multiplier constant (unitless)
- E_c = controlled emission factor (lbs/VMT)
- C = control efficiency of surfactant used to mitigate fugitive dust emissions from roads (%)
- VW = vehicle weight (tons)
- VC = vehicle capacity (tons)

Hourly Uncontrolled Emissions (lbs/hr) = E_{uc} * (L_{hr} / L_{yr}) * (Annual VMT)
Annual Uncontrolled Emissions (tons/yr) = E_{uc} * (Annual VMT) * (ton/2000 lbs)
Hourly Controlled Emissions (lbs/hr) = E_c * (L_{hr} / L_{yr}) * (Annual VMT)
Annual Controlled Emissions (tons/yr) = E_c * (Annual VMT) * (ton/2000 lbs)

Where:
- L_{hr} = Amount of material hauled per hour (tons/hr)
- L_{yr} = Amount of material hauled per year (tons/yr)
- VMT = L_{yr} / Truck Capacity * D_{rt}
- D_{rt} = On-Site Round-Trip Hauling Distance (miles)

**NOTE: If L_{hr} and/or L_{yr} are not applicable (N/A), then the following equations for hourly emissions were used.

Annual Uncontrolled Emissions (tons/yr) = E_{uc} * (Annual VMT) * (ton/2000 lbs)
Hourly Uncontrolled Emissions (lbs/hr) = Annual Uncontrolled Emissions (tons/year) * (2000lbs/ton) / OH
Annual Controlled Emissions (tons/yr) = E_c * (Annual VMT) * (ton/2000 lbs)
Hourly Controlled Emissions (lbs/hr) = Annual Controlled Emissions (tons/year) * (2000lbs/ton) / OH

Where:
- VMT = Vehicle round-trips/year * D_{rt}
- OH = Annual operating hours (hrs/yr)

Data:

k (PM_{10}) =	1.5		[AP-42 13.2.2, Table 2]
k ($PM_{2.5}$) =	0.15		[AP-42 13.2.2, Table 2]
s =	5.8	%	[average silt content for a haul road at a taconite ore mining and processing facility (AP-42, 13.2.2)]
a =	0.9		[AP-42 13.2.2, Table 2]
b =	0.45		[AP-42 13.2.2, Table 2]
OH =	8760	hrs/yr	
C =	75	**%**	[control efficiency for roads sprayed with MgCl, CaCl, or water)

TABLE A-7 (cont.)
ENERGY FUELS RESOURCES (USA) INC. - DANEROS MINE
FUGITIVE UNPAVED ROAD EMISSIONS FROM VEHICLE TRAFFIC - CRITERIA POLLUTANTS - AVERAGE ANNUAL ORE PRODUCTION

Vehicle Type	Load Type	VW (tons)	VC (tons)	W (tons)	E_{uc} (PM_{10}) (lbs/VMT)	E_c (PM_{10}) (lbs/VMT)	L_{yr} (tons/yr)	L_{hr} (tons/hr)	D_{rt} (miles)	Annual VMT (VMT/yr)	Uncontrolled PM_{10} Emissions		Controlled PM_{10} Emissions		Uncontrolled $PM_{2.5}$ Emissions		Controlled $PM_{2.5}$ Emissions	
											Annual (tpy)	Hourly (lbs/hr)	Annual (tpy)	Hourly (lbs/hr)	Annual (tpy)	Hourly (lbs/hr)	Annual (tpy)	Hourly (lbs/hr)
Daneros Portal																		
Haul Trucks	Ore	20	25	33	2.3	0.6	8,333	25.0	0.83	276	0.31	1.89	0.08	0.47	0.031	0.189	0.008	0.047
Low-Profile Haul Trucks	Ore	20	6	23	1.9	0.5	8,333	3.6	0.13	174	0.17	0.15	0.04	0.04	0.017	0.015	0.004	0.004
	dev. Rock	20	6	23	1.9	0.5	12,500	5.4	0.36	752	0.73	0.64	0.18	0.16	0.073	0.064	0.018	0.016
Dump Truck	Various	20	10	25	2.0	0.5	N/A	N/A	1.0	730	0.74	0.17	0.18	0.04	0.074	0.017	0.018	0.004
Pick-Up Trucks	Various	3	N/A	3	0.78	0.2	N/A	N/A	1.0	1392	0.54	0.12	0.14	0.03	0.054	0.012	0.014	0.003
Motor Grader	N/A	16	N/A	16	1.7	0.4	N/A	N/A	1.3	132	0.11	0.02	0.03	0.01	0.011	0.002	0.003	0.001
Water Truck	Dust Suppr	15	8	19	1.8	0.4	N/A	N/A	1.3	462	0.41	0.09	0.10	0.02	0.041	0.009	0.010	0.002
Tanker Truck	Fuel	15	18	24	2.0	0.5	3076	N/A	0.93	161	0.16	0.04	0.04	0.01	0.016	0.004	0.004	0.001
Bullseye Portal																		
Haul Trucks	Ore	20	25	33	2.3	0.6	8,333	25.0	0.41	138	0.16	0.95	0.04	0.24	0.016	0.095	0.004	0.024
Low-Profile Haul Trucks	Ore	20	6	23	1.9	0.5	8,333	3.6	0.07	103	0.10	0.09	0.03	0.02	0.010	0.009	0.003	0.002
	dev. Rock	20	6	23	1.9	0.5	12,500	5.4	0.66	1377	1.34	1.17	0.34	0.29	0.134	0.117	0.034	0.029
Dump Truck	Various	20	10	25	2.0	0.5	N/A	N/A	1.0	730	0.74	0.17	0.18	0.04	0.074	0.017	0.018	0.004
Pick-Up Trucks	Various	3	N/A	3	0.78	0.2	N/A	N/A	0.53	769	0.30	0.07	0.07	0.02	0.030	0.007	0.007	0.002
Motor Grader	N/A	16	N/A	16	1.7	0.4	N/A	N/A	0.59	61	0.05	0.01	0.01	0.003	0.005	0.001	0.001	0.000
Water Truck	Dust Suppr	15	8	19	1.8	0.4	N/A	N/A	0.59	214	0.19	0.04	0.05	0.01	0.019	0.004	0.005	0.001
Tanker Truck	Fuel	15	18	24	2.0	0.5	1025	N/A	0.49	28	0.03	0.01	0.01	0.002	0.003	0.001	0.001	0.000
South Portal Site																		
Haul Trucks	Ore	20	25	33	2.3	0.6	8,333	25.0	0.45	149	0.17	1.02	0.04	0.25	0.017	0.102	0.004	0.025
Low-Profile Haul Trucks	Ore	20	6	23	1.9	0.5	8,333	3.6	0.60	827	0.81	0.70	0.20	0.17	0.081	0.070	0.020	0.017
	dev. Rock	20	6	23	1.9	0.5	12,500	5.4	1.02	2134	2.08	1.81	0.52	0.45	0.208	0.181	0.052	0.045
Dump Truck	Various	20	10	25	2.0	0.5	N/A	N/A	1.0	730	0.74	0.17	0.18	0.04	0.074	0.017	0.018	0.004
Pick-Up Trucks	Various	3	N/A	3	0.78	0.2	N/A	N/A	1.15	1682	0.66	0.15	0.16	0.04	0.066	0.015	0.016	0.004
Motor Grader	N/A	16	N/A	16	1.7	0.4	N/A	N/A	1.35	140	0.12	0.03	0.03	0.01	0.012	0.003	0.003	0.001
Water Truck	Dust Suppr	15	8	19	1.8	0.4	N/A	N/A	1.35	492	0.44	0.10	0.11	0.03	0.044	0.010	0.011	0.003
Tanker Truck	Fuel	15	18	24	2.0	0.5	31	N/A	0.44	1	7.7E-04	1.8E-04	1.9E-04	1.9E-04	1.9E-05	1.9E-05	1.9E-05	1.9E-05
										TOTAL ROAD TRAFFIC EMISSIONS	**11.10**	**9.58**	**2.78**	**2.40**	**1.11**	**0.96**	**0.28**	**0.24**

N/A = not applicable

Example Calculation - Daneros Ore Haul Truck PM_{10}:

$E_{uc} = k * (s/12)^a * (W/3)^b$

$E_{uc} = 1.5 * (5.8/12)^{0.9} * (33/3)^{0.45} = 2.3$ lbs/VMT

$E_c = 2.3 * [(100 - 75) / 100] = 0.6$ lbs/VMT

$PM_{10} = 0.6$ lb/VMT * 795 VMT/yr / 2000 lbs/ton = 0.23 tpy

TABLE A-8
ENERGY FUELS RESOURCES (USA) INC. - DANEROS MINE
FUGITIVE UNPAVED ROAD EMISSIONS FROM VEHICLE TRAFFIC - CRITERIA POLLUTANTS - PEAK ANNUAL ORE PRODUCTION

Emission Factor Source: **AP-42, Section 13.2.2; "Unpaved Roads"**

Calculation Notes: Emissions of PM_{10} and $PM_{2.5}$ were calculated for on-site vehicle traffic by calculating an emission factor for each vehicle type and multiplying by the vehicle miles traveled (VMT) for each vehicle. Access to the mine is via unpaved, county maintained roads. Route CR D0029 traverses the proposed stockpiles and therefore will be restricted to the public across the mine site for safety purposes. Existing and proposed on-site roads will be used for travel between the portals and stockpiles. In most cases, the VMT is calculated by taking the frequency of use and multiplying by the quantity of material hauled divided by the capacity of the vehicle. The product is then multiplied by the haul road distance times two, to accommodate round-trips. When the VMT is not dependant on the amount of material being hauled (such as a pickup truck), the annual VMT is determined by multiplying the distance traveled per trip by an average number of trips per year. Dust suppression methods are applied to all regularly traveled on-site roadways as needed.

Emission Equations:

$$\mathbf{E_{uc} = k * (s/12)^a * (W/3)^b; \quad W = VW + (VC/2)}$$

$$\mathbf{E_c = E_{uc} * [(100 - C) / 100]}$$

Where:
- E_{uc} = uncontrolled emission factor (lbs/VMT)
- k = Aerodynamic Particle Size Multiplier (unitless)
- s = surface material silt content (%)
- a = particle size multiplier constant (unitless)
- W = mean vehicle weight (tons)
- b = particle size multiplier constant (unitless)
- E_c = controlled emission factor (lbs/VMT)
- C = control efficiency of surfactant used to mitigate fugitive dust emissions from roads (%)
- VW = vehicle weight (tons)
- VC = vehicle capacity (tons)

Hourly Uncontrolled Emissions (lbs/hr) = E_{uc} * (L_{hr} / L_{yr}) * (Annual VMT)

Annual Uncontrolled Emissions (tons/yr) = E_{uc} * (Annual VMT) * (ton/2000 lbs)

Hourly Controlled Emissions (lbs/hr) = E_c * (L_{hr} / L_{yr}) * (Annual VMT)

Annual Controlled Emissions (tons/yr) = E_c * (Annual VMT) * (ton/2000 lbs)

Where:
- L_{hr} = Amount of material hauled per hour (tons/hr)
- L_{yr} = Amount of material hauled per year (tons/yr)
- VMT = L_{yr} / Truck Capacity * D_{rt}
- D_{rt} = On-Site Round-Trip Hauling Distance (miles)

**NOTE: If L_{hr} and/or L_{yr} are not applicable (N/A), then the following equations for hourly emissions were used.

Annual Uncontrolled Emissions (tons/yr) = E_{uc} * (Annual VMT) * (ton/2000 lbs)

Hourly Uncontrolled Emissions (lbs/hr) = Annual Uncontrolled Emissions (tons/year) * (2000lbs/ton) / OH

Annual Controlled Emissions (tons/yr) = E_c * (Annual VMT) * (ton/2000 lbs)

Hourly Controlled Emissions (lbs/hr) = Annual Controlled Emissions (tons/year) * (2000lbs/ton) / OH

Where:
- VMT = Vehicle round-trips/year * D_{rt}
- OH = Annual operating hours (hrs/yr)

Data:

k (PM_{10}) =	1.5		[AP-42 13.2.2, Table 2]
k ($PM_{2.5}$) =	0.15		[AP-42 13.2.2, Table 2]
s =	5.8	%	[average silt content for a haul road at a taconite ore mining and processing facility (AP-42, 13.2.2)]
a =	0.9		[AP-42 13.2.2, Table 2]
b =	0.45		[AP-42 13.2.2, Table 2]
OH =	8760	hrs/yr	
C =	75	**%**	[control efficiency for roads sprayed with MgCl, CaCl, or water)

TABLE A-8 (cont.)
ENERGY FUELS RESOURCES (USA) INC. - DANEROS MINE
FUGITIVE UNPAVED ROAD EMISSIONS FROM VEHICLE TRAFFIC - CRITERIA POLLUTANTS - PEAK ANNUAL ORE PRODUCTION

Vehicle Type	Load Type	VW (tons)	VC (tons)	W (tons)	E_{uc} (PM_{10}) (lbs/VMT)	E_c (PM_{10}) (lbs/VMT)	L_{yr} (tons/yr)	L_{hr} (tons/hr)	D_{rt} (miles)	Annual VMT (VMT/yr)	Uncontrolled PM_{10} Emissions		Controlled PM_{10} Emissions		Uncontrolled $PM_{2.5}$ Emissions		Controlled $PM_{2.5}$ Emissions	
											Annual (tpy)	Hourly (lbs/hr)	Annual (tpy)	Hourly (lbs/hr)	Annual (tpy)	Hourly (lbs/hr)	Annual (tpy)	Hourly (lbs/hr)
Daneros Portal																		
Haul Trucks	Ore	20	25	33	2.3	0.6	24,000	25.0	0.83	795	0.91	1.89	0.23	0.47	0.091	0.189	0.023	0.047
Low-Profile Haul Trucks	Ore	20	6	23	1.9	0.5	24,000	10.4	0.13	502	0.49	0.43	0.12	0.11	0.049	0.043	0.012	0.011
	dev. Rock	20	6	23	1.9	0.5	36,000	15.6	0.36	2165	2.11	1.83	0.53	0.46	0.211	0.183	0.053	0.046
Dump Truck	Various	20	10	25	2.0	0.5	N/A	N/A	1.0	730	0.74	0.17	0.18	0.04	0.074	0.017	0.018	0.004
Pick-Up Trucks	Various	3	N/A	3	0.78	0.2	N/A	N/A	1.0	1392	0.54	0.12	0.14	0.03	0.054	0.012	0.014	0.003
Motor Grader	N/A	16	N/A	16	1.7	0.4	N/A	N/A	1.3	132	0.11	0.02	0.03	0.01	0.011	0.002	0.003	0.001
Water Truck	Dust Suppr	15	8	19	1.8	0.4	N/A	N/A	1.3	462	0.41	0.09	0.10	0.02	0.041	0.009	0.010	0.002
Tanker Truck	Fuel	15	18	24	2.0	0.5	3076	N/A	0.93	161	0.16	0.04	0.04	0.01	0.016	0.004	0.004	0.001
Bullseye Portal																		
Haul Trucks	Ore	20	25	33	2.3	0.6	24,000	25.0	0.41	398	0.45	0.95	0.11	0.24	0.045	0.095	0.011	0.024
Low-Profile Haul Trucks	Ore	20	6	23	1.9	0.5	24,000	10.4	0.07	296	0.29	0.25	0.07	0.06	0.029	0.025	0.007	0.006
	dev. Rock	20	6	23	1.9	0.5	36,000	15.6	0.66	3966	3.87	3.36	0.97	0.84	0.387	0.336	0.097	0.084
Dump Truck	Various	20	10	25	2.0	0.5	N/A	N/A	1.0	730	0.74	0.17	0.18	0.04	0.074	0.017	0.018	0.004
Pick-Up Trucks	Various	3	N/A	3	0.78	0.2	N/A	N/A	0.53	769	0.30	0.07	0.07	0.02	0.030	0.007	0.007	0.002
Motor Grader	N/A	16	N/A	16	1.7	0.4	N/A	N/A	0.59	61	0.05	0.01	0.01	0.003	0.005	0.001	0.001	0.000
Water Truck	Dust Suppr	15	8	19	1.8	0.4	N/A	N/A	0.59	214	0.19	0.04	0.05	0.01	0.019	0.004	0.005	0.001
Tanker Truck	Fuel	15	18	24	2.0	0.5	1025	N/A	0.49	28	0.03	0.01	0.01	0.002	0.003	0.001	0.001	0.000
South Portal Site																		
Haul Trucks	Ore	20	25	33	2.3	0.6	24,000	25.0	0.45	429	0.49	1.02	0.12	0.25	0.049	0.102	0.012	0.025
Low-Profile Haul Trucks	Ore	20	6	23	1.9	0.5	24,000	10.4	0.60	2381	2.32	2.02	0.58	0.50	0.232	0.202	0.058	0.050
	dev. Rock	20	6	23	1.9	0.5	36,000	15.6	1.02	6146	5.99	5.20	1.50	1.30	0.599	0.520	0.150	0.130
Dump Truck	Various	20	10	25	2.0	0.5	N/A	N/A	1.0	730	0.74	0.17	0.18	0.04	0.074	0.017	0.018	0.004
Pick-Up Trucks	Various	3	N/A	3	0.78	0.2	N/A	N/A	1.15	1682	0.66	0.15	0.16	0.04	0.066	0.015	0.016	0.004
Motor Grader	N/A	16	N/A	16	1.7	0.4	N/A	N/A	1.35	140	0.12	0.03	0.03	0.01	0.012	0.003	0.003	0.001
Water Truck	Dust Suppr	15	8	19	1.8	0.4	N/A	N/A	1.35	492	0.44	0.10	0.11	0.03	0.044	0.010	0.011	0.003
Tanker Truck	Fuel	15	18	24	2.0	0.5	31	N/A	0.44	1	7.7E-04	1.8E-04	1.9E-04	1.9E-04	1.9E-05	1.9E-05	1.9E-05	1.9E-05
TOTAL ROAD TRAFFIC EMISSIONS											**22.14**	**18.12**	**5.54**	**4.53**	**2.21**	**1.81**	**0.55**	**0.45**

N/A = not applicable

Example Calculation - Daneros Ore Haul Truck PM_{10}:

$E_{uc} = k * (s/12)^a * (W/3)^b$

$E_{uc} = 1.5 * (5.8/12)^{0.9} * (33/3)^{0.45} = 2.3$ lbs/VMT

$E_c = 2.3 * [(100 - 75) / 100] = 0.6$ lbs/VMT

$PM_{10} = 0.6$ lb/VMT * 795 VMT/yr / 2000 lbs/ton = 0.23 tpy

TABLE A-9
ENERGY FUELS RESOURCES (USA) INC. - DANEROS MINE
FUGITIVE UNPAVED ROAD EMISSIONS FROM OFF-SITE VEHICLE TRAFFIC - CRITERIA POLLUTANTS

Emission Factor Source: **AP-42, Section 13.2.2; "Unpaved Roads"**

Calculation Notes: Emissions of PM_{10} and $PM_{2.5}$ were calculated for off-site vehicle traffic by calculating an emission factor for each vehicle type and multiplying by the vehicle miles traveled (VMT). Access to the mine is via an unpaved, county maintained road named Radium King Road (Route CR D0029).
In most cases, the VMT is calculated by taking the frequency of use and multiplying by the quantity of material hauled divided by the capacity of the vehicle. The product is then multiplied by the haul road distance times two, to accommodate round-trips. When the VMT is not dependant on the amount of material being hauled (such as a pickup truck), the annual VMT is determined by multiplying the distance traveled per trip by an average number of trips per year. Dust suppression methods are applied to the county road as applicable.

Emission Equations: $\mathbf{E_{uc} = k * (s/12)^a * (W/3)^b;\quad W = VW + (VC/2)}$

$\mathbf{E_c = E_{uc} * [(100 - C) / 100]}$

Where:
E_{uc} = uncontrolled emission factor (lbs/VMT)
k = Aerodynamic Particle Size Multiplier (unitless)
s = surface material silt content (%)
a = particle size multiplier constant (unitless)
W = mean vehicle weight (tons)
b = particle size multiplier constant (unitless)
E_c = controlled emission factor (lbs/VMT)
C = control efficiency of surfactant used to mitigate fugitive dust emissions from roads (%)
VW = vehicle weight (tons)
VC = vehicle capacity (tons)

Hourly Uncontrolled Emissions (lbs/hr) = E_{uc} * (L_{hr} / L_{yr}) * (Annual VMT)
Annual Uncontrolled Emissions (tons/yr) = E_{uc} * (Annual VMT) * (ton/2000 lbs)
Hourly Controlled Emissions (lbs/hr) = E_c * (L_{hr} / L_{yr}) * (Annual VMT)
Annual Controlled Emissions (tons/yr) = E_c * (Annual VMT) * (ton/2000 lbs)

Where:
L_{hr} = Amount of material hauled per hour (tons/hr)
L_{yr} = Amount of material hauled per year (tons/yr)
VMT = L_{yr} / Truck Capacity * D_{rt}
D_{rt} = On-Site Round-Trip Hauling Distance (miles)

**NOTE: If L_{hr} and/or L_{yr} are not applicable (N/A), then the following equations for hourly emissions were used.
Annual Uncontrolled Emissions (tons/yr) = E_{uc} * (Annual VMT) * (ton/2000 lbs)
Hourly Uncontrolled Emissions (lbs/hr) = Annual Uncontrolled Emissions (tons/year) * (2000lbs/ton) / OH
Annual Controlled Emissions (tons/yr) = E_c * (Annual VMT) * (ton/2000 lbs)
Hourly Controlled Emissions (lbs/hr) = Annual Controlled Emissions (tons/year) * (2000lbs/ton) / OH

Where:
VMT = Vehicle round-trips/year * D_{rt}
OH = Annual operating hours (hrs/yr)

Data:

k (PM_{10}) =	1.5		[AP-42 13.2.2, Table 2]
k ($PM_{2.5}$) =	0.15		[AP-42 13.2.2, Table 2]
s =	5.8	%	[average silt content for a haul road at a taconite ore mining and processing facility (AP-42, 13.2.2)]
a =	0.9		[AP-42 13.2.2, Table 2]
b =	0.45		[AP-42 13.2.2, Table 2]
OH =	8760	hrs/yr	
C =	0	**%**	

TABLE A-9 (cont.)
ENERGY FUELS RESOURCES (USA) INC. - DANEROS MINE
FUGITIVE UNPAVED ROAD EMISSIONS FROM OFF-SITE VEHICLE TRAFFIC - CRITERIA POLLUTANTS

FUGITIVE UNPAVED ROAD EMISSIONS FROM OFF-SITE VEHICLE TRAFFIC - AVERAGE ANNUAL ORE PRODUCTION																			
Vehicle Type	**Load Type**	**VW (tons)**	**VC (tons)**	**W (tons)**	**E_{uc} (PM_{10}) (lbs/VMT)**	**E_c (PM_{10}) (lbs/VMT)**	**L_{yr} (tons/yr)**	**L_{hr} (tons/hr)**	**D_{rt} (miles)**	**Annual VMT (VMT/yr)**	**Uncontrolled PM_{10} Emissions**		**Controlled PM_{10} Emissions**		**Uncontrolled $PM_{2.5}$ Emissions**		**Controlled $PM_{2.5}$ Emissions**	
											Annual (tpy)	**Hourly (lbs/hr)**	**Annual (tpy)**	**Hourly (lbs/hr)**	**Annual (tpy)**	**Hourly (lbs/hr)**	**Annual (tpy)**	**Hourly (lbs/hr)**
Haul Trucks	Ore	20	25	33	2.3	2.3	25,000	75.0	25.0	25,000	28.48	170.85	28.48	170.85	2.848	17.085	2.848	17.085
Pick-Up Trucks	Various	3	N/A	3	0.78	0.8	N/A	N/A	25.0	36,500	14.23	3.25	14.23	3.25	1.423	0.325	1.423	0.325
Motor Grader	N/A	16	N/A	16	1.7	1.7	N/A	N/A	25.0	2,600	2.15	0.49	2.15	0.49	0.215	0.049	0.215	0.049
										TOTAL ROAD TRAFFIC EMISSIONS	**44.86**	**174.59**	**44.86**	**174.59**	**4.49**	**17.46**	**4.49**	**17.46**

N/A = not applicable

FUGITIVE UNPAVED ROAD EMISSIONS FROM OFF-SITE VEHICLE TRAFFIC - PEAK ANNUAL ORE PRODUCTION																			
Vehicle Type	**Load Type**	**VW (tons)**	**VC (tons)**	**W (tons)**	**E_{uc} (PM_{10}) (lbs/VMT)**	**E_c (PM_{10}) (lbs/VMT)**	**L_{yr} (tons/yr)**	**L_{hr} (tons/hr)**	**D_{rt} (miles)**	**Annual VMT (VMT/yr)**	**Uncontrolled PM_{10} Emissions**		**Controlled PM_{10} Emissions**		**Uncontrolled $PM_{2.5}$ Emissions**		**Controlled $PM_{2.5}$ Emissions**	
											Annual (tpy)	**Hourly (lbs/hr)**	**Annual (tpy)**	**Hourly (lbs/hr)**	**Annual (tpy)**	**Hourly (lbs/hr)**	**Annual (tpy)**	**Hourly (lbs/hr)**
Haul Trucks	Ore	20	25	33	2.3	2.3	72,000	75.0	25.0	72,000	82.01	170.85	82.01	170.85	8.201	17.085	8.201	17.085
Pick-Up Trucks	Various	3	N/A	3	0.78	0.8	N/A	N/A	25.0	36,500	14.23	3.25	14.23	3.25	1.423	0.325	1.423	0.325
Motor Grader	N/A	16	N/A	16	1.7	1.7	N/A	N/A	25.0	2,600	2.15	0.49	2.15	0.49	0.215	0.049	0.215	0.049
										TOTAL ROAD TRAFFIC EMISSIONS	**98.39**	**174.59**	**98.39**	**174.59**	**9.84**	**17.46**	**9.84**	**17.46**

N/A = not applicable

Example Calculation - Daneros Ore Haul Truck PM_{10}:

$E_{uc} = k * (s/12)^a * (W/3)^b$

$E_{uc} = 1.5 * (5.8/12)^{0.9} * (33/3)^{0.45} = 2.3$ lbs/VMT

$PM_{10} = 2.3$ lb/VMT * 72,000 VMT/yr / 2000 lbs/ton = 82.01 tpy

TABLE A-10
ENERGY FUELS RESOURCES (USA) INC. - DANEROS MINE
ON-SITE VEHICLE TAILPIPE EMISSIONS - AVERAGE ANNUAL ORE PRODUCTION

Emission Source: **TAILPIPE EMISSIONS FROM ON-SITE MOBILE SOURCES**

Pollutants: **PM_{10}, NOx, CO, VOCs, SO_2, CO_2**

Emission Factor Reference: **EPA NONROAD EMISSION FACTORS[1,2]**

Explanation: Tailpipe emissions of criteria pollutants from on-site mobile equipment were estimated using the EPA's NONROAD engine emission factors (EPA 2010) and the Summary of Emission Standards for mobile equipment (www.dieselnet.com/standards). These emission factors apply to surface mobile equipment, including industrial and construction equipment. Emissions are calculated by taking the emission factor and multiplying by the engine horsepower rating. The emission factor for pick-up trucks is in grams per mile. The CO_2 emission factor is from 40 CFR Part 98, Table C-1

Emission Equations:
Hourly emissions (lbs/hr) = E * PR (hp) * (lb/453.6 g)
Annual emissions (tons/yr) = Hourly emissions * OH * (ton/2000 lbs)
Where: E = emission factor (grams/horsepower-hour, or g/hp-hr)
PR = engine power rating (hp)
OH = annual operating hours on mine surface (hrs/yr)

ON-SITE VEHICLE TAILPIPE EMISSIONS - AVERAGE ANNUAL ORE PRODUCTION

Vehicle Type	E (g/hp-hr)[3]						PR (hp)	Annual VMT	OH[4] (hrs/yr)	Hourly Emissions (lb/hr)					Annual Emissions (tons/yr)					
	CO	NOx	$PM_{2.5}$/ PM_{10}	VOCs	SO_2	CO_2				CO	NOx	$PM_{2.5}$/ PM_{10}	VOCs	SO_2	CO	NOx	$PM_{2.5}$/ PM_{10}	VOCs	SO_2	CO_2
Haul Truck	15.50	4.00	0.70	1.30	0.0048	185.9	300	563	38	10.25	2.65	0.46	0.86	0.003	0.19	0.05	0.01	0.02	0.0001	2.3
Low-Profile Haul Truck	3.70	4.50	0.22	0.40	0.0049	185.9	150	5,367	537	1.22	1.49	0.07	0.13	0.002	0.33	0.40	0.02	0.04	0.0004	16.5
Motor Grader	2.60	4.50	0.22	0.40	0.0049	185.9	175	333	67	1.00	1.74	0.08	0.15	0.002	0.03	0.06	0.00	0.01	0.0001	2.4
Water Truck	2.60	4.50	0.15	0.40	0.0049	185.9	250	1,167	117	1.43	2.48	0.08	0.22	0.003	0.08	0.14	0.00	0.01	0.0002	6.0
Tanker Truck	2.60	4.50	0.15	0.40	0.0049	185.9	250	190	19	1.43	2.48	0.08	0.22	0.003	0.01	0.02	0.00	0.00	0.0000	1.0
Front End Loader	3.70	5.20	0.30	0.40	0.0054	185.9	70	--	1,040	0.57	0.80	0.05	0.06	0.001	0.30	0.42	0.02	0.03	0.0004	14.9
Dozer	3.70	4.50	0.22	0.40	0.0049	185.9	150	--	1,040	1.22	1.49	0.07	0.13	0.002	0.64	0.77	0.04	0.07	0.0008	32.0
10 Ton Dump Truck	2.60	4.50	0.22	0.40	0.0049	185.9	300	2,190	219	1.72	2.98	0.15	0.26	0.003	0.19	0.33	0.02	0.03	0.0004	13.5
Portable Compressor	2.60	4.40	0.15	0.40	0.0049	185.9	375	--	2,000	2.15	3.64	0.12	0.33	0.004	2.15	3.64	0.12	0.33	0.0040	153.7
	E (gram/mile)																			
Pick-Up Truck[3]	4.20	0.20	0.02	0.13	0.1220	4648	250	930	93	0.093	0.004	0.0004	0.003	0.003	0.00	0.00	0.00	0.00	0.0001	4.8
	Total On-Site Tailpipe Emissions:									**21.10**	**19.74**	**1.17**	**2.38**	**0.02**	**3.93**	**5.83**	**0.24**	**0.53**	**0.007**	**246.9**

1 Nonroad tailpipe exhaust emission factors were taken from the EPA's Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition, NR-009d, EPA-420-R-10-018, July 2010. Emission factors are included for NOx, total hydrocarbons (THC), NOx+THC, CO, and PM. For the Daneros Mine emission inventory, it was assumed that all THC were VOCs and all PM was PM_{10}. Tier 2 emission factors were assumed for equipment and NOx/THC breakouts for combined NOx/THC emission factors were taken from EPA's Nonroad engine exhaust document (EPA 2010). Tailpipe emissions from haul trucks and pick-up trucks fall under on-road mobile sources. These emission factors were taken from the Summary of Emission Standards for mobile equipment (www.dieselnet.com/standards), accessed July 8, 2013.

2 In the NONROAD model, sulfur oxide (SOx) emissions are calculated as a function of brake specific fuel consumption (BSFC) factors and hydrocarbon emission factors. SOx emission factors were calculated using a formula presented in the NONROAD support document "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling—Compression-Ignition", July 2010. The calculation is as follows:

SO_2 = [BSFC * (453.6g/lb) * (1 - soxcnv) - HC] * (0.01/%) * soxdsl * (2g SO_2/g S)

where:

SO_2 = SO_2 emission factor (g/hp-hr)

BSFC = brake specific fuel consumption factor (lb/hp-hr) (BSFC = 0.408 for 70-100hp and 0.367 for 100-400hp)

soxcnv = fraction of fuel sulfur converted to direct PM (=0.00247)

HC = THC emission factor (g/hp-hr)

soxdsl = sulfur content of the diesel fuel (%) (soxdsl = 0.0015%)

To estimate the gram per mile SO_2 emission factor for pickup trucks, the g/hp-hr emission factor was multiplied by the engine horsepower and divided by the estimated vehicle speed.

3 Emission Factor units for the pick-up trucks is given in grams per mile (g/mile). The calculations assume 10 miles in an hour of pick-up truck operation.

4 To calculate operating hours (OH), it was assumed that haul trucks travel at 15 miles per hour (mph) per the UDEQ Approval Order; pick-up trucks, water trucks, tanker trucks, and dump trucks travel at 10 mph; and motor graders travel at 5 mph. Annual operation hours were estimated directly for front end loaders, dozers, and compressors.

TABLE A-11
ENERGY FUELS RESOURCES (USA) INC. - DANEROS MINE
ON-SITE VEHICLE TAILPIPE EMISSIONS - PEAK ANNUAL ORE PRODUCTION

Emission Source: **TAILPIPE EMISSIONS FROM ON-SITE MOBILE SOURCES**

Pollutants: **PM_{10}, NOx, CO, VOCs, SO_2, CO_2**

Emission Factor Reference: **EPA NONROAD EMISSION FACTORS[1,2]**

Explanation: Tailpipe emissions of criteria pollutants from on-site mobile equipment were estimated using the EPA's NONROAD engine emission factors (EPA 2010) and the Summary of Emission Standards for mobile equipment (www.dieselnet.com/standards). These emission factors apply to surface mobile equipment, including industrial and construction equipment. Emissions are calculated by taking the emission factor and multiplying by the engine horsepower rating. The emission factor for pick-up trucks is in grams per mile. The CO_2 emission factor is from 40 CFR Part 98, Table C-1

Emission Equations: **Hourly emissions (lbs/hr) = E * PR (hp) * (lb/453.6 g)**
Annual emissions (tons/yr) = Hourly emissions * OH * (ton/2000 lbs)
Where: E = emission factor (grams/horsepower-hour, or g/hp-hr)
PR = engine power rating (hp)
OH = annual operating hours on mine surface (hrs/yr)

ON-SITE VEHICLE TAILPIPE EMISSIONS - PEAK ANNUAL ORE PRODUCTION

Vehicle Type	E (g/hp-hr)[3]						PR (hp)	Annual VMT	OH[4] (hrs/yr)	Hourly Emissions (lb/hr)					Annual Emissions (tons/yr)					
	CO	NOx	$PM_{2.5}$/ PM_{10}	VOCs	SO_2	CO_2				CO	NOx	$PM_{2.5}$/ PM_{10}	VOCs	SO_2	CO	NOx	$PM_{2.5}$/ PM_{10}	VOCs	SO_2	CO_2
Haul Truck	15.50	4.00	0.70	1.30	0.0048	185.9	300	1,622	108	10.25	2.65	0.46	0.86	0.003	0.55	0.14	0.03	0.05	0.0002	6.6
Low-Profile Haul Truck	3.70	4.50	0.22	0.40	0.0049	185.9	150	15,456	1,546	1.22	1.49	0.07	0.13	0.002	0.95	1.15	0.06	0.10	0.0012	47.5
Motor Grader	2.60	4.50	0.22	0.40	0.0049	185.9	175	333	67	1.00	1.74	0.08	0.15	0.002	0.03	0.06	0.00	0.01	0.0001	2.4
Water Truck	2.60	4.50	0.15	0.40	0.0049	185.9	250	1,167	117	1.43	2.48	0.08	0.22	0.003	0.08	0.14	0.00	0.01	0.0002	6.0
Tanker Truck	2.60	4.50	0.15	0.40	0.0049	185.9	250	190	19	1.43	2.48	0.08	0.22	0.003	0.01	0.02	0.00	0.00	0.0000	1.0
Front End Loader	3.70	5.20	0.30	0.40	0.0054	185.9	70	--	1,040	0.57	0.80	0.05	0.06	0.001	0.30	0.42	0.02	0.03	0.0004	14.9
Dozer	3.70	4.50	0.22	0.40	0.0049	185.9	150	--	1,040	1.22	1.49	0.07	0.13	0.002	0.64	0.77	0.04	0.07	0.0008	32.0
10 Ton Dump Truck	2.60	4.50	0.22	0.40	0.0049	185.9	300	2,190	219	1.72	2.98	0.15	0.26	0.003	0.19	0.33	0.02	0.03	0.0004	13.5
Portable Compressor	2.60	4.40	0.15	0.40	0.0049	185.9	375	--	2,000	2.15	3.64	0.12	0.33	0.004	2.15	3.64	0.12	0.33	0.0040	153.7
	E (gram/mile)																			
Pick-Up Truck[3]	4.20	0.20	0.02	0.13	0.1220	4648	250	2,677	268	0.093	0.004	0.0004	0.003	0.003	0.01	0.00	0.00	0.00	0.0004	13.7
	Total On-Site Tailpipe Emissions:									**21.10**	**19.74**	**1.17**	**2.38**	**0.02**	**4.91**	**6.67**	**0.29**	**0.63**	**0.008**	**291.2**

1 Nonroad tailpipe exhaust emission factors were taken from the EPA's Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition, NR-009d, EPA-420-R-10-018, July 2010. Emission factors are included for NOx, total hydrocarbons (THC), NOx+THC, CO, and PM. For the Daneros Mine emission inventory, it was assumed that all THC were VOCs and all PM was PM_{10}. Tier 2 emission factors were assumed for equipment and NOx/THC breakouts for combined NOx/THC emission factors were taken from EPA's Nonroad engine exhaust document (EPA 2010). Tailpipe emissions from haul trucks and pick-up trucks fall under on-road mobile sources. These emission factors were taken from the Summary of Emission Standards for mobile equipment (www.dieselnet.com/standards), accessed July 8, 2013.

2 In the NONROAD model, sulfur oxide (SOx) emissions are calculated as a function of brake specific fuel consumption (BSFC) factors and hydrocarbon emission factors. SOx emission factors were calculated using a formula presented in the NONROAD support document "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling—Compression-Ignition", July 2010. The calculation is as follows:

SO_2 = [BSFC * (453.6g/lb) * (1 - soxcnv) - HC] * (0.01/%) * soxdsl * (2g SO_2/g S)

where:

SO_2 = SO_2 emission factor (g/hp-hr)

BSFC = brake specific fuel consumption factor (lb/hp-hr) (BSFC = 0.408 for 70-100hp and 0.367 for 100-400hp)

soxcnv = fraction of fuel sulfur converted to direct PM (=0.00247)

HC = THC emission factor (g/hp-hr)

soxdsl = sulfur content of the diesel fuel (%) (soxdsl = 0.0015%)

To estimate the gram per mile SO_2 emission factor for pickup trucks, the g/hp-hr emission factor was multiplied by the engine horsepower and divided by the estimated vehicle speed.

3 Emission Factor units for the pick-up trucks is given in grams per mile (g/mile). The calculations assume 10 miles in an hour of pick-up truck operation.

4 To calculate operating hours (OH), it was assumed that haul trucks travel at 15 miles per hour (mph) per the UDEQ Approval Order; pick-up trucks, water trucks, tanker trucks, and dump trucks travel at 10 mph; and motor graders travel at 5 mph. Annual operation hours were estimated directly for front end loaders, dozers, and compressors.

TABLE A-12
ENERGY FUELS RESOURCES (USA) INC. - DANEROS MINE
OFF-SITE VEHICLE TAILPIPE EMISSIONS - AVERAGE ANNUAL ORE PRODUCTION

Emission Source: **TAILPIPE EMISSIONS FROM OFF-SITE MOBILE SOURCES**

Pollutants: **PM_{10}, NOx, CO, VOCs, SO_2, CO_2**

Emission Factor Reference: **EPA ONROAD EMISSION FACTORS[1,2]**

Explanation: Tailpipe emissions of criteria pollutants from off-site mobile equipment travel were estimated using the EPA's Summary of Emission Standards for mobile equipment (www.dieselnet.com/standards). These emission factors apply to haul trucks travelling between the mine site and the White Mesa Mill, located in Blanding, Utah, and pick-up trucks travelling on Radium King Road to the mine site from the Fry Canyon Store and RV Park. In addition, a motor grader will occassionaly blade the unpaved access road. Emissions are calculated by taking the emission factor and multiplying by the engine horsepower rating for haul trucks. The emission factor for pick-up trucks is in grams per mile. The CO_2 emission factor is from 40 CFR Part 98, Table C-1.

Emission Equations: **Hourly emissions (lbs/hr) = E * PR (hp) * (lb/453.6 g)**
Annual emissions (tons/yr) = Hourly emissions * OH * (ton/2000 lbs)
Where: E = emission factor (grams/horsepower-hour, or g/hp-hr)
PR = engine power rating (hp)
OH = annual operating hours on mine surface (hrs/yr)

OFF-SITE VEHICLE TAILPIPE EMISSIONS - AVERAGE ANNUAL ORE PRODUCTION

Vehicle Type	E (g/hp-hr)						PR (hp)	Annual VMT[3]	OH[4] (hrs/yr)	Hourly Emissions (lb/hr)					Annual Emissions (tons/yr)					
	CO	NOx	$PM_{2.5}$/ PM_{10}	VOCs	SO_2	CO_2				CO	NOx	$PM_{2.5}$/ PM_{10}	VOCs	SO_2	CO	NOx	$PM_{2.5}$/ PM_{10}	VOCs	SO_2	CO_2
Haul Truck Travel - unpaved	15.50	4.00	0.70	1.30	0.0048	185.9	300	25,000	1,667	30.75	7.94	1.39	2.58	0.01	8.54	2.20	0.39	0.72	0.00	102.5
Haul Truck Travel - paved	15.50	4.00	0.70	1.30	0.0048	185.9	300	106,000	2,650	30.75	7.94	1.39	2.58	0.01	13.58	3.51	0.61	1.14	0.00	162.9
Motor Grader - unpaved	2.60	4.50	0.22	0.40	0.0049	185.9	175	2,600	520	1.00	1.74	0.08	0.15	0.00	0.26	0.45	0.02	0.04	0.00	18.6

Vehicle Type	E (g/mile)						PR (hp)	Annual VMT[5]		Hourly Emissions (lb/hr)					Annual Emissions (tons/yr)					
	CO	NOx	$PM_{2.5}$/ PM_{10}	VOCs	SO_2	CO_2				CO	NOx	$PM_{2.5}$/ PM_{10}	VOCs	SO_2	CO	NOx	$PM_{2.5}$/ PM_{10}	VOCs	SO_2	CO_2
Pick-Up Truck	4.20	0.20	0.02	0.13	0.0813	1162	250	36,500		0.926	0.044	0.004	0.028	0.018	0.169	0.008	0.001	0.005	0.003	46.7

	Hourly Emissions (lb/hr)					Annual Emissions (tons/yr)					
	CO	NOx	$PM_{2.5}$/ PM_{10}	VOCs	SO_2	CO	NOx	$PM_{2.5}$/ PM_{10}	VOCs	SO_2	CO_2
Total On-Site Tailpipe Emissions:	**63.44**	**17.65**	**2.87**	**5.34**	**0.04**	**22.56**	**6.17**	**1.02**	**1.90**	**0.011**	**330.8**

1 Emission factors are included for NOx, total hydrocarbons (THC), NOx+THC, CO, and PM. For the Daneros Mine emission inventory, it was assumed that all THC were VOCs and all PM was PM_{10}. Tailpipe emissions from haul trucks and pick-up trucks fall under on-road mobile sources. These emission factors were taken from the Summary of Emission Standards for mobile equipment (www.dieselnet.com/standards), accessed July 8, 2013.

2 Sulfur oxide (SOx) emissions are calculated as a function of brake specific fuel consumption (BSFC) factors and hydrocarbon emission factors. SOx emission factors were calculated using a formula presented in the NONROAD support document "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling—Compression-Ignition", July 2010
The calculation is as follows:
SO_2 = [BSFC * (453.6g/lb) * (1 - soxcnv) - HC] * (0.01/%) * soxdsl * (2g SO_2/g S)
where:
SO_2 = SO_2 emission factor (g/hp-hr)
BSFC = brake specific fuel consumption factor (lb/hp-hr) (BSFC = 0.408 for 70-100hp and 0.367 for 100-300hp)
soxcnv = fraction of fuel sulfur converted to direct PM (=0.00247)
HC = THC emission factor (g/hp-hr)
soxdsl = sulfur content of the diesel fuel (%) (soxdsl = 0.0015%)
To estimate the gram per mile SO_2 emission factor for pickup trucks, the g/hp-hr emission factor was multiplied by the engine horsepower and divided by the estimated vehicle speed.

3 The one-way distance on Radium King Road to Highway 95 is 12.5 miles. Therefore the round-trip (RT) distance is 25 miles. The one-way distance from the Highway 95 intersect (at Fry Canyon) to the White Mesa Mill in Blanding is 53 miles. Therefore, the RT distance on this road segement is 106 miles. Annual vehicle miles travelled (VMT) are calculated by dividing the average annual production (25,000 tpy) by the haul truck capacity (25 ton) to determine the number of annual RTs (1,000 RTs/yr). The number of RTs is then multiplied by the RT distance. The motor grader may make up to 2 RTs per week.

4 To calculate operating hours (OH) for haul trucks, it was assumed that haul trucks travel at 15 miles per hour (mph) over Radium King Road per the UDEQ Approval Order, and 40 mph on the paved roads between the mine and the White Mesa Mill. The motor grader is assumed to travel at 5 mph. To calculate operating hours, the total VMT was divided by the vehicle speed to determine the annual operation hours for the haul trucks for each leg of the haul route. For purposes of calculating hourly emissions, it was assumed that a maximum of three RT haul truck trips occur in one hour.

5 Pick-up trucks are assumed to travel at 15 mph on Radium King Road. It was assumed that 4 pick-up RTs occur each day between the mine site and Highway 95. Assuming 365 days per year operation, the annual number of RTs will be 1,460 RTs per year. Multiplying the RTs per year by the RT distance yields the total VMT.

TABLE A-13
ENERGY FUELS RESOURCES (USA) INC. - DANEROS MINE
OFF-SITE VEHICLE TAILPIPE EMISSIONS - PEAK ANNUAL ORE PRODUCTION

Emission Source: **TAILPIPE EMISSIONS FROM OFF-SITE MOBILE SOURCES**

Pollutants: **PM_{10}, NOx, CO, VOCs, SO_2, CO_2**

Emission Factor Reference: **EPA ONROAD EMISSION FACTORS[1,2]**

Explanation: Tailpipe emissions of criteria pollutants from off-site mobile equipment travel were estimated using the EPA's Summary of Emission Standards for mobile equipment (www.dieselnet.com/standards). These emission factors apply to haul trucks travelling between the mine site and the White Mesa Mill, located in Blanding, Utah, and pick-up trucks travelling on Radium King Road to the mine site from the Fry Canyon Store and RV Park. In addition, a motor grader will occassionaly blade the unpaved access road. Emissions are calculated by taking the emission factor and multiplying by the engine horsepower rating for haul trucks. The emission factor for pick-up trucks is in grams per mile. The CO_2 emission factor is from 40 CFR Part 98, Table C-1.

Emission Equations: **Hourly emissions (lbs/hr) = E * PR (hp) * (lb/453.6 g)**
Annual emissions (tons/yr) = Hourly emissions * OH * (ton/2000 lbs)
Where: E = emission factor (grams/horsepower-hour, or g/hp-hr)
PR = engine power rating (hp)
OH = annual operating hours on mine surface (hrs/yr)

OFF-SITE VEHICLE TAILPIPE EMISSIONS - PEAK ANNUAL ORE PRODUCTION

Vehicle Type	E (g/hp-hr)						PR (hp)	Annual VMT[3]	OH[4] (hrs/yr)	Hourly Emissions (lb/hr)					Annual Emissions (tons/yr)					
	CO	NOx	$PM_{2.5}$/ PM_{10}	VOCs	SO_2	CO_2				CO	NOx	$PM_{2.5}$/ PM_{10}	VOCs	SO_2	CO	NOx	$PM_{2.5}$/ PM_{10}	VOCs	SO_2	CO_2
Haul Truck Travel - unpaved	15.50	4.00	0.70	1.30	0.0048	185.9	300	72,000	4,800	30.75	7.94	1.39	2.58	0.01	24.60	6.35	1.11	2.06	0.01	295.1
Haul Truck Travel - paved	15.50	4.00	0.70	1.30	0.0048	185.9	300	305,280	7,632	30.75	7.94	1.39	2.58	0.01	39.12	10.10	1.77	3.28	0.01	469.2
Motor Grader - unpaved	2.60	4.50	0.22	0.40	0.0049	185.9	175	2,600	520	1.00	1.74	0.08	0.15	0.00	0.26	0.45	0.02	0.04	0.00	18.6

Vehicle Type	E (g/mile)						PR (hp)	Annual VMT[5]		Hourly Emissions (lb/hr)					Annual Emissions (tons/yr)					
	CO	NOx	$PM_{2.5}$/ PM_{10}	VOCs	SO_2	CO_2				CO	NOx	$PM_{2.5}$/ PM_{10}	VOCs	SO_2	CO	NOx	$PM_{2.5}$/ PM_{10}	VOCs	SO_2	CO_2
Pick-Up Truck	4.20	0.20	0.02	0.13	0.0813	1162	250	36,500		0.926	0.044	0.004	0.028	0.018	0.169	0.008	0.001	0.005	0.003	46.7

Total On-Site Tailpipe Emissions:	**63.44**	**17.65**	**2.87**	**5.34**	**0.04**	**64.15**	**16.90**	**2.90**	**5.39**	**0.024**	**829.6**

1 Emission factors are included for NOx, total hydrocarbons (THC), NOx+THC, CO, and PM. For the Daneros Mine emission inventory, it was assumed that all THC were VOCs and all PM was PM_{10}. Tailpipe emissions from haul trucks and pick-up trucks fall under on-road mobile sources. These emission factors were taken from the Summary of Emission Standards for mobile equipment (www.dieselnet.com/standards), accessed July 8, 2013.

2 Sulfur oxide (SOx) emissions are calculated as a function of brake specific fuel consumption (BSFC) factors and hydrocarbon emission factors. SOx emission factors were calculated using a formula presented in the NONROAD support document "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling—Compression-Ignition", July 2010
The calculation is as follows:
SO_2 = [BSFC * (453.6g/lb) * (1 - soxcnv) - HC] * (0.01/%) * soxdsl * (2g SO_2/g S)
where:
SO_2 = SO_2 emission factor (g/hp-hr)
BSFC = brake specific fuel consumption factor (lb/hp-hr) (BSFC = 0.408 for 70-100hp and 0.367 for 100-300hp)
soxcnv = fraction of fuel sulfur converted to direct PM (=0.00247)
HC = THC emission factor (g/hp-hr)
soxdsl = sulfur content of the diesel fuel (%) (soxdsl = 0.0015%)
To estimate the gram per mile SO_2 emission factor for pickup trucks, the g/hp-hr emission factor was multiplied by the engine horsepower and divided by the estimated vehicle speed.

3 The one-way distance on Radium King Road to Highway 95 is 12.5 miles. Therefore the round-trip (RT) distance is 25 miles. The one-way distance from the Highway 95 intersect (at Fry Canyon) to the White Mesa Mill in Blanding is 53 miles. Therefore, the RT distance on this road segement is 106 miles. Annual vehicle miles travelled (VMT) are calculated by dividing the peak annual production (72,000 tpy) by the haul truck capacity (25 ton) to determine the number of annual RTs (2,880 RTs/yr). The number of RTs is then multiplied by the RT distance. The motor grader may make up to 2 RTs per week.

4 To calculate operating hours (OH) for haul trucks, it was assumed that haul trucks travel at 15 miles per hour (mph) over Radium King Road per the UDEQ Approval Order, and 40 mph on the paved roads between the mine and the White Mesa Mill. The motor grader is assumed to travel at 5 mph. To calculate operating hours, the total VMT was divided by the vehicle speed to determine the annual operation hours for the haul trucks for each leg of the haul route. For purposes of calculating hourly emissions, it was assumed that a maximum of three RT haul truck trips occur in one hour.

5 Pick-up trucks are assumed to travel at 15 mph on Radium King Road. It was assumed that 4 pick-up RTs occur each day between the mine site and Highway 95. Assuming 365 days per year operation, the annual number of RTs will be 1,460 RTs per year. Multiplying the RTs per year by the RT distance yields the total VMT.

TABLE A-14
ENERGY FUELS RESOURCES (USA) INC. - DANEROS MINE
UNDERGROUND EQUIPMENT TAILPIPE EMISSIONS

Emission Source: **TAILPIPE EMISSIONS FROM UNDERGROUND MOBILE SOURCES**

Pollutants: **PM_{10}, NOx, CO, VOCs, SO_2**

Emission Factor Reference: **EPA NONROAD EMISSION FACTORS[1,2]**

Explanation: Tailpipe emissions of criteria pollutants from underground mobile equipment were estimated using the EPA's NONROAD engine emission factors (EPA 2010). These emission factors apply to underground mobile equipment, including industrial and construction equipment. Emissions are calculated by taking the emission factor and multiplying by the engine horsepower rating. The CO_2 emission factor is from 40 CFR Part 98, Table C-1

Emission Equations:

Hourly emissions (lbs/hr) = E * PR (hp) * (lb/453.6 g)

Annual emissions (tons/yr) = Hourly emissions * OH * (ton/2000 lbs)

Where: E = emission factor (grams/horsepower-hour, or g/hp-hr)
PR = engine power rating (hp)
OH = annual operating hours (hrs/yr)

Vehicle Type	Number	E (g/hp-hr)						PR (hp)	OH[3] (hrs/yr)	Hourly Emissions (lb/hr)					Annual Emissions (tons/yr)					
		CO	NOx	$PM_{2.5}$/ PM_{10}	VOCs	SO_2	CO_2			CO	NOx	$PM_{2.5}$/ PM_{10}	VOCs	SO_2	CO	NOx	$PM_{2.5}$/ PM_{10}	VOCs	SO_2	CO_2
Low-Profile haul trucks	10	3.70	4.50	0.22	0.40	0.0049	185.9	150	12,480	1.22	1.49	0.07	0.13	0.002	7.63	9.29	0.45	0.83	0.0100	384
3.5 cy diesel loaders	6	3.70	4.50	0.22	0.40	0.0049	185.9	154	7,488	1.26	1.53	0.07	0.14	0.002	4.70	5.72	0.28	0.51	0.0062	236
Skid steers	2	3.70	5.20	0.30	0.40	0.0054	185.9	80	2,496	0.65	0.92	0.05	0.07	0.001	0.81	1.14	0.07	0.09	0.0012	41
Diesel Mantrips/Utility Vehicles	9	3.70	5.20	0.30	0.40	0.0054	185.9	75	11,232	0.61	0.86	0.05	0.07	0.001	3.44	4.83	0.28	0.37	0.0050	173
Water Truck	1	2.60	4.50	0.15	0.40	0.0049	185.9	250	500	1.43	2.48	0.08	0.22	0.003	0.36	0.62	0.02	0.06	0.0007	26
Exploration Long/Short Hole Machines	2	3.70	5.20	0.30	0.40	0.0054	185.9	75	2,496	0.61	0.86	0.05	0.07	0.001	0.76	1.07	0.06	0.08	0.0011	38
Development Drills, Jumbos	2	3.70	4.50	0.22	0.40	0.0049	185.9	400	1,000	3.26	3.97	0.19	0.35	0.004	1.63	1.98	0.10	0.18	0.0021	82
	Total Underground Equipment Tailpipe Emissions:									**9.05**	**12.10**	**0.58**	**1.04**	**0.01**	**19.34**	**24.66**	**1.26**	**2.11**	**0.026**	**979**

1 Nonroad tailpipe exhaust emission factors were taken from the EPA's Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition, NR-009d, EPA-420-R-10-018, July 2010. Emission factors are included for NOx, total hydrocarbons (THC), NOx+THC, CO, and PM. For the Daneros Mine emission inventory, it was assumed that all THC were VOCs and all PM was PM_{10}. Tier 2 emission factors were assumed for equipment and NOx/THC breakouts for combined NOx/THC emission factors were taken from EPA's Nonroad engine exhaust document (EPA 2010).

2 In the NONROAD model, sulfur oxide (SOx) emissions are calculated as a function of brake specific fuel consumption (BSFC) factors and hydrocarbon emission factors. SOx emission factors were calculated using a formula presented in the NONROAD support document "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling—Compression-Ignition", July 2010. The calculation is as follows:

SO_2 = [BSFC * (453.6g/lb) * (1 - soxcnv) - HC] * (0.01/%) * soxdsl * (2g SO_2/g S)

where:

SO_2 = SO_2 emission factor (g/hp-hr)

BSFC = brake specific fuel consumption factor (lb/hp-hr) (BSFC = 0.408 for 70-100hp and 0.367 for 100-300hp)

soxcnv = fraction of fuel sulfur converted to direct PM (=0.00247)

HC = THC emission factor (g/hp-hr)

soxdsl = sulfur content of the diesel fuel (%) (soxdsl = 0.0015%)

3 Operating hours (OH) for underground equipment were conservatively estimated to operate 1/2 the total expected average mine operating hours of (4 days per week, 12 hours per day), except for the explosives truck and drill air compressors which were assumed to operate 500 hours per year.

TABLE A-15
ENERGY FUELS RESOURCES (USA) INC. - DANEROS MINE
UNDERGROUND BLASTING EMISSIONS - ANFO

Emission Source: **Blasting emissions using ANFO**

Pollutants: **PM_{10}, NOx, CO, VOCs, SO_2**

Emission Factor Reference: **Emission Estimation Technique Manual for Explosives Detonation and Firing Ranges. National Pollutant Inventory. Tables 2 and 4. March 1999. Gaseous Pollutants**

WRAP Fugitive Dust Handbook. Prepared by Countess Environmental. Prepared for the Western Governor's Association. September 2006. Table 11-7, Particualate Matter

Explanation: Blasting operations will be conducted to break apart rock within the ore seam. ANFO will be used as the explosive to accomplish the blasting operations. Emission factors in lb/ton explosive are multiplied by the ANFO usage to estimate pollutant emissions.

Emission Equations: **Hourly emissions (lbs/hr) = EF (lb/ton) * ANFO (tons/hr)**

Annual emissions (ton/year) = EF (lb/ton) * ANFO (tons/year)

ANFO Usage		Emission Factor (lb/ton)			Hourly Emissions (lbs/hour)			Annual Emissions (tons/year)		
(tons/hour)	(tons/year)	CO	NO_X	SO_2	CO	NO_X	SO_2	CO	NO_X	SO_2
7	4000	39.2	12	2	274.4	84	14	78.4	24	4

Total Material Processed		(lb/ton)		(lbs/hour)		(tons/year)	
(tons/hour)	(tons/year)	PM_{10}	$PM_{2.5}$ [a]	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
599	180,000	0.0008	0.00012	0.4792	0.07188	0.072	0.0108

a Assumes a $PM_{2.5}/PM_{10}$ ratio of 0.15 (WRAP 2006)

TABLE A-16
ENERGY FUELS RESOURCES (USA) INC. - DANEROS MINE
STORAGE TANK EMISSIONS - CRITERIA POLLUTANTS

Emission Estimate Source: **EPA TANKS 4.0.9D Storage Tank Emissions Calculation Software (2005)**
Pollutants: **VOCs**
Calculation Notes: Volatile organic compound (VOC) and hazardous air pollutant (HAP) emissions were calculated using EPA's TANKS 4.0.9D. Storage tank specifications were used as input into the EPA TANKS model. The TANKS model output files are attached.

Mine Area	Storage Tank	Tank Contents	Tank Volume (gallons)	Tank Orientation	Tank Length (ft)	Tank Diameter (ft)	Tank Width (ft)	Tank Height (ft)	Equivalent Diameter (ft)	Average Liquid Height (ft)	Turnovers per Year per Tank	Annual VOC Emissions		
												(lbs/year)	(tons/year)	(lbs/hr)
Daneros Portal Site	AST_1	Diesel	6,000	H	16.0	8.0	N/A	10.0	N/A	4.0	28	3.55	1.78E-03	4.05E-04
	AST_2	Diesel	6,000	H	16.0	8.0	N/A	10.0	N/A	4.0	28	3.55	1.78E-03	4.05E-04
Bullseye Portal Site	AST_3	Diesel	6,000	H	16.0	8.0	N/A	10.0	N/A	4.0	48	4.42	2.21E-03	5.05E-04
South Portal Site	AST_4	Diesel	6,000	H	16.0	8.0	N/A	10.0	N/A	4.0	48	4.41	2.21E-03	5.03E-04
											TOTAL TANK EMISSIONS:	**15.93**	**0.01**	**0.002**

N/A - Not applicable.