Appendix 2-A
Transportation Plan

Transportation Plan

Sheep Mountain Project

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Presented to:

Bureau of Land Management
Lander Field Office
Lander, WY

August 2014

TRANSPORTATION PLAN
SHEEP MOUNTAIN PROJECT

1.1 INTRODUCTION

This Transportation Plan addresses traffic and road use associated with the Energy Fuels Resources (USA) Inc. (Energy Fuels) Sheep Mountain Uranium Project. The Project Area is located in Fremont County, Wyoming, approximately 8 miles south of Jeffrey City, 57 miles southeast of Lander, 62 miles southeast of Riverton, 67 miles north of Rawlins, and 105 miles southwest of Casper.

Open pit and underground mining methods will be used to extract uranium ore from the Project Area. Ore will either be processed on-site using heap leach methods and a process plant or off-site at an existing processing facility in Sweetwater County. Based on currently identified resources, the open pit mine (Congo Pit) is expected to have an 8 year mine life. Development of the Sheep Underground Mine will be deferred for up to 5 years and is expected to have an 11 year mine life. The anticipated Project life is approximately 20 years from initial construction through final reclamation.

The Sheep Mountain Project Area will be accessed using existing federal and state highways and county roads. Access routes and rights-of-way are pre-existing. Within the Project Area, Energy Fuels has identified up to 0.9 miles of existing roads that would require upgrades and up to 1.7 miles of new road construction.

This Transportation Plan addresses roads that may be used to access the Project Area and roads within the Project Area. The plan describes existing roads and roads identified for upgrade/construction; identifies the parties responsible for road maintenance; and estimates traffic levels associated with construction and operation of the Project.

1.2 ACCESS ROUTES

1.2.1 Primary Access Routes in the Vicinity of the Project Area

Road types, or functional classifications, describe the functions that roads serve in facilitating traffic flows within a transportation network. Arterial roads, such as interstates and state highways, connect population centers, accommodate high traffic volumes and have limited access. Collector roads include federal, state, county, and municipal roads that provide primary access through towns or to large blocks of land, and are generally two lanes wide. Table 1 lists the arterial and collector roads in the Project Area’s transportation network that could be used for Project access. The table also indicates road surfacing and identifies the parties responsible for road maintenance.

Table 1
Potential Access Routes

Road Name	Road Type	Surface Type	Maintenance Responsibility
US Highway 287	Arterial	Paved	WYDOT[1]
Wyoming State Highway (WY) 135 (Sand Draw Road)	Arterial	Paved	WYDOT[1]
WY 136 (Gas Hills Road)	Arterial	Paved	WYDOT[1]
WY 220	Arterial	Paved	WYDOT[1]
WY 789	Arterial	Paved	WYDOT[1]
Crooks Gap Road (Fremont County Road –CR 318)	Collector	Unpaved[2]	Fremont County
Wamsutter Road (Sweetwater CR 4-23	Collector	Unpaved[2]	Sweetwater County
Bairoil Road (Sweetwater CR 4-22)	Collector	Unpaved	Sweetwater County, Sweetwater Mine[3]
Minerals Exploration Road (Sweetwater CR 4-63)	Collector	Unpaved between Sweetwater CR 4-23 and Sweetwater Mill. Paved between Sweetwater Mill and Carbon County line.	Sweetwater County, Sweetwater Mine[3]
BLM Road 3206	Collector	Paved	BLM, Sweetwater Mine[4]

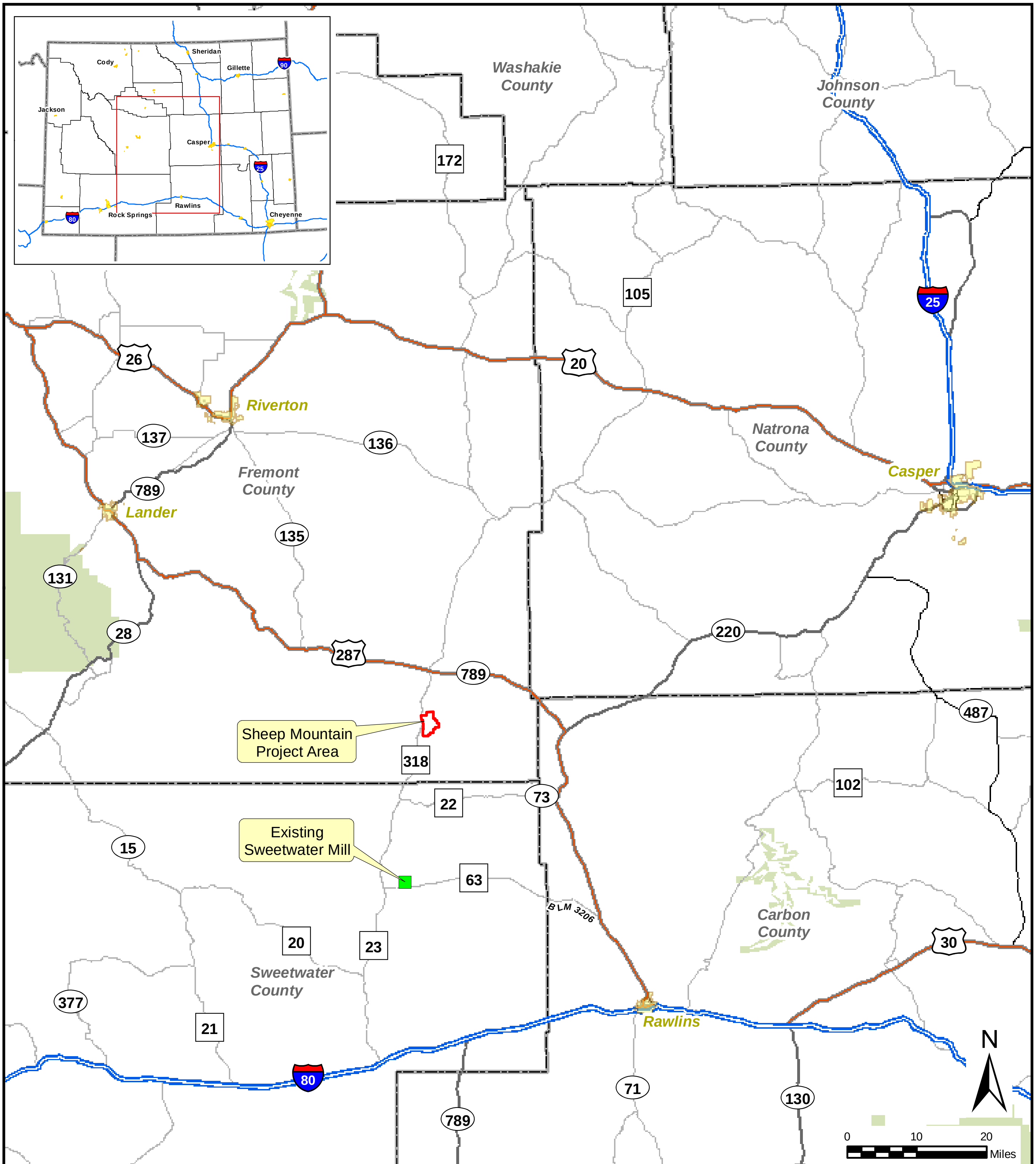
[1] WYDOT = Wyoming Department of Transportation.
[2] Improved gravel surface treated with magnesium chloride.
[3] The Sweetwater Mill conducts road maintenance on Sweetwater County roads 4-22, 4-23 and 4-63 under maintenance agreements with Sweetwater County.
[4] The BLM provides minimal maintenance along BLM Road 3206. The Sweetwater Mill conducts periodic road maintenance under its right-of-way agreement with the BLM.

Local and resource roads include BLM, county, municipal, and private roads that link areas with low traffic volumes to higher classification roads. Local roads connect to collector roads and serve a smaller area than collector roads, and may be one or two lanes with lower traffic volumes. Resource roads provide point access, connecting to local or collector roads, and are single lanes to individual facilities. Primary access routes to the Sheep Mountain Project Area include arterial and collector roads.

1.2.2 Access Routes

1.2.2.1 Access Roads to the Project Area

Travel routes for most workers and supplies travelling to the Project Area are expected to originate in Riverton, Lander, and Rawlins. Some supply routes may also originate in Casper. If ore is processed off-site, trucks will haul ore extracted from the Sheep Mountain Project Area to the Sweetwater Mill, which is located 33 miles south of the Project Area (see Map 1).



Map 1

Transportation Plan

Sheep Mountain Project Area Access Routes

Fremont County, WY

From Riverton, Project-related traffic will access the Project Area by heading south on South Federal Boulevard (Wyoming State Highway 789) and turning left onto Wyoming State Highway 136 (WY 136). The access route follows WY 136 for approximately 1.2 miles and merges into WY 135. Traffic will proceed 35 miles south on WY 135 to its junction with US Highway 287 (US Highway 287) at Sweetwater Station and then travel east for 19 miles on US 287 (also WY 789) to Jeffrey City. From there, traffic will turn right onto Fremont County Road (CR) 318 (Crooks Gap Road) and proceed 9 miles south to turn left on Project Access Road, which is the Project Area's primary point of ingress and egress. A secondary access road into the Project Area, Hank's Draw Road, is located approximately 1 mile north of the Project Access Road.

From Lander, project traffic will travel 57 miles southeast on US 287 to Jeffrey City, and from Rawlins, project traffic will travel 67 miles northwest on US 287 to Jeffrey City. From Casper, Project traffic will travel 74 miles southwest on US 220 to its junction with US 287 at Muddy Gap, and continue 23 miles west on US Highway 287 to Jeffrey City. From Jeffrey City, all traffic will use Crooks Gap Road to access the Project Area as described above.

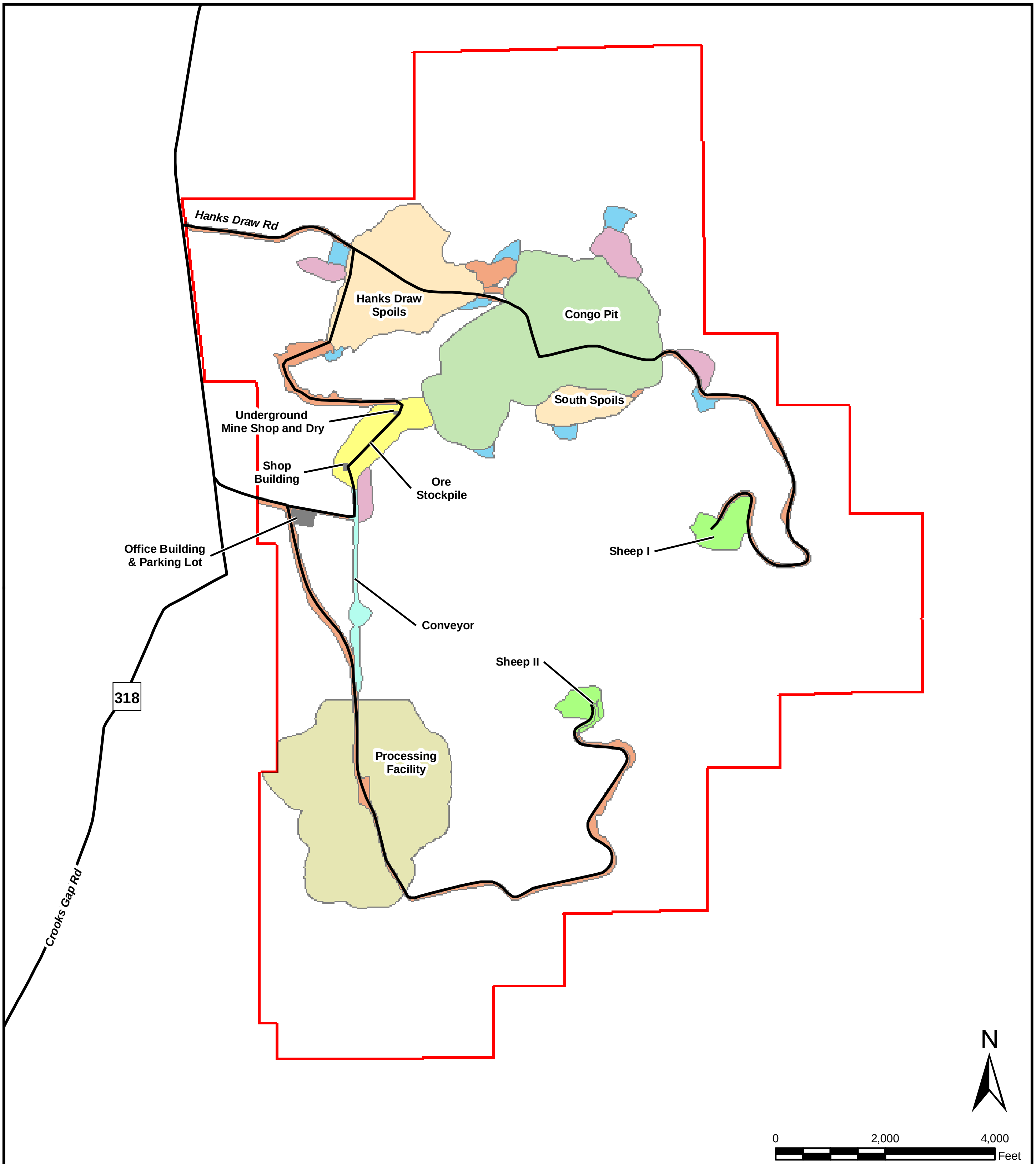
If ore is processed off-site, trucks will haul ore from the Project Area to the Sweetwater Mill by traveling approximately 10 miles south on Crooks Gap Road to enter Sweetwater County, where the road becomes Sweetwater CR 4-23 (Wamsutter Road), and continuing 16 miles to CR 4-63 (Mineral Exploration Road). Vehicles will turn left (east) onto Mineral Exploration Road and travel approximately 4 miles to the Sweetwater Mill entry road.

Processed ore from the Project Area will be trucked from the processing facility to a conversion plant in Metropolis, Illinois via Interstate-80. If processing occurs on-site, the processed product will be transported on US Highway 287 to access Interstate-80 at Rawlins. If processing occurs at the Sweetwater Mill, the processed product will travel approximately 20 miles east on Mineral Exploration Road to the Carbon County line. From there, traffic will continue 10 miles east on BLM Road 3206 to access US 287 north of Rawlins. Weather permitting, haul trucks leaving the Sweetwater Mill could also travel 22 miles south on Wamsutter Road to access Interstate-80 at Wamsutter.

1.2.2.2. Access Roads within the Project Area

The Project Area is accessed from Crooks Gap Road by Hank's Draw Road and Project Access Road (see Map 2). Within the Project Area, Energy Fuels has identified up to 0.9 mile of existing roads that will require upgrades and up to 1.7 miles of new road construction that will be used to access the Project facilities.

Hank's Draw Road will provide access to the Hanks Draw Spoils pile. The road will be extended along the south side of the spoils pile to access the open pit mine (Congo Pit). During pit operations, a road will be extended for approximately 0.7 mile along the southern side of the Congo Pit and eastern side of the Project Area to provide continuous access to the Sheep I Shaft to the Sheep Underground Mine.



Legend

Sheep Mountain Project Area
Access Roads

Proposed Action Disturbance Footprint

Congo Pit
Processing Facility
Ore Stockpile
Pad
Topsoil Stockpile
Spoils
Ponds
Conveyor
Roads
Buildings and Parking

Map 2

Transportation Plan

Roads in the Vicinity of the

Sheep Mountain Project Area

Fremont County, WY

From the site's entry along Project Access Road, vehicles will proceed approximately 0.3 mile east to access the site office. The route forks near the office. To the left, a new road will extend north for approximately 1.7 mile through the ore pad area and Hanks Draw Spoils Facility. Just beyond the main gate, an existing 1.1 mile road will also access the Ore Processing Facility. An existing 2.0 mile road through the proposed processing facility provides on-site access to the Sheep II Shaft. If the proposed processing facility is constructed, the road will be extended around the Ore Processing Facility to provide continuous access to the Sheep II Shaft.

Use of roads within the Project Area will be restricted to authorized personnel only. Access to the Project Area will be controlled by barbed-wire fencing and/or gates at all defined points of ingress and egress. Public access to the mine and processing facility will be controlled through a single entrance at Project Access Road with a guard hut manned during operating hours and gated at all other times. Hank's Draw Road will be gated and opened for deliveries, maintenance, and inspections on an as-needed basis.

1.3 ROAD CONSTRUCTION AND IMPROVEMENTS

On-site haul roads will be crowned and ditched to quickly shed any direct precipitation, and culverts will be installed to convey runoff from first and second order drainages that are crossed by the haul road. Berms reaching the midpoint of the wheel of the largest equipment on site will be installed in any area where the potential for equipment tipping exists in accordance with Mine Safety and Health Administration (MSHA) regulations. Berms may be utilized to divide opposing lanes of travel to provide further protection against collision. Haul roads will be surfaced with site-produced sandy gravel passing a 3/8-inch screen, to provide a surface which minimizes tire wear, is easily maintained, reduces fugitive dust emissions, and does not become slick when wet. A motor grader will maintain haul roads on a full-time basis. Off-road water trucks will apply water to roadway surfaces to control dust and promote surface compaction on an as-needed basis.

1.4 ROAD MAINTENANCE

Energy Fuels will coordinate with the Wyoming Department of Transportation (WYDOT), Fremont County and, in the event of off-site processing, Sweetwater County and the BLM, to ensure that use of state highways and county and BLM roads is consistent with issued use permits, rights-of-ways, and other state and county requirements. Energy Fuels will also obtain the necessary permits from the Wyoming Office of State Lands and Investments to utilize the portions of Hank's Draw and Project Access roads that traverse State trust lands.

Energy Fuels does not anticipate that paved roads will require improvement or maintenance prior to or during project construction. WYDOT maintains paved access roads leading to the project area. Fremont County maintains Crooks Gap Road and Sweetwater County maintains Wamsutter, Bairoil, and Minerals Exploration roads (see Table 1). Fremont County provides winter maintenance on Crooks Gap Road and Sweetwater County provides winter maintenance on Wamsutter and Minerals Exploration roads; however county maintenance crews do not plow these roads during periods of inclement winter weather (heavy or blowing snow). Sweetwater County does not maintain Bairoil Road in the winter. Energy Fuels will coordinate the maintenance of county roads with Fremont and Sweetwater counties based on maintenance agreements that will be put into effect prior to the start of mining.

The BLM provides minimal maintenance on BLM Road 3206. The Sweetwater Mill has a BLM right-of-way on this route and conducts periodic roadway maintenance as part of its right-of-way agreement. In the event of additional commercial use of BLM Road 3206, the BLM would require commercial users to enter maintenance cost-sharing agreements with one another and the BLM. If ore from the Sheep Mountain Project Area is processed at the Sweetwater Mill, Energy Fuels will comply with roadway maintenance agreements in coordination with the Sweetwater Mill.

Energy Fuels will maintain on-site roads in accordance with BLM 9113 Manual specifications (BLM, 2011). Most roads in the Project Area will be wider with greater vertical clearance than those specified in the manual to accommodate large mine equipment. Energy Fuels will be responsible for all maintenance actions necessary to provide all-weather access to the Project Area. In addition, Energy Fuels will provide timely maintenance and cleanup of access roads to pre-existing conditions. Energy Fuels' maintenance agreements with Fremont and Sweetwater counties will include provisions addressing the repair of existing roads due to damages caused by construction and/or operational traffic.

Maintenance will include, but not be limited to: dust abatement; reconstruction of the crown, slope, and/or water bars; blading or resurfacing; material application; clean-out of ditches, culverts, catchments; snow plowing, and other best management practices (BMPs).

Roads will not be bladed directly up drainages and will be designed at right angles to the drainage, as feasible. Roads bladed in drainages will be located a sufficient height above the channel so that fill material does not enter the drainage channel.

Saturated soil conditions may exist when water is flowing on the ground surface. Examples of saturated conditions include: water comes to the ground surface from walking or driving across the soil; the ground surface is spongy when walked upon; ruts 3 inches or deeper result from driving across the ground surface; vehicles get stuck in the mud; or a bulldozer is needed to pull vehicles through the mud. When saturated soil is present, construction travel will be halted until the road dries out or is frozen sufficiently for use to proceed without undue damage and erosion to soils and roads. Road maintenance or upgrades will be conducted when rutting of the travel-way reaches a depth of 3 inches.

Dust suppression will be implemented by spraying water on unpaved roads on an as-needed basis. Magnesium chloride and other surfactants, binding agents, or other dust-suppression chemicals will not be used for dust control without prior approval from the BLM.

1.5 ROADWAY SAFETY

All ore shipments will be conducted in accordance with applicable U.S. Department of Transportation (USDOT) and MSHA regulations. The required documents be prepared for each shipment and will accompany the shipment to its destination. Federal regulations also mandate that ore shipments be tarped to reduce the potential for accidental spillage or fugitive dust.

WYDOT requires commercial carriers to comply with federal regulations covering the transportation of hazardous materials, and has not issued separate regulations. There are no hazardous material route designations in Wyoming.

Energy Fuels will prepare a Spill Prevention, Control and Countermeasure (SPCC) Plan that will describe procedures for addressing spills associated with transportation accidents. If ore is processed off-site, ore haulage will be contracted to one or more trucking companies who will be responsible for developing and implementing an Emergency Response Plan in the event of an accident, obtaining required road use permits, and obeying all traffic rules. Emergency response and remediation services in the event of an accident may be supported by the Sheep Mountain Mine, provided that the ore haulage contractor requests this service as part of the contractual arrangement. Materials transported to the mine and processing facility will primarily include diesel fuel, chemical reagents for mineral processing, underground mine materials, and explosives. Items transported from the processing facility will primarily consist of concentrated uranium oxide (yellowcake), which is a solid product packaged in USDOT-approved 55 gallon drums for shipment. The USDOT requires trucking companies that transport these materials to have emergency response plans in place to respond to accidents and cargo spills. As part of its contracting program, Energy Fuels will verify that its trucking contractors have such plans in place.

1.6 TRAFFIC LEVELS

1.6.1 Construction Traffic

Development Schedule

The Sheep Mountain Uranium Project will be constructed under a staggered development schedule. The Congo Pit will be developed sequentially to accommodate the desired mine production and allow for internal backfilling. Because the Congo Pit does not require large pre-stripping, mining personnel will also construct the mine during the Project's first year (Year 1). Development of the Sheep Underground Mine will be deferred for up to 5 years after surface mining commences. If a Heap Leach Pad/Ore Processing Facility is built in the Project Area, its construction is expected to begin 6 months prior to development of the Congo Pit.

On-Site Processing

Under the schedule outlined above, traffic related to construction of the Heap Leach Pad and Ore Processing Facility is estimated to include between 40 and 61 vehicle round-trips per day during the first 6 months of project construction. Construction of the Heap Leach and Ore Processing Facility will overlap with development of the Congo Pit for approximately 3 months in Year 1, when construction traffic is expected to include between 48 and 71 vehicle round trips per day (see Table 2). Construction of the Sheep Underground Mine is estimated to include between 18 and 25 vehicles a day for approximately 18 months sometime after Year 1. This traffic will overlap with operational traffic at the Congo Pit and Heap Leach and Ore Processing Facility.

Off-Site Processing

If ore is transported to the Sweetwater Mill for processing, construction traffic to the Project Area will include between 8 and 10 vehicles per day for the Congo Pit and between 18 and 25 vehicles per day for the Sheep Underground Mine. Construction traffic for the Sheep

Underground Mine will overlap with operational traffic for the Congo Pit. Construction and refurbishment of the Sweetwater Mill will include additional traffic to that site.

Table 2
Estimated Range of Vehicle Round-Trips per Day During Construction

Project Component	Project Schedule	Light Vehicles	Heavy Vehicles	Total Vehicles
Congo Pit	12 months in Year 1	8 -10[1]	0[2]	8 – 10
Sheep Underground Mine[3]	18 Months after Year 1	18 - 25[4]	0[2]	18 – 25
Heap Leach & Ore Processing Facility	9 Months in Years 0 - 1[5]	35 - 55[6]	5 - 6[2, 7]	40 – 61

Assumptions:
[1] Assumes that between 15 and 20 workers are required to develop the Congo Pit. Vehicle estimates include workers' personal vehicles, assuming two workers per vehicle.
[2] Assumes that heavy equipment remains on-site during construction.
[3] Development of the Sheep Underground Mine will be deferred for up to 5 years depending on financing and market conditions.
[4] Development of the Sheep Underground Mine will include between 20 and 30 workers to drive the double-entry decline and 20 workers to conduct rehabilitation in the mine. Vehicle estimates include workers' personal vehicles, assuming two workers per vehicle.
[5] Construction of the Heap Leach Pad and Ore Processing Facility is expected to begin 6 months prior to Year 1.
[6] Includes personal vehicles for 70 to 110 processing facility construction workers, assuming two workers per vehicle.
[7] Includes 302 truckloads of materials delivered between 135 and 270 days. Also assumes that durable rock material is obtained off-site.

1.6.2 Operational Traffic

On-Site Processing

Traffic related to operation of the Sheep Mountain Uranium Project is expected to include between 55 and 107 vehicle round trips per day. The lower-bound estimate assumes that the Project is operating at less than full capacity with partial workforce levels and the upper-bound estimate assumes that the Project is operating at full capacity with peak workforce levels. Operational traffic will be highest when the Sheep Underground Mine will be producing ore. Prior to that time, operations-only traffic is estimated to include between 23 and 43 vehicle round-trips per day (see Table 3).

Off-Site Processing

If Sheep Mountain Mine ore is processed at the Sweetwater Mill, operational traffic is estimated to include between 49 and 100 vehicle round trips per day to the Project Area (commuting workers) and between 36 and 81 vehicle round trips per day to the Sweetwater Mill (ore haul trucks), for a total of 85 to 181 vehicle round trips per day. During the Project's early years, when only the Congo Pit will be producing ore, operational traffic is estimated to include approximately 64 vehicle round-trips per day. Operation of the Sweetwater Mill will include additional traffic, primarily associated with commuting workers.

Table 3
Estimated Range of Vehicle Round-Trips per Day During Operations

Project Component	Light Vehicles	Heavy Vehicles	Total Vehicles
Congo Pit	10 - 21[1]	0[2]	10 - 21
Sheep Underground Mine	32 - 64[3]	0[2]	32 - 64
Heap Leach Pad and Ore Processing Facility	10 - 18[4]	3 - 4[5]	13 - 22
Off-Site Processing	7 - 15[6]	36 - 81[7]	43 - 96

Assumptions:
[1] Includes personal vehicles for between 20 and 41 open pit mine workers, assuming two workers per vehicle.
[2] Assumes that mine support vehicles, water trucks and mechanical service trucks remain on-site.
[3] At full production, the Sheep Underground Mine is expected to employ 128 workers over two shifts. Lower production levels may require only one daily work shift. The estimated vehicle range includes personal for between 64 and 128 underground mine workers, assuming two workers per vehicle.
[4] Includes personal vehicles for 20 to 35 Heap Leach & Ore Processing Facility workers, assuming two workers per vehicle.
[5] Includes approximately one yellow cake shipment per week, one delivery of sodium chlorate per week, nine shipments of sulfuric acid per week, two shipments of miscellaneous chemicals (sodium carbonate, hydrogen peroxide, sodium hydroxide, hydrated lime) per week, one fuel delivery per day, and two shipments per week of domestic solid wastes to the Jeffrey City Transfer Station.
[6] Includes personal vehicles for between 7 and 15 haul truck drivers, assuming one worker per vehicle.
[7] Assumes between 7 and 15 haul trucks make up to 5.3 round trips per day between the project area and Sweetwater Mill (assumed cycle time of two hours). Assumes that haul trucks remain on-site when not in use.

Project traffic is expected to peak at 107 vehicle round-trips per day with an on-site processing facility and 181 vehicle round-trips per day with off-site processing. Peak traffic will occur with both the Congo Pit and Sheep Underground Mine in operation. Development of the Sheep Underground Mine may be deferred up to 5 years, depending on financing and market conditions.

1.6.3 Final Reclamation Traffic

Final reclamation of the Project Area will be conducted for approximately 2 years after mining is complete. If a Heap Leach Pad and Ore Processing Facility is built in the Project Area, traffic during final reclamation is estimated to include between 32 and 39 vehicle round-trips per day. If ore is processed off-site, final reclamation traffic to the Project Area is estimated to include between 12 and 15 vehicle round-trips per day (see Table 4). Closure of the Sweetwater Mill will include additional traffic to that site.

Table 4
Estimated Vehicle Round-Trips per Day During Final Reclamation

Project Component	Light Vehicles	Heavy Vehicles	Total Vehicles
Congo Pit	10 - 12[1]	0[2]	10 - 12
Sheep Underground Mine	2 - 3[3]	0[2]	2 - 3
Heap Leach Pad and Ore Processing Facility	10 - 12[4]	10 - 12[5]	20 - 24

Assumptions:
[1] Includes personal vehicles for between 20 and 24 reclamation workers, assuming 2 workers per vehicle.
[2] Assumes that heavy vehicles required for mine reclamation remain on-site.
[3] Includes personal vehicles for 4 to 6 reclamation workers, assuming two workers per vehicle.
[4] Includes personal vehicles for between 20 and 24 reclamation workers, assuming two workers per vehicle.
[5] Assumes that reclamation will occur over a two year period, and that materials for the radon barrier (i.e. clay), riprap and other durable rock layers will be sourced off-site.

1.7 REFERENCES

Bureau of Land Management, 2011. Manual 9113 – Roads. Manual Transmittal Sheet Release 9-390. October 21.

Bureau of Land Management and Forest Service (BLM and Forest Service). 2007. Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development. Gold Book. Fourth Edition.

Appendix 2-B
Monitoring Summary

Table 1
Summary of Site Environmental Monitoring Program

MEDIA	LOCATIONS	FREQUENCY	PARAMETER TABLE	AGENCY
Ground Water	**Mine:** MW-6NEW, MW-7, MW-9, MW-10, McIntosh Pit **Mill:** PZ-1, PZ-2, PZ-3, PZ-4, PZ-5, G-3, G-4, G-5, G-6, G-7, G-8 Point of Compliance Wells (TBD)	Annual Quarterly	Field: pH, Temperature, Conductivity, Water Level, Dissolved Oxygen Lab: Ca, Mg, Na, K, CO_3, HCO_3, SO_4, Cl, NH4, NO_2+NO_3, F, SiO_2, TDS, Cond., Alk., pH, Al, As, Ba, Be, Bo, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Mo, Ni, Se, V, Zn, Unat, Ra-226, Ra-228, Th-230, Po-210, Pb-210, Gross Alpha, Gross Beta	WDEQ/NRC WDEQ/NRC
Surface Water	CC-MU, CC-US, CC-DS SW-1, SW-2, SW-3	Quarterly As water is available after rainfall	Same as Ground Water but add Turbidity, TSS and flow rate	NRC NRC
Air	**Mine: (TBD)** **Mill:** AM-4, -5, -6, -7, -8, -9, -10	As required by WDEQ/AQD Permit (TBD) Continuous measurement, Quarterly sampling	TBD Unat, Ra-226, Th-230, Pb-210 and Radon	WDEQ NRC
Noise	Permit Boundary, Mine Areas (TBD)	Quarterly	dB	MSHA/NIOSH
Soil	Downwind of Mill Area (TBD)	Annual	Unat, Ra-226, Th-230, Pb-210	NRC
Vegetation	Downwind of Mill Area (TBD)	Annual	Unat, Ra-226, Th-230, Pb-210	NRC
Wildlife	Raptors Large Game Sage Grouse	Seasonal, annually Seasonal, annually Seasonal, annually	Visual Observations	WDEQ WDEQ WDEQ

Table 2
Operational Monitoring

MEDIA	LOCATIONS	FREQUENCY	PARAMETER TABLE	AGENCY
Stability/SWPPP	**Mine:** (as per SWPPP) **Mill:** (as per SWPPP)	Monthly, opportunistically after rainfall Monthly, opportunistically after rainfall	Visual observation of landform stability, sediment control, storm water discharge	WDEQ
Early Detection Monitoring	Heap Leach Pad Collection Pond Raffinate Pond Holding Pond Plant Buildings	Daily, Weekly, Monthly Annual	Unat, Ra-226, Th-230, Pb-210, Po-210, SO_4 as per license (TBD)	NRC
Personnel & Workplace	Radiation Control Areas	Personnel: Continuous, quarterly sampling Bioassay Workplace: throughout buildings	Radon-222, direct gamma Unat Radioparticulates, Radon-222 & daughters, Beta/gamma radiation	NRC

Appendix 3-A
Air Quality Monitoring Data

Table 1
Passive Air Monitoring Station Radon Results Summary[1]

Passive Monitoring Station ID	Start Date	End (seal) Date	Result (pCi-days/L)	Precision (pCi-days/L)	Avg. Radon Concentration (pCi/L)	Precision (pCi/L)
	2010 Q3					
AM-1	6/29/2010	9/30/2010	54.6	5.61	0.6	0.06
AM-2	6/29/2010	10/5/2010	48.7	5.16	0.5	0.05
AM-3	6/29/2010	10/5/2010	86.4	7.67	0.9	0.08
AM-4	6/29/2010	9/30/2010	108.3	8.9	1.2	0.10
AM-5	6/29/2010	9/30/2010	72.5	6.82	0.8	0.07
	2010 Q3					
AM-1	10/5/2010	1/4/2011	<30.0		<0.3	0.03
AM-2	10/5/2010	1/4/2011	36.8	3.85	0.4	0.04
AM-3	10/5/2010	1/4/2011	58.6	5.51	0.6	0.06
AM-4	9/30/2010	1/4/2011	88.4	7.39	0.9	0.08
AM-5	9/30/2010	1/4/2011	57.6	5.44	0.6	0.06
	2011 Q1					
AM-1	1/4/2011	4/3/2011	<30.0		<0.3	0.03
AM-2	1/4/2011	4/3/2011	<30.0		<0.3	0.03
AM-3	1/4/2011	4/3/2011	37.0	3.84	0.4	0.04
AM-4	1/4/2011	4/3/2011	<30.0		<0.3	0.03
AM-5	1/4/2011	4/3/2011	32.5	3.46	0.4	0.04
	2011 Q2					
AM-1	4/3/2011	7/5/2011	<30.0		<3.0	0.03
AM-2	4/3/2011	7/5/2011	51.6	5.19	0.6	0.06
AM-3	4/3/2011	7/5/2011	82.5	7.13	0.9	0.08
AM-4	4/3/2011	7/5/2011	88.7	7.47	1.0	0.08
AM-5	4/3/2011	7/5/2011	70.1	6.4	0.8	0.07
	2011 Q3					
AM-1	7/5/2011	9/27/2011	142.1	9.5	1.7	0.11
AM-2	7/5/2011	9/27/2011	<30.0		<0.3	0.03
AM-3	7/5/2011	9/27/2011	36.9	3.55	0.4	0.04
AM-4	7/5/2011	9/27/2011	63.7	5.44	0.8	0.06
AM-5	7/5/2011	9/27/2011	<30.0		<0.3	0.03
Claytor Ranch	6/20/2011	9/27/2011	120.4	8.5	1.2	0.09
AM-6	6/17/2011	9/27/2011	65.0	5.53	0.6	0.05

Passive Monitoring Station ID	Start Date	End (seal) Date	Result (pCi-days/L)	Precision (pCi-days/L)	Avg. Radon Concentration (pCi/L)	Precision (pCi/L)
AM-7	6/17/2011	9/27/2011	62.3	5.37	0.6	0.05
AM-8	6/17/2011	9/27/2011	148.3	9.7	1.5	0.10
AM-9	6/17/2011	9/27/2011	44.7	4.17	0.4	0.04
	2011 Q4					
AM-1	9/27/2011	1/5/2012	37.2	3.40	0.4	0.03
AM-2	9/27/2011	1/5/2012	31.9	2.99	0.3	0.03
AM-3	9/27/2011	1/5/2012	<30.0		<0.3	0.03
AM-4	9/27/2011	1/5/2012	<30.0		<0.3	0.03
AM-5	9/27/2011	1/5/2012	42.0	3.73	0.4	0.04
AM-6	9/27/2011	1/5/2012	<30.0		<0.3	0.03
AM-7	9/27/2011	1/5/2012	66.9	5.39	0.7	0.05
AM-8	9/27/2011	1/5/2012	75.3	5.89	0.8	0.06
AM-9	9/27/2011	1/5/2012	50.3	4.31	0.5	0.04
	2012 Q1					
AM-1	1/5/2012	3/28/2012	66.4	5.71	0.8	0.07
AM-2	1/5/2012	3/28/2012	51.7	4.74	0.6	0.06
AM-3	1/5/2012	3/28/2012	80.2	6.54	1.0	0.08
AM-4	1/5/2012	3/28/2012	58.1	5.18	0.7	0.06
AM-5	1/5/2012	3/28/2012	67.3	5.77	0.8	0.07
Claytor Ranch	1/5/2012	3/28/2012	251.8	13.5	2.9	0.15
AM-6	1/5/2012	3/28/2012	93.0	7.26	1.1	0.09
AM-7	1/5/2012	3/28/2012	51.0	4.54	0.6	0.05
AM-8	1/5/2012	3/28/2012	37.6	3.57	0.5	0.04
AM-9	1/5/2012	3/28/2012	68.0	5.64	0.8	0.07
	2012 Q2					
AM-1	3/28/2012	6/27/2012	53.3	4.57	0.6	0.05
AM-2	3/28/2012	6/27/2012	<30.0		<0.3	0.03
AM-3	3/28/2012	6/27/2012	59.6	4.98	0.7	0.05
AM-4	3/28/2012	6/27/2012	51.5	4.45	0.6	0.05
AM-5	3/28/2012	6/27/2012	45.3	4.02	0.5	0.04
Claytor Ranch	3/28/2012	6/27/2012	185.7	11.4	2.0	0.13
AM-6	3/28/2012	6/27/2012	31.0	2.94	0.3	0.03
AM-7	3/28/2012	6/27/2012	50.6	4.39	0.6	0.05
AM-8	3/28/2012	6/27/2012	115.1	8.0	1.3	0.09
AM-9	3/28/2012	6/27/2012	41.7	3.76	0.5	0.04

Passive Monitoring Station ID	Start Date	End (seal) Date	Result (pCi-days/L)	Precision (pCi-days/L)	Avg. Radon Concentration (pCi/L)	Precision (pCi/L)
	2012 Q3					
AM-1	6/27/2012	10/2/2012	43.2	3.96	0.4	0.04
AM-2	6/27/2012	10/2/2012	62.4	5.27	0.6	0.05
AM-3	6/27/2012	10/2/2012	131.3	9.0	1.4	0.09
AM-4	6/27/2012	10/2/2012	97.3	7.29	1.0	0.08
AM-5	6/27/2012	10/2/2012	72.5	5.90	0.7	0.06
Claytor Ranch	6/27/2012	10/2/2012	125.3	9.4	1.3	0.10
AM-6	6/27/2012	10/2/2012	112.9	8.1	1.2	0.08
AM-7	6/27/2012	10/2/2012	125.8	8.7	1.3	0.09
AM-8	6/27/2012	10/2/2012	263.7	13.9	2.7	0.14
AM-9	6/27/2012	10/2/2012	126.7	8.7	1.3	0.09
	2012 Q4					
AM-1	10/2/2012	1/3/2013	67.1	6.68	0.7	0.07
AM-2	10/2/2012	1/3/2013	59.4	6.16	0.6	0.07
AM-3	10/2/2012	1/3/2013	61.3	6.29	0.7	0.07
AM-4	10/2/2012	1/3/2013	93.4	8.26	1.0	0.09
AM-5	10/2/2012	1/3/2013	95.3	8.36	1.0	0.09
Claytor Ranch	10/2/2012	1/3/2013	255.5	14.5	2.7	0.16
AM-6	10/2/2012	1/3/2013	96.3	8.42	1.0	0.09
AM-7	10/2/2012	1/3/2013	89.4	8.03	1.0	0.09
AM-8	10/2/2012	1/3/2013	126.7	10.0	1.4	0.11
AM-9	10/2/2012	1/3/2013	100.2	8.6	1.1	0.09
AM-10	10/2/2012	1/3/2013	<30.0		<0.3	0.03
	2013 Q1					
AM-1	1/3/2013	3/28/2013	79.2	7.12	0.9	0.08
AM-2	1/3/2013	3/28/2013	78.3	7.06	0.9	78.3
AM-3	1/3/2013	3/28/2013	95.6	8.05	1.1	8.05
AM-4	1/3/2013	3/28/2013	62.9	6.08	0.7	0.07
AM-5	1/3/2013	3/28/2013	116.8	9.2	1.4	.11
Claytor Ranch	1/3/2013	4/3/2013	214.7	13.2	2.4	0.15
AM-6	1/3/2013	3/28/2013	76.3	6.94	0.9	0.08
AM-7	1/3/2013	3/28/2013	97.5	8.16	1.2	0.10
AM-8	1/3/2013	3/28/2013	118.8	9.2	1.4	0.11
AM-9	1/3/2013	3/28/2013	66.5	6.31	0.8	0.08
AM-10	1/3/2013	3/28/2013	56.8	5.65	0.7	0.07

Passive Monitoring Station ID	Start Date	End (seal) Date	Result (pCi-days/L)	Precision (pCi-days/L)	Avg. Radon Concentration (pCi/L)	Precision (pCi/L)
	2013 Q2					
AM-1	3/28/2013	6/26/2013	48.3	4.72	0.5	0.05
AM-2	3/28/2013	6/26/2013	<30.0		<0.3	0.03
AM-3	3/28/2013	6/26/2013	141.4	10.0	1.6	0.11
AM-4	3/28/2013	6/26/2013	<30.0		<0.3	0.03
AM-5	3/28/2013	6/26/2013	<30.0		<0.3	0.03
Claytor Ranch	4/2/2013	6/26/2013	197.9	12.5	2.3	0.15
AM-6	3/28/2013	6/26/2013	<30.0		<0.3	0.03
AM-7	3/28/2013	6/26/2013	<30.0		<0.3	0.03
AM-8	3/28/2013	6/26/2013	188.7	12.0	2.1	0.13
AM-9	3/28/2013	6/26/2013	114.9	8.7	1.3	0.10
AM-10	3/28/2013	6/26/2013	<30.0		<0.3	0.03

Table 2
Passive Air Monitoring Station Gamma Results Summary

Passive Monitoring Station ID	OSL Issue Date	Field Installation Date	Monitoring End Date	Processed Date	Landauer's GROSS Result (mrems)	Estimated Dose During Monitoring Period (mrem)	Estimated Daily Field Dose (mrem)	Estimated Field Dose Rate (mrem/hour)
3rd Quarter 2010								
AM-1	6/17/2010	7/1/2010	10/5/2010	10/26/2010	44.2	34.6	0.360	0.015
AM-2	6/17/2010	7/1/2010	10/5/2010	10/26/2010	86.5	76.9	0.801	0.033
AM-3	6/17/2010	7/1/2010	10/5/2010	10/26/2010	214.2	204.6	2.131	0.089
AM-4	6/17/2010	7/1/2010	9/30/2010	10/26/2010	76.7	65.7	0.722	0.030
AM-5	6/17/2010	7/1/2010	9/30/2010	10/26/2010	60.2	49.2	0.540	0.023
Deploy Control	6/17/2010			10/26/2010	66.2			
Transit control	6/17/2010			10/26/2010	36.1			
4th Quarter 2010								
AM-1	9/7/2010	10/1/2010	1/4/2011	1/26/2011	45.9	34.3	0.361	0.015
AM-2	9/7/2010	10/1/2010	1/4/2011	1/26/2011	85.9	74.3	0.782	0.033
AM-3	9/7/2010	10/1/2010	1/4/2011	1/26/2011	184.8	173.2	1.823	0.076
AM-4	9/7/2010	10/1/2010	1/4/2011	1/26/2011	60.1	48.5	0.510	0.021
AM-5	9/7/2010	10/1/2010	1/4/2011	1/26/2011	58.6	47.0	0.494	0.021
Deploy Control	9/7/2010			1/26/2011	56.8			
Transit control	9/7/2010			1/26/2011	35.7			
1st Quarter 2011								
AM-1	12/06/2010	1/4/2011	4/3/2011	4/14/2011	35.6	24.6	0.276	0.011
AM-2	12/06/2010	1/4/2011	4/3/2011	4/14/2011	64.8	53.8	0.604	0.025
AM-3	12/06/2010	1/4/2011	4/3/2011	4/14/2011	178.4	167.4	1.880	0.078
AM-4	12/06/2010	1/4/2011	4/3/2011	4/14/2011	64.7	53.7	0.603	0.025
AM-5	12/06/2010	1/4/2011	4/3/2011	4/14/2011	50.0	39.0	0.438	0.018
Deploy Control	12/06/2010			4/14/2011	59.2			
Transit control	12/06/2010			4/14/2011	35.6			
2nd Quarter 2011								
AM-1	3/07/2011	4/3/2011	7/5/2011	10/19/2011	45.9	NC		
AM-2	3/07/2011	4/3/2011	7/5/2011	10/19/2011	81.8	NC		

Passive Monitoring Station ID	OSL Issue Date	Field Installation Date	Monitoring End Date	Processed Date	Landauer's GROSS Result (mrems)	Estimated Dose During Monitoring Period (mrem)	Estimated Daily Field Dose (mrem)	Estimated Field Dose Rate (mrem/hour)
AM-3	3/07/2011	4/3/2011	7/5/2011	10/19/2011	203.5	NC		
AM-4	3/07/2011	4/3/2011	7/5/2011	10/19/2011	83.7	NC		
AM-5	3/07/2011	4/3/2011	7/5/2011	10/19/2011	60.0	NC		
3rd Quarter 2011								
AM-1	06/06/2011	7/5/2011	9/27/2011	10/19/2011	41.9	29.1	0.346	0.014
AM-2	06/06/2011	7/5/2011	9/27/2011	10/19/2011	81.9	69.1	0.823	0.034
AM-3	06/06/2011	7/5/2011	9/27/2011	10/19/2011	217.1	204.3	2.432	0.101
AM-4	06/06/2011	7/5/2011	9/27/2011	10/19/2011	77.1	64.3	0.765	0.032
AM-5	06/06/2011	7/5/2011	9/27/2011	10/19/2011	59.0	46.2	0.550	0.023
Deploy Control	06/06/2011			10/19/2011	32.6			
Transit control	06/06/2011			10/19/2011	33.9			
4th Quarter 2011								
AM-1	9/6/2011	9/27/2011	1/1/2012	2/2/2012	46.6	33.0	0.344	0.014
AM-2	9/6/2011	9/27/2011	1/1/2012	2/2/2012	80.7	67.1	0.699	0.029
AM-3	9/6/2011	9/27/2011	1/1/2012	2/2/2012	228.8	215.2	2.242	0.093
AM-4	9/6/2011	9/27/2011	1/1/2012	2/2/2012	77.7	64.1	0.668	0.028
AM-5	9/6/2011	9/27/2011	1/1/2012	2/2/2012	62.2	48.6	0.507	0.021
Deploy Control	9/6/2011			2/2/2012	36.5			
Transit control	9/6/2011			2/2/2012	38.1			
1st Quarter 2012								
AM-1	12/29/2011	1/1/2012	3/28/2012	4/18/2012	30.6	24.5	0.282	0.012
AM-2	12/29/2011							
AM-3	12/29/2011	1/1/2012	3/28/2012	4/18/2012	184.6	178.5	2.052	0.086
AM-4	12/29/2011	1/1/2012	3/28/2012	4/18/2012	58.4	52.3	0.602	0.025
AM-5	12/29/2011	1/1/2012	3/28/2012	4/18/2012	43.7	37.6	0.433	0.018
AM-6	12/29/2011	1/1/2012	3/28/2012	4/18/2012	47.8	41.7	0.480	0.020
AM-7	12/29/2011	1/1/2012	3/28/2012	4/18/2012	48.6	42.5	0.489	0.020
AM-8	12/29/2011							
AM-9	12/29/2011	1/1/2012	3/28/2012	4/18/2012	46.1	40.0	0.460	0.019
AM-10	12/29/2011	1/1/2012	3/28/2012	4/18/2012	64.4	58.3	0.671	0.028
Deploy	12/29/2011			4/18/2012	29.2			

Passive Monitoring Station ID	OSL Issue Date	Field Installation Date	Monitoring End Date	Processed Date	Landauer's GROSS Result (mrems)	Estimated Dose During Monitoring Period (mrem)	Estimated Daily Field Dose (mrem)	Estimated Field Dose Rate (mrem/hour)
Control								
Transit control	12/29/2011			4/18/2012	28			
2nd Quarter 2012								
AM-1	03/05/2012	3/28/2012	6/27/2012	7/26/2012	44.6	30.3	0.333	0.014
AM-2	03/05/2012	3/28/2012	6/27/2012	7/26/2012	81.8	67.5	0.741	0.031
AM-3	03/05/2012	3/28/2012	6/27/2012	7/26/2012	258.2	243.9	2.680	0.112
AM-4	03/05/2012	3/28/2012	6/27/2012	7/26/2012	80.9	66.6	0.732	0.030
AM-5	03/05/2012	3/28/2012	6/27/2012	7/26/2012	61.9	47.6	0.523	0.022
AM-6	03/05/2012	3/28/2012	6/27/2012	7/26/2012	66.3	52.0	0.571	0.024
AM-7	03/05/2012	3/28/2012	6/27/2012	7/26/2012	85.8	71.5	0.785	0.033
AM-8	03/05/2012	3/28/2012	6/27/2012	7/26/2012	271.3	257.0	2.824	0.118
AM-9	03/05/2012	3/28/2012	6/27/2012	7/26/2012	64	49.7	0.546	0.023
AM-10	03/05/2012	3/28/2012	6/27/2012	7/26/2012	45.7	31.4	0.345	0.014
Deploy Control	03/05/2012			7/26/2012	39.4			
3rd Quarter 2012								
AM-1	06/06/2012	6/27/2012	10/3/2012	10/09/2012	41.2	34.4	0.351	0.015
AM-2	06/06/2012	6/27/2012	10/3/2012	10/09/2012	84.6	77.8	0.794	0.033
AM-3	06/06/2012	6/27/2012	10/3/2012	10/09/2012	245.8	239.0	2.439	0.102
AM-4	06/06/2012	6/27/2012	10/3/2012	10/09/2012	83.6	76.8	0.784	0.033
AM-5	06/06/2012	6/27/2012	10/3/2012	10/09/2012	60.1	53.3	0.544	0.023
AM-6	06/06/2012	6/27/2012	10/3/2012	10/09/2012	60.9	54.1	0.552	0.023
AM-7	06/06/2012	6/27/2012	10/3/2012	10/09/2012	83.6	76.8	0.784	0.033
AM-8	06/06/2012	6/27/2012	10/3/2012	10/09/2012	306.2	299.4	3.055	0.127
AM-9	06/06/2012	6/27/2012	10/3/2012	10/09/2012	61.9	55.1	0.562	0.023
AM-10	06/06/2012	6/27/2012	10/3/2012	10/09/2012	34.9	28.1	0.287	0.012
Control Dose	06/06/2012			10/09/2012	31.5			
4th Quarter 2012								
AM-1	9/7/2014	10/3/2012	1/3/2013	1/09/2013	43.3	34.6	0.376	0.016
AM-2	9/7/2014	10/3/2012	1/3/2013	1/09/2013	79.6	70.9	0.770	0.032
AM-3	9/7/2014	10/3/2012	1/3/2013	1/09/2013	216.9	208.2	2.263	0.094
AM-4	9/7/2014	10/3/2012	1/3/2013	1/09/2013	79.6	70.9	0.770	0.032
AM-5	9/7/2014	10/3/2012	1/3/2013	1/09/2013	58.8	50.1	0.544	0.023

Passive Monitoring Station ID	OSL Issue Date	Field Installation Date	Monitoring End Date	Processed Date	Landauer's GROSS Result (mrems)	Estimated Dose During Monitoring Period (mrem)	Estimated Daily Field Dose (mrem)	Estimated Field Dose Rate (mrem/hour)
AM-6	9/7/2014	10/3/2012	1/3/2013	1/09/2013	78.7	70.0	0.760	0.032
AM-7	9/7/2014	10/3/2012	1/3/2013	1/09/2013	78.7	70.0	0.760	0.032
AM-8	9/7/2014	10/3/2012	1/3/2013	1/09/2013	279.8	271.1	2.946	0.123
AM-9	9/7/2014	10/3/2012	1/3/2013	1/09/2013	61	52.3	0.568	0.024
AM-10	9/7/2014	10/3/2012	1/3/2013	1/09/2013	67.6	58.9	0.640	0.027
Control Dose	9/7/2014			1/09/2013	33.9			
1st Quarter 2013								
AM-1	12/17/2012	1/3/2013	3/28/2013	04/09/2013	38	28.7	0.341	0.014
AM-2	12/17/2012	1/3/2013	3/28/2013	04/09/2013	76.4	67.1	0.798	0.033
AM-3	12/17/2012	1/3/2013	3/28/2013	04/09/2013	213.6	204.3	2.432	0.101
AM-4	12/17/2012	1/3/2013	3/28/2013	04/09/2013	73.7	64.4	0.766	0.032
AM-5	12/17/2012	1/3/2013	3/28/2013	04/09/2013	51.5	42.2	0.502	0.021
AM-6	12/17/2012	1/3/2013	3/28/2013	04/09/2013	51.6	42.3	0.503	0.021
AM-7	12/17/2012	1/3/2013	3/28/2013	04/09/2013	71.6	62.3	0.741	0.031
AM-8	12/17/2012	1/3/2013	3/28/2013	04/09/2013	285.7	276.4	3.290	0.137
AM-9	12/17/2012	1/3/2013	3/28/2013	04/09/2013	57.9	48.6	0.578	0.024
AM-10	12/17/2012	1/3/2013	3/28/2013	04/09/2013	65.1	55.8	0.664	0.028
Control Dose	12/17/2012			04/09/2013	36.4			
2nd Quarter 2013								
AM-1	3/13/2013	4/1/2013	6/30/2013	7/2/2013	37.9	31.5	0.350	0.015
AM-2	3/13/2013	4/1/2013	6/30/2013	7/2/2013	77.3	70.9	0.788	0.033
AM-3	3/13/2013	4/1/2013	6/30/2013	7/2/2013	206.2	199.8	2.220	0.093
AM-4	3/13/2013	4/1/2013	6/30/2013	7/2/2013	74.7	68.3	0.759	0.032
AM-5	3/13/2013	4/1/2013	6/30/2013	7/2/2013	55.2	48.8	0.542	0.023
AM-6	3/13/2013	4/1/2013	6/30/2013	7/2/2013	58.6	52.2	0.580	0.024
AM-7	3/13/2013	4/1/2013	6/30/2013	7/2/2013	75.5	69.1	0.768	0.032
AM-8	3/13/2013	4/1/2013	6/30/2013	7/2/2013	281.1	274.7	3.052	0.127
AM-9	3/13/2013	4/1/2013	6/30/2013	7/2/2013	56.9	50.5	0.561	0.023
AM-10	3/13/2013	4/1/2013	6/30/2013	7/2/2013	67.7	61.3	0.681	0.028
Control Dose	3/13/2013			7/2/2013	33.8			

NC – arrived without control values not calculated

Table 3
Air Particulate Monitoring: Third Quarter 2010

Air Station ID	Collection Date	Air Volume Sampled (L)	Analyte	Filter Conc. (pCi/filter)	Precision (pCi/filter)	Reporting Limit (pCi/filter)	Concentration (µCi/mL)	Precision (µCi/mL)	Reporting Limit (µCi/mL)
AM-1	9/1/2010	2,602,044	Pb-210	25.4	3.7	2	9.8E-15	1.4E-15	2.0E-15
		2,602,044	Ra-226	3.25	1.5	0.1	1.2E-15	5.8E-16	1.0E-16
		2,602,044	Th-230	0.92	1.2	0.1	3.5E-16	4.6E-16	1.0E-16
		2,602,044	U-Nat	0.4	n/a	0.1	1.5E-16	n/a	1.0E-16
AM-2	9/1/2010	4,930,533	Pb-210	26.7	3.7	2	5.4E-15	7.5E-16	2.0E-15
		4,930,533	Ra-226	7.03	2.0	0.1	1.4E-15	4.1E-16	1.0E-16
		4,930,533	Th-230	3.44	2.4	0.1	7.0E-16	4.9E-16	1.0E-16
		4,930,533	U-Nat	2.0	n/a	0.1	4.1E-16	n/a	1.0E-16
AM-3	9/1/2010	3,891,630	Pb-210	17.8	3.2	2	4.6E-15	8.2E-16	2.0E-15
		3,891,630	Ra-226	3.32	1.5	0.1	8.5E-16	3.9E-16	1.0E-16
		3,891,630	Th-230	2.95	2.4	0.1	7.6E-16	6.2E-16	1.0E-16
		3,891,630	U-Nat	0.2	n/a	0.1	<1.0E-16	n/a	1.0E-16
AM-4	10/7/2010	2,241,652	Pb-210	37.6	0.9	1	1.7E-14	4.0E-16	2.0E-15
		2,241,652	Ra-226	0.4	0.2	0.2	1.8E-16	8.9E-17	1.0E-16
		2,241,652	Th-230	0.6	0.4	0.2	2.7E-16	1.8E-16	1.0E-16
		2,241,652	U-Nat	0.98	n/a	0.01	4.4E-16	n/a	1.0E-16
AM-5	9/1/2010	3,900,782	Pb-210	26.1	3.7	2	6.7E-15	9.5E-16	2.0E-15
		3,900,782	Ra-226	9.71	4.5	0.1	2.5E-15	1.2E-15	1.0E-16
		3,900,782	Th-230	2.04	1.8	0.1	5.2E-16	4.6E-16	1.0E-16
		3,900,782	U-Nat	0.2	n/a	0.1	<1.0E-16	n/a	1.0E-16

[1] Concentration is from lab calculated value.

Table 4
Air Particulate Monitoring: Fourth Quarter 2010

Air Station ID	Collection Date	Air Volume Sampled (L)	Analyte	Filter Conc. (pCi/filter)	Precision (pCi/filter)	Reporting Limit (pCi/filter)	Concentration (µCi/mL)	Precision (µCi/mL)	Reporting Limit (µCi/mL)
AM1	1/4/2011	3,687,000	Pb-210	63.0	5.0	2	1.7E-14	1.4E-15	2.0E-15
		3,687,000	Ra-226	<0.3		0.3	<1.0E-16		1.0E-16
		3,687,000	Th-230	<0.3		0.3	<1.0E-16		1.0E-16
		3,687,000	U-Nat	0.4		0.1	1.1E-16		1.0E-16
AM2	1/4/2011	3,965,000	Pb-210	76.6	5.3	2	1.9E-14	1.3E-15	2.0E-15
		3,965,000	Ra-226	0.8	0.4	0.3	2.0E-16	1.0E-16	1.0E-16
		3,965,000	Th-230	0.6	0.4	0.3	1.5E-16	1.0E-16	1.0E-16
		3,965,000	U-Nat	1.0		0.1	2.5E-16		1.0E-16
AM3	1/4/2011	3,797,000	Pb-210	69.7	5.1	2	1.8E-14	1.3E-15	2.0E-15
		3,797,000	Ra-226	<0.3		0.3	<1.0E-16		1.0E-16
		3,797,000	Th-230	<0.3		0.3	<1.0E-16		1.0E-16
		3,797,000	U-Nat	1.0		0.1	2.6E-16		1.0E-16
AM4	1/4/2011	3,446,400	Pb-210	71.5	5.2	2	2.1E-14	1.5E-15	2.0E-15
		3,446,400	Ra-226	1.0	0.4	0.3	2.9E-16	1.2E-16	1.0E-16
		3,446,400	Th-230	0.5	0.3	0.3	1.5E-16	8.7E-17	1.0E-16
		3,446,400	U-Nat	1.1		0.1	3.2E-16		1.0E-16
AM5	1/4/2011	3,900,782	Pb-210	78.5	5.7	2	2.0E-14	1.5E-15	2.0E-15
		3,900,782	Ra-226	0.5	0.3	0.3	1.3E-16	7.7E-17	1.0E-16
		3,900,782	Th-230	<0.3		0.3	<1.0E-16		1.0E-16
		3,900,782	U-Nat	0.6		0.1	1.5E-16		1.0E-16

[1] Concentration is from lab calculated values

Table 5
Air Particulate Monitoring: First Quarter 2011

Air Station ID	Collection-Date	Air Volume Sampled (L)	Analyte	Filter Conc. (pCi/filter)	Precision (pCi/filter)	Reporting Limit (pCi/filter)	Concentration (µCi/mL)	Precision (µCi/mL)	Reporting Limit (µCi/mL)
AM1	3/31/2011	3,349,100	Pb-210	44.8	4.4	2	1.3E-14	1.3E-15	2.0E-15
		3,349,100	Ra-226	0.4	0.1	0.3	1.2E-16	3.0E-17	1.0E-16
		3,349,100	Th-230	<0.2		0.2	<1.0E-16		1.0E-16
		3,349,100	U-Nat	0.4		0.3	1.1E-16		1.0E-16
AM2	3/31/2011	3,522,800	Pb-210	59.3	6.6	2	1.7E-14	1.9E-15	2.0E-15
		3,522,800	Ra-226	0.7	0.2	0.3	2.0E-16	5.7E-17	1.0E-16
		3,522,800	Th-230	0.6	0.3	0.2	1.7E-16	8.5E-17	1.0E-16
		3,522,800	U-Nat	1.0		0.3	2.8E-16		1.0E-16
AM3	3/31/2011	3,359,000	Pb-210	47.2	5.5	2	1.4E-14	1.6E-15	2.0E-15
		3,359,000	Ra-226	0.4	0.1	0.3	1.2E-16	3.0E-17	1.0E-16
		3,359,000	Th-230	0.2	0.2	0.2	<1.0E-16	3.0E-17	1.0E-16
		3,359,000	U-Nat	0.5		0.3	1.6E-16		1.0E-16
AM4	3/31/2011	3,230,000	Pb-210	58.4	5.2	2	1.8E-14	1.6E-15	2.0E-15
		3,230,000	Ra-226	<1.2		1.2	2.1E-16	9.3E-17	2.1E-16
		3,230,000	Th-230	0.4	0.2	0.2	1.2E-16	6.2E-17	1.0E-16
		3,230,000	U-Nat	1.0		0.3	3.2E-16		1.0E-16
AM5	3/31/2011	3,125,721	Pb-210	52.4	4.9	2	1.7E-14	1.6E-15	2.0E-15
		3,125,721	Ra-226	0.4	0.1	0.3	1.3E-16	3.2E-17	1.0E-16
		3,125,721	Th-230	<0.2		0.2	<1.0E-16		1.0E-16
		3,125,721	U-Nat	0.4		0.3	1.3E-16		1.0E-16

Table 6
Air Particulate Monitoring: Second Quarter 2011[1]

Air Station ID	Collection Date	Air Volume Sampled (L)	Analyte	Filter Conc. (pCi/filter)	Precision (pCi/filter)	Reporting Limit (pCi/filter)	Concentration (µCi/mL)	Precision (µCi/mL)	Reporting Limit (µCi/mL)
AM1	6/27/2011	4,175,300	Pb-210	39.0	3.4	3	9.4E-15	8.1E-16	2.0E-15
		4,175,300	Ra-226	0.3	0.1	0.3	<1.0E-16		1.0E-16
		4,175,300	Th-230	<0.2		0.2	<1.0E-16		1.0E-16
		4,175,300	U-Nat	0.3		0.3	<1.0E-16		1.0E-16
AM2	6/27/2011	3,660,900	Pb-210	34.7	3.2	3	9.5E-15	8.7E-16	2.0E-15
		3,660,900	Ra-226	0.5	0.1	0.3	1.4E-16	2.7E-17	1.0E-16
		3,660,900	Th-230	0.4	0.2	0.2	<1.0E-16		1.0E-16
		3,660,900	U-Nat	0.6		0.3	1.5E-16		1.0E-16
AM3	6/27/2011	2,635,740	Pb-210	31.5	3.8	3	1.2E-14	1.4E-15	2.0E-15
		2,635,740	Ra-226	<0.3		0.3	<1.0E-16		1.0E-16
		2,635,740	Th-230	0.2	0.2	0.2	<1.0E-16		1.0E-16
		2,635,740	U-Nat	0.4		0.3	1.4E-16		1.0E-16
AM4	6/27/2011	3,470,300	Pb-210	29.9	3.0	2	8.6E-15	8.6E-16	2.0E-15
		3,470,300	Ra-226	0.5	0.1	0.3	1.5E-16	2.9E-17	2.1E-16
		3,470,300	Th-230	0.5	0.3	0.2	1.6E-16	8.6E-17	1.0E-16
		3,470,300	U-Nat	0.7		0.3	2.0E-16		1.0E-16
AM5	6/27/2011	3,788,500	Pb-210	32.2	3.1	3	8.5E-15	8.2E-16	2.0E-15
		3,788,500	Ra-226	<0.3		0.3	<1.0E-16		1.0E-16
		3,788,500	Th-230	0.4	0.2	0.2	<1.0E-16		1.0E-16
		3,788,500	U-Nat	<0.3		0.3	<1.0E-16		1.0E-16

Table 7
Air Particulate Monitoring: Third Quarter 2011

Air Station ID	Collection-Date	Air Volume Sampled (L)	Analyte	Filter Conc. (pCi/filter)	Precision (pCi/filter)	Reporting Limit (pCi/filter)	Concentration (µCi/mL)	Precision (µCi/mL)	Reporting Limit (µCi/mL)
AM1	9/27/2011	5,344,124	Pb-210	57.9	4.6	3	1.1E-14	8.6E-16	2.0E-15
		5,344,124	Ra-226	0.5	0.1	0.3	<1.0E-16		1.0E-16
		5,344,124	Th-230	0.4	0.2	0.2	<1.0E-16		1.0E-16
		5,344,124	U-Nat	0.5		0.3	<1.0E-16		1.0E-16
AM2	9/27/2011	4,697,676	Pb-210	46.7	4.1	3	9.9E-15	8.7E-16	2.0E-15
		4,697,676	Ra-226	0.7	0.2	0.3	1.4E-16	4.3E-17	1.0E-16
		4,697,676	Th-230	0.5	0.3	0.2	1.2E-16	6.4E-17	1.0E-16
		4,697,676	U-Nat	0.9		0.3	1.8E-16		1.0E-16
AM3	9/27/2011	3,738,675	Pb-210	53.7	5.2	3	1.4E-14	1.4E-15	2.0E-15
		3,738,675	Ra-226	0.6	0.1	0.3	1.5E-16	2.7E-17	1.0E-16
		3,738,675	Th-230	0.4	0.2	0.2	1.0E-16	5.3E-17	1.0E-16
		3,738,675	U-Nat	0.9		0.3	2.3E-16		1.0E-16
AM4	9/27/2011	4,597,006	Pb-210	69.3	4.9	3	1.5E-14	1.1E-15	2.0E-15
		4,597,006	Ra-226	1.1	0.2	0.3	2.3E-16	4.4E-17	1.0E-16
		4,597,006	Th-230	1.1	0.4	0.2	2.4E-16	8.7E-17	1.0E-16
		4,597,006	U-Nat	2.2		0.3	4.8E-16		1.0E-16
AM5	9/27/2011	4,885,130	Pb-210	60.2	4.6	3	1.2E-14	9.4E-16	2.0E-15
		4,885,130	Ra-226	<0.3		0.3	<1.0E-16		1.0E-16
		4,885,130	Th-230	0.2	0.2	0.2	<1.0E-16		1.0E-16
		4,885,130	U-Nat	0.4		0.3	<1.0E-16		1.0E-16
AM6	9/27/2011	6,093,170	Pb-210	52.8	4.3	2	8.7E-15	7.1E-16	2.0E-15
		6,093,170	Ra-226	0.5	0.1	0.3	<1.0E-16		1.0E-16
		6,093,170	Th-230	0.3	0.2	0.2	<1.0E-16		1.0E-16
		6,093,170	U-Nat	1.1		0.3	1.8E-16		1.0E-16
AM7	9/27/2011	5,345,795	Pb-210	62.5	5.7	4	1.2E-14	1.1E-15	2.0E-15
		5,345,795	Ra-226	0.5	0.1	0.3	<1.0E-16		1.0E-16
		5,345,795	Th-230	1.1	0.5	0.2	2.1E-16	9.4E-17	1.0E-16

Air Station ID	Collection-Date	Air Volume Sampled (L)	Analyte	Filter Conc. (pCi/filter)	Precision (pCi/filter)	Reporting Limit (pCi/filter)	Concentration (µCi/mL)	Precision (µCi/mL)	Reporting Limit (µCi/mL)
		5,345,795	U-Nat	0.5		0.3	<1.0E-16		1.0E-16
AM8	9/27/2011	6,078,899	Pb-210	81.4	5.4	3	1.3E-14	8.9E-16	2.0E-15
		6,078,899	Ra-226	1.0	0.2	0.3	1.6E-16	3.3E-17	1.0E-16
		6,078,899	Th-230	0.7	0.3	0.2	1.2E-16	4.9E-17	1.0E-16
		6,078,899	U-Nat	1.7		0.3	2.8E-16		1.0E-16
AM9	9/27/2011	5,320,210	Pb-210	61.5	5.0	3	1.2E-14	9.4E-16	2.0E-15
		5,320,210	Ra-226	<0.3		0.3	<1.0E-16		1.0E-16
		5,320,210	Th-230	0.4	0.2	0.2	<1.0E-16		1.0E-16
		5,320,210	U-Nat	0.9		0.3	1.7E-16		1.0E-16

Table 8
Air Particulate Monitoring: Fourth Quarter 2011

Air Station ID	Collection Date	Air Volume Sampled (L)	Analyte	Filter Conc. (pCi/filter)	Precision (pCi/filter)	Reporting Limit (pCi/filter)	Concentration (µCi/mL)	Precision (µCi/mL)	Reporting Limit (µCi/mL)
AM1	12/27/2011	4,887,468	Pb-210	81.6	6.4	2	1.7E-14	1.3E-15	2.0E-15
		4,887,468	Ra-226	1.3	0.3	0.3	2.7E-16	6.1E-17	1.0E-16
		4,887,468	Th-230	0.2	0.2	0.2	<1.0E-16		1.0E-16
		4,887,468	U-Nat	0.9		0.3	1.9E-16		1.0E-16
AM2	12/27/2011	4,395,618	Pb-210	83.3	6.5	2	1.9E-14	1.5E-15	2.0E-15
		4,395,618	Ra-226	1.3	0.3	0.3	2.8E-16	6.8E-17	1.0E-16
		4,395,618	Th-230	0.4	0.2	0.2	<1.0E-16		1.0E-16
		4,395,618	U-Nat	1.2		0.3	2.8E-16		1.0E-16
AM3	12/27/2011	4,655,631	Pb-210	73.9	6.0	2	1.6E-14	1.3E-15	2.0E-15
		4,655,631	Ra-226	3.3	0.4	0.3	7.0E-16	8.6E-17	1.0E-16
		4,655,631	Th-230	1.7	0.5	0.2	3.6E-16	1.1E-16	1.0E-16
		4,655,631	U-Nat	4.1		0.3	8.9E-16		1.0E-16
AM4	12/27/2011	4,174,006	Pb-210	63.5	5.0	2	1.5E-14	1.2E-15	2.0E-15
		4,174,006	Ra-226	1.6	0.3	0.3	3.7E-16	7.2E-17	1.0E-16
		4,174,006	Th-230	0.4	0.2	0.2	1.1E-16	4.8E17	1.0E-16
		4,174,006	U-Nat	1.6		0.3	3.9E-16		1.0E-16
AM5	12/27/2011	4,969,383	Pb-210	84.4	6.4	2	1.7E-14	1.3E-15	2.0E-15
		4,969,383	Ra-226	0.9	0.2	0.3	1.9E-16	4.0E-17	1.0E-16
		4,969,383	Th-230	0.2	0.2	0.2	<1.0E-16		1.0E-16
		4,969,383	U-Nat	0.8		0.3	1.7E-16		1.0E-16
AM6	12/27/2011	4,421,457	Pb-210	77.0	6.0	2	1.7E-14	1.4E-15	2.0E-15
		4,421,457	Ra-226	1.2	0.3	0.3	2.7E-16	6.8E-17	1.0E-16
		4,421,457	Th-230	0.4	0.2	0.2	<1.0E-16		1.0E-16
		4,421,457	U-Nat	1.0		0.3	2.2E-16		1.0E-16
AM7	12/27/2011	4,612,712	Pb-210	63.1	5.6	2	1.4E-14	1.2E-15	2.0E-15
		4,612,712	Ra-226	1.2	0.2	0.3	2.5E-16	4.3E-17	1.0E-16
		4,612,712	Th-230	0.5	0.3	0.2	1.0E-16	6.5E-17	1.0E-16

Air Station ID	Collection Date	Air Volume Sampled (L)	Analyte	Filter Conc. (pCi/filter)	Precision (pCi/filter)	Reporting Limit (pCi/filter)	Concentration (µCi/mL)	Precision (µCi/mL)	Reporting Limit (µCi/mL)
		4,612,712	U-Nat	1.0		0.3	2.1E-16		1.0E-16
AM8	12/27/2011	4,678,340	Pb-210	78.6	5.8	2	1.7E-14	1.2E-15	2.0E-15
		4,678,340	Ra-226	0.9	0.2	0.3	1.9E-16	4.3E-17	1.0E-16
		4,678,340	Th-230	0.3	0.2	0.2	<1.0E-16		1.0E-16
		4,678,340	U-Nat	0.7		0.3	1.4E-16		1.0E-16
AM9	12/27/2011	5,236,768	Pb-210	83.0	6.4	2	1.6E-14	1.2E-15	2.0E-15
		5,236,768	Ra-226	1.3	0.3	0.3	2.4E-16	5.7E-17	1.0E-16
		5,236,768	Th-230	0.4	0.2	0.2	<1.0E-16		1.0E-16
		5,236,768	U-Nat	0.9		0.3	1.8E-16		1.0E-16

Table 9
Air Particulate Monitoring: First Quarter 2012

Air Station ID	Collection Date	Air Volume Sampled (L)	Analyte	Filter Conc. (pCi/filter)	Precision (pCi/filter)	Reporting Limit (pCi/filter)	Concentration (µCi/mL)	Precision (µCi/mL)	Reporting Limit (µCi/mL)
AM1	3/28/12	4,828,496	Pb-210	90.9	7.0	2	1.9E-14	1.4E-15	2.0E-15
		4,828,496	Ra-226	0.7	0.2	0.3	1.4E-16	4.1E-17	1.0E-16
		4,828,496	Th-230	0.3	0.2	0.2	<1.0E-16		1.0E-16
		4,828,496	U-Nat	0.8		0.3	1.7E-16		1.0E-16
AM2	3/28/12	4,518,610	Pb-210	55.4	4.9	2	1.2E-14	1.4E-15	2.0E-15
		4,518,610	Ra-226	1.0	0.2	0.3	2.2E-16	4.4E-17	1.0E-16
		4,518,610	Th-230	1.4	0.5	0.2	3.1E-16	1.1E-16	1.0E-16
		4,518,610	U-Nat	2.8		0.3	6.2E-16		1.0E-16
AM3	3/28/12	4,672,074	Pb-210	50.0	4.6	2	1.1E-14	9.8E-16	2.0E-15
		4,672,074	Ra-226	1.2	0.2	0.3	2.5E-16	4.3E-17	1.0E-16
		4,672,074	Th-230	0.6	0.3	0.2	1.3E-16	6.4E-17	1.0E-16
		4,672,074	U-Nat	2.3		0.3	4.9E-16		1.0E-16
AM4	3/28/12	4,187,307	Pb-210	61.3	5.0	2	1.5E-14	1.2E-15	2.0E-15
		4,187,307	Ra-226	2.5	0.3	0.3	5.9E-16	7.2E-17	1.0E-16
		4,187,307	Th-230	1.9	0.5	0.2	4.6E-16	1.2E-16	1.0E-16
		4,187,307	U-Nat	3.9		0.3	9.4E-16		1.0E-16
AM5	3/28/12	4,944,570	Pb-210	65.5	5.3	2	1.3E-14	1.1E-15	2.0E-15
		4,944,570	Ra-226	0.7	0.2	0.3	1.3E-16	4.0E-17	1.0E-16
		4,944,570	Th-230	0.4	0.2	0.2	<1.0E-16		1.0E-16
		4,944,570	U-Nat	0.8		0.3	1.6E-16		1.0E-16
AM6	3/28/12	4,983,498	Pb-210	62.3	5.0	2	1.3E-14	1.0E-15	2.0E-15
		4,983,498	Ra-226	0.6	0.2	0.3	1.1E-16	4.0E-17	1.0E-16
		4,983,498	Th-230	<0.2		0.2	<1.0E-16		1.0E-16
		4,983,498	U-Nat	0.8		0.3	1.6E-16		1.0E-16
AM7	3/28/12	4,340,298	Pb-210	55.3	4.8	2	1.3E-14	1.1E-15	2.0E-15
		4,340,298	Ra-226	0.7	0.2	0.3	1.7E-16	4.6E-17	1.0E-16
		4,340,298	Th-230	0.3	0.2	0.2	<1.0E-16		1.0E-16

Air Station ID	Collection Date	Air Volume Sampled (L)	Analyte	Filter Conc. (pCi/filter)	Precision (pCi/filter)	Reporting Limit (pCi/filter)	Concentration (µCi/mL)	Precision (µCi/mL)	Reporting Limit (µCi/mL)
		4,340,298	U-Nat	1.0		0.3	2.4E-16		1.0E-16
AM8	3/28/12	4,625,520	Pb-210	56.5	5.0	2	1.2E-14	1.1E-15	2.0E-15
		4,625,520	Ra-226	3.9	0.4	0.3	8.5E-16	8.6E-17	1.0E-16
		4,625,520	Th-230	3.5	0.7	0.2	7.6E-16	1.5E-16	1.0E-16
		4,625,520	U-Nat	5.2		0.3	1.1E-15		1.0E-16
AM9	3/28/12	4,743,659	Pb-210	63.4	5.1	2	1.3E-14	1.1E-15	2.0E-15
		4,743,659	Ra-226	0.5	0.1	0.3	1.2E-16	2.1E-17	1.0E-16
		4,743,659	Th-230	0.3	0.2	0.2	<1.0E-16		1.0E-16
		4,743,659	U-Nat	0.7		0.3	1.5E-16		1.0E-16

Table 10
Air Particulate Monitoring: Second Quarter 2012

Air Station ID	Collection Date	Air Volume Sampled (L)	Analyte	Filter Conc. (pCi/filter)	Precision (pCi/filter)	Reporting Limit (pCi/filter)	Concentration (µCi/mL)	Precision (µCi/mL)	Reporting Limit (µCi/mL)
AM1	3/28/2012	4,234,024	Pb-210	51.6	5.7	2	1.2E-14	1.3E-15	2.0E-15
		4,234,024	Ra-226	0.4	0.1	0.3	<1.0E-16		1.0E-16
		4,234,024	Th-230	0.3	0.2	0.2	<1.0E-16		1.0E-16
		4,234,024	U-Nat	0.5		0.3	1.2E-16		1.0E-16
AM2	3/28/2012	3,622,831	Pb-210	49.7	6.2	2	1.4E-14	1.7E-15	2.0E-15
		3,622,831	Ra-226	0.5	0.1	0.3	1.4E-16	2.8E-17	1.0E-16
		3,622,831	Th-230	0.2	0.2	0.2	<1.0E-16		1.0E-16
		3,622,831	U-Nat	0.5		0.3	1.3E-16		1.0E-16
AM3	3/28/2012	4,470,310	Pb-210	55.8	6.1	2	1.2E-14	1.4E-15	2.0E-15
		4,470,310	Ra-226	0.4	0.1	0.3	<1.0E-16		1.0E-16
		4,470,310	Th-230	0.2		0.2	<1.0E-16		1.0E-16
		4,470,310	U-Nat	0.7		0.3	1.5E-16		1.0E-16
AM4	3/28/2012	4,207,538	Pb-210	62.3	6.7	2	1.5E-14	1.6E-15	2.0E-15
		4,207,538	Ra-226	0.6	0.1	0.3	1.3E-16	2.4E-17	1.0E-16
		4,207,538	Th-230	0.3	0.2	0.2	<1.0E-16		1.0E-16
		4,207,538	U-Nat	0.7		0.3	1.6E-16		1.0E-16
AM5	3/28/2012	4,809,229	Pb-210	53.6	5.8	2	1.1E-14	1.2E-15	2.0E-15
		4,809,229	Ra-226	0.4	0.1	0.3	<1.0E-16		1.0E-16
		4,809,229	Th-230	<0.2		0.2	<1.0E-16		1.0E-16
		4,809,229	U-Nat	0.3		0.3	<1.0E-16		1.0E-16
AM6	3/28/2012	4,772,075	Pb-210	48.5	5.0	2	1.0E-14	1.0E-15	2.0E-15
		4,772,075	Ra-226	<0.3		0.3	<1.0E-16		1.0E-16
		4,772,075	Th-230	<0.2		0.2	<1.0E-16		1.0E-16
		4,772,075	U-Nat	0.4		0.3	<1.0E-16		1.0E-16
AM7	3/28/2012	3,689,474	Pb-210	44.0	4.6	2	1.2E-14	1.2E-15	2.0E-15
		3,689,474	Ra-226	0.4	0.1	0.3	1.1E-16	2.7E-17	1.0E-16
		3,689,474	Th-230	<0.2		0.2	<1.0E-16		1.0E-16

Air Station ID	Collection Date	Air Volume Sampled (L)	Analyte	Filter Conc. (pCi/filter)	Precision (pCi/filter)	Reporting Limit (pCi/filter)	Concentration (µCi/mL)	Precision (µCi/mL)	Reporting Limit (µCi/mL)
		3,689,474	U-Nat	0.4		0.3	1.1E-16		1.0E-16
AM8	3/28/2012	4,112,019	Pb-210	45.8	4.8	2	1.1E-14	1.2E-15	2.0E-15
		4,112,019	Ra-226	0.9	0.2	0.3	2.3E-16	4.9E-17	1.0E-16
		4,112,019	Th-230	1.3	1.3	0.2	3.1E-16	3.2E-16	1.0E-16
		4,112,019	U-Nat	1.2		0.3	3.0E-16		1.0E-16
AM9	3/28/2012	4,430,827	Pb-210	49.2	5.0	2	1.1E-14	1.1E-15	2.0E-15
		4,430,827	Ra-226	0.5	0.1	0.3	1.2E-16	2.3E-17	1.0E-16
		4,430,827	Th-230	<0.2		0.2	<1.0E-16		1.0E-16
		4,430,827	U-Nat	0.4		0.3	<1.0E-16		1.0E-16

Table 11
Air Particulate Monitoring: Third Quarter 2012

Air Station ID	Collection Date	Air Volume Sampled (L)	Analyte	Filter Conc. (pCi/filter)	Precision (pCi/filter)	Reporting Limit (pCi/filter)	Concentration (µCi/mL)	Precision (µCi/mL)	Reporting Limit (µCi/mL)
AM1	9/30/2012	4,317,282	Pb-210	79.9	5.8	2	1.8E-14	1.3E-15	2.0E-15
		4,317,282	Ra-226	0.4	0.1	0.3	<1.0E-16		1.0E-16
		4,317,282	Th-230	0.2	0.2	0.2	<1.0E-16		1.0E-16
		4,317,282	U-Nat	0.4		0.3	<1.0E-16		1.0E-16
AM2	9/30/2012	4,291,002	Pb-210	69.6	6.3	2	1.6E-14	1.5E-15	2.0E-15
		4,291,002	Ra-226	0.3	0.1	0.3	<1.0E-16		1.0E-16
		4,291,002	Th-230	0.3	0.2	0.2	<1.0E-16		1.0E-16
		4,291,002	U-Nat	0.4		0.3	<1.0E-16		1.0E-16
AM3	9/30/2012	4,996,481	Pb-210	82.5	5.9	2	1.7E-14	1.2E-15	2.0E-15
		4,996,481	Ra-226	0.6	0.2	0.3	1.2E-16	4.0E-17	1.0E-16
		4,996,481	Th-230	0.3	0.2	0.2	<1.0E-16		1.0E-16
		4,996,481	U-Nat	0.7		0.3	1.4E-16		1.0E-16
AM4	9/30/2012	4,964,002	Pb-210	73.3	5.7	2	1.5E-14	1.1E-15	2.0E-15
		4,964,002	Ra-226	0.4	0.1	0.3	<1.0E-16		1.0E-16
		4,964,002	Th-230	<0.2		0.2	<1.0E-16		1.0E-16
		4,964,002	U-Nat	0.4		0.3	<1.0E-16		1.0E-16
AM5	9/30/2012	4,735,430	Pb-210	87.6	6.2	2	1.9E-14	1.3E-15	2.0E-15
		4,735,430	Ra-226	0.5	0.1	0.3	1.1E-16	2.1E-17	1.0E-16
		4,735,430	Th-230	<0.2		0.2	<1.0E-16		1.0E-16
		4,735,430	U-Nat	0.3		0.3	<1.0E-16		1.0E-16
AM6	9/30/2012	4,979,380	Pb-210	82.7	6.0	2	1.7E-14	1.2E-15	2.0E-15
		4,979,380	Ra-226	0.4	0.1	0.3	<1.0E-16		1.0E-16
		4,979,380	Th-230	<0.2		0.2	<1.0E-16		1.0E-16
		4,979,380	U-Nat	0.3		0.3	<1.0E-16		1.0E-16
AM7	9/30/2012	4,160,426	Pb-210	64.1	5.3	2	1.5E-14	1.3E-15	2.0E-15
		4,160,426	Ra-226	0.4	0.1	0.3	<1.0E-16		1.0E-16
		4,160,426	Th-230	<0.2		0.2	<1.0E-16		1.0E-16

Air Station ID	Collection Date	Air Volume Sampled (L)	Analyte	Filter Conc. (pCi/filter)	Precision (pCi/filter)	Reporting Limit (pCi/filter)	Concentration (µCi/mL)	Precision (µCi/mL)	Reporting Limit (µCi/mL)
		4,160,426	U-Nat	0.4		0.3	<1.0E-16		1.0E-16
AM8	9/30/2012	5,105,620	Pb-210	78.2	6.2	2	1.5E-14	1.2E-15	2.0E-15
		5,105,620	Ra-226	0.7	0.2	0.3	1.3E-16	3.9E-17	1.0E-16
		5,105,620	Th-230	0.4		0.2	<1.0E-16		1.0E-16
		5,105,620	U-Nat	0.8		0.3	1.6E-16		1.0E-16
AM9	9/30/2012	4,588,716	Pb-210	80.3	5.9	2	1.8E-14	1.3E-15	2.0E-15
		4,588,716	Ra-226	0.5	0.1	0.3	1.1E-16	2.2E-17	1.0E-16
		4,588,716	Th-230	<0.2		0.2	<1.0E-16		1.0E-16
		4,588,716	U-Nat	0.4		0.3	<1.0E-16		1.0E-16

Table 12
Air Particulate Monitoring: Fourth Quarter 2012

Air Station ID	Collection Date	Air Volume Sampled (L)	Analyte	Filter Conc. (pCi/filter)	Precision (pCi/filter)	Reporting Limit (pCi/filter)	Concentration (µCi/mL)	Precision (µCi/mL)	Reporting Limit (µCi/mL)
AM1	12/24/2012	3,993,919	Pb-210	59.5	5.8	2	1.5E-14	1.5E-15	2.0E-15
		3,993,919	Ra-226	<0.3		0.3	<1.0E-16		1.0E-16
		3,993,919	Th-230	0.2	0.1	0.2	<1.0E-16		1.0E-16
		3,993,919	U-Nat	0.4		0.3	<1.0E-16		1.0E-16
AM2	12/24/2012	3,858,431	Pb-210	63.4	6.0	2	1.6E-14	1.6E-15	2.0E-15
		3,858,431	Ra-226	0.5	0.1	0.3	1.4E-16	2.6E-17	1.0E-16
		3,858,431	Th-230	<0.20		0.2	<1.0E-16		1.0E-16
		3,858,431	U-Nat	0.5		0.3	1.2E-16		1.0E-16
AM4	12/24/2012	4,511,349	Pb-210	56.9	5.6	2	1.3E-14	1.2E-15	2.0E-15
		4,511,349	Ra-226	1.0	0.2	0.3	2.2E-16	4.4E-17	1.0E-16
		4,511,349	Th-230	0.7	0.3	0.2	1.5E-16	6.6E-17	1.0E-16
		4,511,349	U-Nat	1.3		0.3	2.8E-16		1.0E-16
AM5	12/24/2012	4,387,349	Pb-210	69.5	6.6	2	1.6E-14	1.5E-15	2.0E-15
		4,387,349	Ra-226	0.5	0.1	0.3	1.1E-16	2.3E-17	1.0E-16
		4,387,349	Th-230	0.3	0.2	0.2	<1.0E-16		1.0E-16
		4,387,349	U-Nat	0.5		0.3	1.1E-16		1.0E-16
AM6	12/24/2012	4,540,000	Pb-210	72.7	6.5	2	1.6E-14	1.4E-15	2.0E-15
		4,540,000	Ra-226	0.3	0.1	0.3	<1.0E-16		1.0E-16
		4,540,000	Th-230	<0.2		0.2	<1.0E-16		1.0E-16
		4,540,000	U-Nat	0.4		0.3	<1.0E-16		1.0E-16
AM7	12/24/2012	3,951,045	Pb-210	54.7	6.0	2	1.4E-14	1.5E-15	2.0E-15
		3,951,045	Ra-226	0.4	0.1	0.3	1.0E-16	1.5E-15	1.0E-16
		3,951,045	Th-230	0.2	0.1	0.2	<1.0E-16		1.0E-16
		3,951,045	U-Nat	0.4		0.3	1.0E-16		1.0E-16
AM8	12/24/2012	4,585,199	Pb-210	66.6	6.4	2	1.5E-14	1.E-15	2.0E-15
		4,585,199	Ra-226	3.4	0.4	0.3	7.5E-16	8.7E-17	1.0E-16
		4,585,199	Th-230	2.4	0.5	0.2	5.2E-16	1.1E-16	1.0E-16

Air Station ID	Collection Date	Air Volume Sampled (L)	Analyte	Filter Conc. (pCi/filter)	Precision (pCi/filter)	Reporting Limit (pCi/filter)	Concentration (µCi/mL)	Precision (µCi/mL)	Reporting Limit (µCi/mL)
		4,585,199	U-Nat	4.1		0.3	9.0E-16		1.0E-16
AM9	12/24/2012	4,163,513	Pb-210	64.8	6.7	2	1.6E-14	1.6E-15	2.0E-15
		4,163,513	Ra-226	0.4	0.1	0.3	<1.0E-16		1.0E-16
		4,163,513	Th-230	0.2	0.1	0.2	<1.0E-16		1.0E-16
		4,163,513	U-Nat	0.4		0.3	<1.0E-16		1.0E-16
AM10	12/24/2012	4,426,438	Pb-210	42.6	5.9	2	9.6E-15	1.3E-15	2.0E-15
		4,426,438	Ra-226	0.4	0.1	0.3	<1.0E-16		1.0E-16
		4,426,438	Th-230	0.3	0.2	0.2	<1.0E-16		1.0E-16
		4,426,438	U-Nat	0.3		0.3	<1.0E-16		1.0E-16

Table 13
Air Particulate Monitoring: First Quarter 2013

Air Station ID	Collection Date	Air Volume Sampled (L)	Analyte	Filter Conc. (pCi/filter)	Precision (pCi/filter)	Reporting Limit (pCi/filter)	Concentration (µCi/mL)	Precision (µCi/mL)	Reporting Limit (µCi/mL)
AM1	3/30/13	3,542,807	Pb-210	36.7	3.6	2	1.0E-14	1.0E-15	2.0E-15
		3,542,807	Ra-226	0.4	0.1	0.3	1.1E-16	2.8E-17	1.0E-16
		3,542,807	Th-230	0.5	0.4	0.2	1.5E-16	1.1E-16	1.0E-16
		3,542,807	U-Nat	0.6		0.3	1.6E-16		1.0E-16
AM2	3/30/13	4,071,122	Pb-210	34.9	3.4	2	8.6E-15	8.4E-16	2.0E-15
		4,071,122	Ra-226	0.6	0.1	0.3	1.4E-16	2.5E-17	1.0E-16
		4,071,122	Th-230	0.7	0.4	0.2	1.8E-16	9.8E-17	1.0E-16
		4,071,122	U-Nat	0.8		0.3	1.9E-16		1.0E-16
AM4	3/30/13	4,772,331	Pb-210	77.1	6.4	2	1.6E-14	1.3E-15	2.0E-15
		4,772,331	Ra-226	0.6	0.2	0.3	1.3E-16	4.2E-17	1.0E-16
		4,772,331	Th-230	0.8	0.4	0.2	1.6E-16	8.4E-17	1.0E-16
		4,772,331	U-Nat	0.7		0.3	1.5E-16		1.0E-16
AM5	3/30/13	4,573,126	Pb-210	72.4	6.1	2	1.6E-14	1.3E-15	2.0E-15
		4,573,126	Ra-226	0.4	0.1	0.3	<1.0E-16		1.0E-16
		4,573,126	Th-230	0.2	0.2	0.2	<1.0E-16		1.0E-16
		4,573,126	U-Nat	0.6		0.3	1.4E-16		1.0E-16
AM6	3/30/13	4,842,921	Pb-210	75.6	6.4	2	1.6E-14	1.3E-15	2.0E-15
		4,842,921	Ra-226	0.6	0.2	0.3	1.3E-16	4.1E-17	1.0E-16
		4,842,921	Th-230	0.5	0.3	0.2	<1.0E-16		1.0E-16
		4,842,921	U-Nat	0.7		0.3	1.5E-16		1.0E-16
AM7	3/30/13	4,492,199	Pb-210	65.2	6.0	2	1.5E-14	1.3E-15	2.0E-15
		4,492,199	Ra-226	0.6	0.2	0.3	1.4E-16	4.5E-17	1.0E-16
		4,492,199	Th-230	0.4	0.3	0.2	<1.0E-16		1.0E-16
		4,492,199	U-Nat	0.6		0.3	1.4E-16		1.0E-16
AM8	3/30/13	4,757,296	Pb-210	69.9	6.1	2	1.5E-14	1.3E-15	2.0E-15
		4,757,296	Ra-226	1.6	0.2	0.3	3.3E-16	4.2E-17	1.0E-16
		4,757,296	Th-230	2.4	0.7	0.2	4.9E-16	1.5E-16	1.0E-16

Air Station ID	Collection Date	Air Volume Sampled (L)	Analyte	Filter Conc. (pCi/filter)	Precision (pCi/filter)	Reporting Limit (pCi/filter)	Concentration (µCi/mL)	Precision (µCi/mL)	Reporting Limit (µCi/mL)
		4,757,296	U-Nat	2.0		0.3	4.1E-16		1.0E-16
AM9	3/30/13	4,832,233	Pb-210	76.8	6.4	2	1.6E-14	1.3E-15	2.0E-15
		4,832,233	Ra-226	0.6	0.1	0.3	1.2E-16	2.1E-17	1.0E-16
		4,832,233	Th-230	0.4	0.3	0.2	<1.0E-16		1.0E-16
		4,832,233	U-Nat	0.7		0.3	1.4E-16		1.0E-16
AM10	3/30/13	4,960,729	Pb-210	78.5	6.4	2	1.6E-14	1.3E-15	2.0E-15
		4,960,729	Ra-226	0.4	0.1	0.3	<1.0E-16		1.0E-16
		4,960,729	Th-230	0.3	0.3	0.2	<1.0E-16		1.0E-16
		4,960,729	U-Nat	0.5		0.3	1.1E-16		1.0E-16

Table 14
Air Particulate Monitoring: Second Quarter 2013

Air Station ID	Collection Date	Air Volume Sampled (L)	Analyte	Filter Conc. (pCi/filter)	Precision (pCi/filter)	Reporting Limit (pCi/filter)	Concentration (µCi/mL)	Precision (µCi/mL)	Reporting Limit (µCi/mL)
AM1[1]	6/29/2013	2,681,836	Pb-210	33.5	3.8	2	1.2E-14	1.4E-15	2.0E-15
		2,681,836	Ra-226	0.4	0.1	0.3	1.6E-16	3.7E-17	1.0E-16
		2,681,836	Th-230	0.7	0.3	0.2	2.6E-16	1.1E-16	1.0E-16
		2,681,836	U-Nat	0.6		0.3	2.4E-16		1.0E-16
AM2	6/29/2013	3,842,959	Pb-210	40.0	4.1	2	1.0E-14	1.1E-15	2.0E-15
		3,842,959	Ra-226	0.3	0.1	0.3	<1.0E-16		1.0E-16
		3,842,959	Th-230	<0.2		0.2	<1.0E-16		1.0E-16
		3,842,959	U-Nat	0.8		0.3	2.0E-16		1.0E-16
AM4[1]	6/29/2013	2,980,824	Pb-210	31.8	3.8	2	1.1E-14	1.3E-15	2.0E-15
		2,980,824	Ra-226	0.5	0.1	0.3	1.6E-16	3.4E-17	1.0E-16
		2,980,824	Th-230	<0.2		0.2	<1.0E-16		1.0E-16
		2,980,824	U-Nat	0.5		0.3	1.6E-16		1.0E-16
AM5[1]	6/29/2013	2,055,968	Pb-210	25.1	3.3	2	1.2E-14	1.6E-15	2.0E-15
		2,055,968	Ra-226	0.8	0.2	0.3	4.0E-16	9.7E-17	1.0E-16
		2,055,968	Th-230	0.3	0.2	0.2	1.5E-16	9.7E-17	1.0E-16
		2,055,968	U-Nat	1.0		0.3	4.7E-16		1.0E-16
AM6	6/29/2013	4,040,705	Pb-210	42.3	4.0	2	1.0E-14	9.9E-16	2.0E-15
		4,040,705	Ra-226	0.7	.02	0.3	1.6E-16	4.9E-17	1.0E-16
		4,040,705	Th-230	<0.2		0.2	<1.0E-16		1.0E-16
		4,040,705	U-Nat	0.8		0.3	1.9E-16		1.0E-16
AM7	6/29/2013	4,354,243	Pb-210	50.9	4.4	2	1.2E-14	1.0E-15	2.0E-15
		4,354,243	Ra-226	0.8	0.2	0.3	1.7E-16	4.6E-`7	1.0E-16
		4,354,243	Th-230	0.4	0.2	0.2	<1.0E-16		1.0E-16
		4,354,243	U-Nat	1.2		0.3	2.7E-16		1.0E-16
AM8	6/29/2013	4,628,230	Pb-210	44.7	4.2	2	9.7E-15	9.1E-16	2.0E-15
		4,628,230	Ra-226	1.5	0.3	0.3	3.3E-16	6.5E-17	1.0E-16
		4,628,230	Th-230	1.4	0.4	0.2	3.1E-16	8.6E-17	1.0E-16

Air Station ID	Collection Date	Air Volume Sampled (L)	Analyte	Filter Conc. (pCi/filter)	Precision (pCi/filter)	Reporting Limit (pCi/filter)	Concentration (µCi/mL)	Precision (µCi/mL)	Reporting Limit (µCi/mL)
		4,628,230	U-Nat	1.8		0.3	3.9E-16		1.0E-16
AM9	6/29/2013	4,604,134	Pb-210	46.2	4.3	2	1.0E-14	9.3E-16	2.0E-15
		4,604,134	Ra-226	0.7	0.2	0.3	1.6E-16	4.3E-17	1.0E-16
		4,604,134	Th-230	0.4	0.2	0.2	<1.0E-16		1.0E-16
		4,604,134	U-Nat	77.2		0.3	1.3E-16		1.0E-16
AM10	6/29/2013	3,832,148	Pb-210	42.0	4.0	2	1.1E-14	1.0E-15	2.0E-15
		3,832,148	Ra-226	0.7	0.2	0.3	1.7E-16	5.2E-17	1.0E-16
		3,832,148	Th-230	0.3	0.2	0.2	<1.0E-16		1.0E-16
		3,832,148	U-Nat	0.7		0.3	1.7E-16		1.0E-16

[1] *flow was less than minimum required flow of 3,000,000 Liters per quarter*

Appendix 3-B
Water Quality Monitoring Data

Table 1
Historic Crooks Creek Discharge Measurements at USGS Gage Station #06638300[1]

Date	Peak Flow (cfs)	Gage Height (ft)
1961	22	Unavailable
1962-03	128	6.27
1963	26	Unavailable
1964	26	Unavailable
1965-04	67	5.1
1966	13	Unavailable
1967	13	Unavailable
1968	13	Unavailable
1969	13	Unavailable
4/24/1970	12	3.7
1971-04	108	5.89
1972-04	51	4.76
5/20/1973	97	5.67
4/20/1974	3	2.91
7/10/1975	255	8.98
5/19/1976	2	2.8
7/25/1977	37	4.43
7/21/1978	29	4.2
4/20/1979	3	2.93
4/23/1980	49	4.71
5/24/1981	17	4.18
[1] Lidstone and Associates, Inc., 2013a.		

Table 2
Energy Fuels Crooks Creek Discharge Measurements[1]

Location	Date	Discharge (cfs)
XSCCDS	6/16/2010	5.4
XSCCDS	8/17/2010	5.7
XSCCDS	10/6/2010	3.3
XSCCDS	3/30/2011	4.1
XSCCDS	5/18/2011	3.7
XSCCDS	3/14/2012	7.6
XSCCDS	5/18/2012	4.1
Weir	8/13/2012	2.4
Weir	9/20/2012	2.6
Weir	10/25/2012	3.5
Weir	3/6/2013	3.8
Weir	4/24/2013	4.2
Weir	5/8/2013	3.6
Weir	6/26/2013	2.3
XSCCUS	5/24/2010	6.8
XSCCUS	6/16/2010	4.6
XSCCUS	8/17/2010	5.5
XSCCUS	10/6/2010	3.3
XSCCUS	3/30/2011	3.8
XSCCUS	5/18/2011	3.8
XSCCUS	3/14/2012	5.9
XSCCUS	5/18/2012	3.6
XSCCMU	5/18/2011	3.3
XSCCMU	3/14/2012	Frozen
XSCCMU	5/15/2012	2.9
1 Lidstone and Associates, Inc., 2013a.		

Table 3
Surface Water Sampling History

Year	Quarter	Crooks Creek			Impoundments				
		XSCCDS	XSCCUS	XSCCMU	McIntosh Pit	Fish Pond	SW-1	SW-2	SW-3
2010	1st	NA	NA	NA	NA	NA	NA	NA	NA
2010	2nd	5/25; 6/29	5/25; 6/28	NA	6/28	NA	4/13; 5/25	4/13; 5/25	4/13
2010	3rd	7/22; 8/18; 9/21	7/22; 8/18; 9/14	NA	9/14	NA	Dry	Dry	Dry
2010	4th	10/7; 11/15; 12/10	10/7; 11/15	NA	11/17	NA	NA	NA	NA
2011	1st	3/16; 3/29	3/29	NA	3/28	NA	NA	NA	NA
2011	2nd	4/28; 5/19; 6/21	4/28; 5/19; 6/21	5/19	6/21	NA	NA	NA	NA
2011	3rd	8/17; 9/26	8/17; 9/26	8/17; 9/26	8/17	8/17	NA	NA	NA
2011	4th	10/31	10/31	10/31		NA	NA	NA	NA
2012	1st	3/14	3/14	Frozen	3/28	NA	3/14	3/14	3/28
2012	2nd	4/16; 5/15; 6/27	4/16; 5/15; 6/27	4/16; 5/15; 6/27	5/14	NA	4/16	Dry	Dry
2012	3rd	7/23; 8/13; 9/20	7/23; 8/13; 9/20	7/23; 8/13; 9/20	8/13	NA	NA	NA	NA
2012	4th	10/25; 11/28	10/25; 11/28	10/25; 11/28	11/28	NA	NA	NA	NA
2013	1st	Frozen	3/6	3/6	Frozen	Frozen	NA	NA	NA
2013	2nd	4/24; 5/8; 6/26	4/24; 5/8; 6/26	4/24; 5/8; 6/26	4/24; 6/26	4/24; 6/26	4/24	Dry	Dry
NA = Not Applicable									

Table 4
Energy Fuels Crooks Creek Water Quality Summary

Analyses	XSCCDS						XSCCUDS						XSCCMU					
	Minimum	Maximum	Average Without Non-Detects	Standard Deviation Without Non-Detects	Percent Non-Detect	Sample Size (N)	Minimum	Maximum	Average Without Non-Detects	Standard Deviation Without Non-Detects	Percent Non-Detect	Sample Size (N)	Minimum	Maximum	Average Without Non-Detects	Standard Deviation Without Non-Detects	Percent Non-Detect	Sample Size (N)
MAJOR IONS (mg/L)																		
Total Alkalinity as CaCO3	107	168	150	12.8	0	28	110	164	145	12.5	0	27	121	161	136	8.78	0	16
Chloride	2	5	4	1	0	28	2	6	3	1	0	27	2	6	3	1	0	16
Fluoride	<0.1	0.5	0.2	0.07	7	28	<0.1	0.2	0.2	0.0	4	27	0.1	0.2	0.2	0.0	0	16
Sulfate	19	46	36	6.2	0	28	14	38	31	5.6	0	27	19	39	25	5.1	0	16
Calcium	31	53	47	4.2	0	28	12	49	44	7.2	0	27	36	47	41	2.6	0	16
Magnesium	4	6	6	0.6	0	28	4	11	5	1	0	27	4	5	4.2	0.4	0	16
Potassium	1	4	2	0.6	0	28	1	4	2	0.6	0	27	1	3	1.8	0.6	0	16
Sodium	17	28	24	2.5	0	28	16	25	21	2.2	0	27	15	23	18	2.0	0	16
PHYSICAL PROPERITES																		
pH (std units)	8.0	8.6	8.4	0.15	0	28	8.0	9.3	8.4	0.24	0	27	8.0	8.5	8.4	0.12	0	16
Conductivity (umho/cm)	289	416	359	34	0	28	259	390	336	32.1	0	27	267	371	311	28.8	0	16
Total Dissolved Solids @ 180°C	150	290	247	31.5	0	28	170	350	243	38.2	0	27	180	300	223	28.7	0	16
Total Suspended Solids	<5	46	18	12	19	27	<5	26	12	5.4	46	26	<5	18	9.5	5.1	73	15
Turbidity (NTU)	1.5	26.1	7.0	6.4	0	26	1.2	8.3	3.0	1.8	0	26	0.6	4.3	1.8	0.9	0	15
Field pH(std units)	6.7	9.1	8.3	0.54	0	24	7.1	8.9	8.2	0.41	0	23	7.0	8.6	8.0	0.43	0	15
Field Conductivity (umho/cm)	312	723	402	75.2	0	24	290	418	366	32.9	0	22	236	396	312	44.0	0	14
Field Temperature (°C)	0.60	38.6	13	8.8	0	23	0.4	37.6	13	9	0	23	1.1	37	15	8.4	0	15
TRACE METALS (mg/L) DISSOLVED																		
Arsenic	<0.005	0.008	0.002	0.002	32	28	<0.001	0.006	0.002	0.001	37	27	<0.001	0.008	0.002	0.002	19	16
Barium	<0.1	<0.1	-	-	100	28	<0.1	<0.1	-	-	100	27	<0.1	<0.1	-	-	100	16
Boron	<0.1	0.2	0.2	0.0	4	28	<0.1	0.2	0.2	0.0	96	27	<0.1	<0.1	-	-	100	16
Copper	<0.01	<0.01	-	-	100	28	<0.01	<0.01	-	-	100	27	<0.01	<0.01	-	-	100	16
Iron	<0.05	0.15	0.08	0.03	18	28	<0.05	0.18	0.1	0.03	11	27	<0.05	0.14	0.1	0.03	13	16
Lead	<0.01	<0.01	-	-	100	28	<0.01	<0.01	-	-	100	27	<0.01	<0.01	-	-	100	16
Manganese	<0.02	0.04	0.02	0.01	29	28	<0.01	0.08	0.04	0.02	11	27	<0.02	0.04	0.02	0.01	6	16
Molybdenum	<0.01	<0.01	-	-	100	28	<0.01	<0.01	-	-	100	27	<0.01	<0.01	-	-	100	16
Selenium	<0.001	0.002	0.002	0.001	86	28	<0.001	0.001	0.001	0.000	96	27	<0.001	0.001	0.001	0.000	94	16
Uranium (Dissolved)	0.0137	0.0279	0.0198	0.00297	0	28	0.0094	0.0611	0.016	0.0093	0	27	0.0105	0.0171	0.0131	0.00212	0	16
Vanadium	<0.1	<0.1	-	-	100	28	<0.1	<0.1	-	-	100	27	<0.1	<0.1	-	-	100	16
Zinc	<0.01	0.02	0.02	0.00	93	28	<0.01	0.01	0.01	0.00	96	27	<0.01	0.1	0.1	0.0	94	16
TRACE METALS (mg/L) TOTAL																		
Iron	0.2	1.5	0.5	0.3	0	28	0.08	0.63	0.34	0.10	0	27	0.09	0.69	0.3	0.16	0	16
Manganese	0.02	0.11	0.05	0.02	0	28	0.03	0.11	0.06	0.02	0	27	<0.02	0.06	0.04	0.01	6	16
RADIOMETRICS (pCi/L) TOTAL																		
Unadjusted Gross Alpha	12.3	19.3	16.3	2.35	0	8	9.6	13.2	12	1.1	0	7	NA	NA	NA	NA	NA	NA
Gross Beta	5.0	13.7	8.9	2.7	0	8	4.2	8.3	5.6	1.3	0	7	NA	NA	NA	NA	NA	NA
RADIOMETRICS (pCi/L) DISSOLVED																		
Unadjusted Gross Alpha	12.0	20.4	16.4	2.45	0	19	8.2	48.5	14	8.2	0	20	8.7	18.3	14	2.7	0	16
Gross Beta	4.4	83.7	10	17	0	19	<3	10.4	5.31	1.66	5	19	3.2	6.9	4.8	1.0	0	16
Lead 210	<1	4.2	1.8	0.83	44	27	<1	5.3	1.6	1.1	44	27	<1	4.3	2.0	0.93	44	16
Polonium 210	<1	1.3	1.3	0.0	96	27	<1	<1	-	-	100	27	<1	1.2	1.2	0.0	94	16
Radium 226	0.6	1.6	0.9	0.2	0	27	0.7	2.1	0.9	0.3	0	27	0.5	1.2	0.9	0.2	0	16
Radium 228	<1	1.2	1.1	0.05	89	27	<1	1.9	1.5	0.33	89	27	<1	<1	-	-	100	16
Thorium 230	<0.2	0.59	0.59	0.00	96	27	<0.2	0.3	0.3	0.00	93	27	<0.2	<0.2	-	-	100	16
RADIOMETRICS (pCi/L) SUSPENDED																		
Lead 210	<1	5.3	1.9	1.3	67	27	<1	3.5	1.9	0.95	67	27	<1	4.0	2	1	63	16
Polonium 210	<1	2.3	2.3	0.05	93	27	<1	4.4	4.3	0.19	89	27	<1	<1	-	-	100	16
Radium 226	<0.2	6.3	0.78	1.4	33	27	<0.2	3.6	0.53	0.80	41	27	<0.2	7.1	1.9	3.0	75	16
Thorium 230	<0.2	2.2	0.74	0.74	81	27	<0.2	0.3	0.3	0.05	93	27	<0.2	0.2	0.2	0.0	94	16
Uranium (mg/L)	<0.0003	0.287	0.04	0.09	71	28	<0.0003	0.118	0.04	0.06	89	27	<0.0003	0.0007	0.001	0.000	94	16

NA = Not Analyzed
Note: Wyoming Water Quality Tables can be found in Chapter 1 and 8: http://deq.state.wy.us/wqd/WQDrules/index.asp.

Table 5
Energy Fuels Impoundment Sites Water Quality Summary

Analyses	McIntosh Pit						Fish Pond						SW-1, SW-2, and SW-3					
	Minimum	Maximum	Average Without Non-Detects	Standard Deviation Without Non-Detects	Percent Non-Detect	Sample Size (N)	Minimum	Maximum	Average Without Non-Detects	Standard Deviation Without Non-Detects	Percent Non-Detect	Sample Size (N)	Minimum	Maximum	Average Without Non-Detects	Standard Deviation Without Non-Detects	Percent Non-Detect	Sample Size (N)
MAJOR IONS (mg/L)																		
Total Alkalinity as CaCO3	56	150	125	22.7	0	12	128	169	155	19.1	0	3	15	251	94	83	0	7
Chloride	3	19	7	4	0	12	3	5	4	1	0	3	<1	105	24.6	40.3	50	5
Fluoride	0.1	0.2	0.2	0.04	0	12	0.1	0.4	0.3	0.1	0	3	<0.1	0.3	0.2	0.06	50	5
Sulfate	99	302	223	46	0	12	20	32	27	5.1	0	3	1.0	3790	411	1127	0	10
Calcium	29	63	57	9.1	0	12	33	38	36	2.4	0	3	4	233	40	66	0	10
Magnesium	3	8	7	1	0	12	4	12	9	4	0	3	<1	118	17.0	35.9	10	9
Potassium	2	4	3	1	0	12	1	4	3	1	0	3	2	18	6	4	0	10
Sodium	38	108	94	19	0	12	16	27	23	5.0	0	3	<1	1670	256	578	30	7
PHYSICAL PROPERITES																		
pH (std units)	8.0	8.5	8.3	0.13	0	12	8.3	8.7	8.5	0.16	0	3	6.7	8.3	7.6	0.6	0	10
Conductivity (umho/cm)	313	841	738	136	0	12	299	392	360	43.2	0	3	45	8240	1011	2417	0	10
Total Dissolved Solids @ 180°C	210	600	511	98.2	0	12	200	260	237	26.2	0	3	50	7010	867	2052	0	10
Total Suspended Solids	<5	62	23	23	33	6	<5	77	64	14	33	3	28	2040	618	696	0	7
Turbidity (NTU)	1.1	16.3	5.7	5.7	0	6	3.2	19.3	10	6.7	0	3	16.3	3440	954	1307	0	7
TRACE METALS (mg/L) DISSOLVED																		
Arsenic	<0.001	<0.001	-	-	100	12	<0.005	0.002	0.002	0.000	67	3	<0.001	0.002	0.001	0.000	60	4
Barium	<0.1	<0.1	-	-	100	12	<0.1	<0.1	-	-	100	3	<0.1	0.2	0.1	0.05	70	3
Boron	<0.1	<0.1	-	-	100	12	<0.1	<0.1	-	-	100	3	<0.1	0.3	0.3	0.0	90	1
Copper	<0.01	<0.01	-	-	100	12	<0.01	<0.01	-	-	100	3	<0.01	0.01	0.01	0.00	90	1
Iron	<0.05	0.06	0.1	0.0	92	12	<0.05	0.09	0.09	0.00	67	3	<0.05	0.6	0.2	0.2	20	8
Lead	<0.01	<0.01	-	-	100	12	<0.01	<0.01	-	-	100	3	<0.01	0.001	0.001	0.000	90	1
Manganese	<0.01	<0.01	-	-	100	12	<0.01	0.04	0.04	0.00	67	3	<0.01	0.23	0.12	0.11	80	2
Molybdenum	<0.02	0.01	0.01	0.00	42	12	<0.01	<0.01	-	-	100	3	<0.01	0.05	0.04	0.02	80	2
Selenium	<0.005	0.005	0.004	0.001	33	12	<0.001	<0.001	-	-	100	3	<0.001	0.01	0.01	0.00	60	4
Uranium (Dissolved)	1.26	3.69	3.21	0.624	0	12	0.0124	0.108	0.0761	0.0451	0	3	0.003	15.0	2.0	4.4	0	10
Vanadium	<0.1	<0.1	-	-	100	12	<0.1	<0.1	-	-	100	3	<0.1	<0.1	-	-	100	0
Zinc	<0.01	0.02	0.02	0.00	67	12	<0.01	<0.01	-	-	100	3	<0.01	0.02	0.02	0.00	80	2
TRACE METALS (mg/L) TOTAL																		
Iron	<0.05	0.27	0.15	0.08	42	12	0.24	0.55	0.39	0.13	0	3	0.52	27.5	8.9	9.4	0	10
Manganese	<0.01	<0.01	-	-	100	12	0.07	0.25	0.1	0.08	0	3	0.02	0.49	0.1	0.2	0	10
RADIOMETRICS (pCi/L) TOTAL																		
Unadjusted Gross Alpha	1450	2368	1908	375	0	3	NA	NA	NA	NA	NA	NA	104	1560	832	728	0	2
Gross Beta	854	1121	989	109	0	3	NA	NA	NA	NA	NA	NA	58.2	1035	547	488	0	2
RADIOMETRICS (pCi/L) DISSOLVED																		
Unadjusted Gross Alpha	804	2340	1863	427	0	9	12.8	60.7	44.2	22.2	0	3	9.1	10400	1912	3270	0	8
Gross Beta	281	1230	720	323	0	9	3.0	26.4	16	9.6	0	3	11.9	3700	660	1167	0	8
Lead 210	1.0	45.5	10	12	0	12	1.4	5.7	3.6	1.8	0	3	<1	27	17	8.2	14	7
Polonium 210	<1	1.4	1.4	0.0	91	12	<1	<1	-	-	100	3	<1	11.1	6.0	4.5	43	7
Radium 226	10.8	41.4	19.1	7.75	0	12	<0.2	1.6	1.4	0.25	33	3	<0.2	878	173	322	10	9
Radium 228	<1	5.09	2.59	1.08	33	12	<1	<1	-	-	100	3	<1	36.5	8.62	12.6	20	8
Thorium 230	<0.2	0.2	0.2	0.0	92	12	<0.2	<0.2	-	-	100	3	0.28	9.7	3.2	3.2	0	7
RADIOMETRICS (pCi/L) SUSPENDED																		
Lead 210	<1	121	20.6	33.0	8	12	1.4	2.4	1.7	0.47	0	3	2.7	293	84	109	0	7
Polonium 210	<1	10.3	4.00	3.69	67	12	<1	<1	-	-	100	3	<1	9.5	3.7	3.1	29	5
Radium 226	0.2	7.5	1.9	1.9	0	12	0.8	1.2	0.97	0.17	0	3	1.5	314	83	115	0	7
Thorium 230	<0.2	16.7	2.8	4.7	17	12	0.5	0.7	0.6	0.09	0	3	2.4	305	77	112	0	7
Uranium (mg/L)	0.0009	0.0206	0.005	0.01	0	12	0.0006	0.0012	0.001	0.0002	0	3	0.02	38.5	8	14	0	7

NA = Not Analyzed
Note: Wyoming Water Quality Tables can be found in Chapter 1 and 8: http://deq.state.wy.us/wqd/WQDrules/index.asp.

Table 6
Groundwater Quality Mean Values (Q2 2010 through Q3 2013)

Constituents (units):	Mean Concentrations																				
	PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-7	PZ-8	PZ-9	PZ-10	MW-6 New	MW-6N	MW-6S	MW-7	MW-9	MW-10	G-3	G-4	G-5	G-6	G-7	G-8*	Sheep I†
Field Parameters																						
pH (Std. Units)	6.1 - 7.42	7.1 - 8.7	6.61 - 9.5	6.73 - 8.63	7.1 - 9.1	7.2 - 10.42	7.5 - 9.38	7.35 - 8.44	7.28 - 8.06	7.1 - 8.1	6.85 - 9.41	7.5 - 9.06	6.91 - 8.51	7.22 - 9.3	7.21 - 9.6	6.93 - 7.64	7.16 - 7.8	6.03-7.3	7.2 - 7.8	6.71 - 7.2	-	6.62 - 8.79
General Parameters																						
Solids, Total Dissolved TDS @ 180°C (mg/L)	352	47	419	223	192	733	253	597	316	398	854	965	272	608	635	2296	416	738	486	788	630	475
Solids, Total Suspended (mg/L)	3.1	9.0	<5	<5	7.2	-	-	-	-	7.7	15.5	32.0	48.1	8.4	1471.8	74.8	33.3	34.0	372.0	107.0	22300.0	-
Major Ions																						
Alkalinity (mg/L)	172	98	141	164	105	117	105	231	153	185	403	482	234	207	162	340	186	139	196	218	330	97
Bicarbonate (mg/L)	210	118	158	196	121	117	102	278	186	220	451	544	280	235	176	411	226	169	237	266	402	118
Calcium, Dissolved (mg/L)	54	17	62	49	11	116	12	22	54	43	4	6	43	4	2	165	81	133	88	166	55	17
Carbonate (mg/L)	<5	<5	<5	5.3	6.4	<5	18.0	5.0	<5	5.3	20.2	21.5	5.5	9.2	11.4	5.8	<5	<5	5.1	5.0	<5	<5
Chloride (mg/L)	10	3	4	6	4	6	2	18	5	13	11	262	4	32	4	14	6	5	17	19	14	4
Fluoride, Total (mg/L)	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.1	0.1	0.1	0.7	0.4	0.2	0.3	0.1	0.2	0.2	0.2	0.2	0.1	0.5	0.1
Magnesium, Dissolved (mg/L)	7	2	5	7	1	23	2	6	13	10	1	2	19	1	1	93	10	18	10	16	12	4
Nitrogen, Ammonia (mg/L)	0	<0.1	<0.1	<0.1	<0.1	0	<0.1	<0.1	0.2	0	0.2	0.4	0.7	0.2	0.6	0.5	<0.1	<0.1	0.1	0.1	0.3	0.2
Nitrogen, Nitrate & Nitrite (mg/L)	0.55	<0.1	0.14	0.16	<0.1	<0.1	<0.1	0.17	0.10	<0.1	<0.1	<0.1	<0.1	0.11	<0.1	<0.1	<0.1	0.18	0.11	2.15	<0.1	<0.1
Potassium, Dissolved (mg/L)	2	2	2	2	1	5	2	4	2	3	2	3	5	3	4	9	2	3	2	4	7	3
Sodium, Dissolved (mg/L)	46	27	62	17	54	60	58	157	20	73	300	399	33	205	90	424	34	39	50	38	181	126
Sulfate (mg/L)	77	8	159	20	36	384	53	170	73	106	219	6	28	190	40	1287	132	349	145	296	220	223
Metals																						
Aluminum, Dissolved (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.15	0.16	0.4	<0.1	0.11	1.1	<0.1	<0.1	<0.1	0.11	<0.1	<0.1	<0.1
Arsenic, Dissolved (mg/L)	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.002	<0.005	0.002	<0.005	<0.005	0.0104	0.003	<0.005	<0.005	<0.005	<0.001	0.001	<0.001
Barium, Dissolved (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beryllium, Dissolved (mg/L)	0.004	0.004	0.001	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.003	<0.1	<0.01	<0.01	<0.01	<0.01	0.004	<0.01	<0.01	<0.01	<0.001	<0.001	<0.001
Boron, Dissolved (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.10	0.3	<0.1	<0.1	<0.1	0.6	<0.1	<0.1	<0.1	<0.1	0.20	<0.1
Cadmium, Dissolved (mg/L)	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.002	<0.002	<0.002	<0.001	<0.001	<0.001
Chromium, Dissolved (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper, Dissolved (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.011	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron, Dissolved (mg/L)	<0.05	0.0578	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.11	0.22	<0.05	<0.05	0.33	<0.05	<0.05	<0.05	<0.05	0.095	<0.05	<0.05
Iron, Total (mg/L)	0.92	0.06	<0.05	0.25	<0.05	5.43	0.39	0.38	0.45	0.32	1.38	3.28	1.45	0.18	9.89	4.78	0.75	3.80	10.20	1.05	136.00	3.79
Lead, Dissolved (mg/L)	<0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.02	<0.01	<0.02	<0.02	<0.02	<0.01	<0.01	<0.01
Manganese, Dissolved (mg/L)	0.05	<0.02	0.06	<0.02	<0.02	0.29	0.29	<0.02	0.02	0.10	0.01	0.02	0.03	<0.02	<0.02	0.65	0.13	0.26	0.17	0.16	0.39	<0.1
Manganese, Total (mg/L)	0.15	<0.02	0.06	<0.02	<0.02	0.32	0.13	0.04	0.03	0.14	0.03	0.06	0.04	<0.02	0.17	0.72	0.18	0.28	0.39	0.17	2.83	0.12
Mercury, Dissolved (mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Molybdenum, Dissolved (mg/L)	<0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	0.03	0.02
Nickel, Dissolved (mg/L)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Selenium, Dissolved (mg/L)	0.005	<0.005	<0.005	<0.005	0.002	<0.005	0.004	<0.005	<0.005	<0.005	<0.005	0.003	<0.005	<0.005	<0.005	<0.005	<0.005	0.020	<0.005	0.0295	0.004	<0.001

Constituents (units):	Mean Concentrations																				
	PZ-1	**PZ-2**	**PZ-3**	**PZ-4**	**PZ-5**	**PZ-7**	**PZ-8**	**PZ-9**	**PZ-10**	**MW-6 New**	**MW-6N**	**MW-6S**	**MW-7**	**MW-9**	**MW-10**	**G-3**	**G-4**	**G-5**	**G-6**	**G-7**	**G-8***	**Sheep I†**
Uranium Suspended (mg/L)	0.001	<0.0003	<0.0003	0.00033	<0.0003	0.1	0.001	0.0004	0.0004	0.0006	0.0036	0.0003	0.001	0.0009	0.031	0.003	0.002	0.01	0.02	0.02	0.14	0.02
Uranium, Dissolved (mg/L)	0.74	0.00354	0.00492	0.257	0.002	0.50	0.16	0.044	0.067	0.0785	0.00222	0.0008	0.0074	0.0021	0.0086	0.104	0.0396	0.395	0.0640	6.6400	0.3740	0.1890
Vanadium, Dissolved (mg/L)	0.08	0.08	<0.1	0.08	<0.1	<0.02	0.05	<0.02	<0.1	<0.1	<0.1	<0.1	<0.1	0.08	<0.1	0.02	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Zinc, Dissolved (mg/L)	<0.01	0.011	0.01	<0.01	0.011	0.1	0.1	0.3	0.02	0.02	<0.01	<0.01	<0.01	<0.01	0.011	<0.01	0.013	0.05	0.012	<0.01	<0.01	<0.01
Radionuclides																						
Gross Alpha, Dissolved (pCi/L)	459.3	17.6	11.3	160.8	9.3	189.0	120.0	27.2	21.7	35.0	7.7	4.0	22.8	6.6	65.0	57.4	48.8	265.5	46.6	4115.0	252.0	-
Adjusted Dissolved Gross Alpha, (pCi/L)	6.5	15.3	7.5	5.00	8	33.3	32.7	<1	1.7	4.4	6.2	3.7	18.3	5.7	63.3	<1	22.0	10.9	5.2	<1	<1	-
Gross Alpha, Total (pCi/L)	374.3	20.5	9.9	196.3	9.8	508.5	223.0	63.0	72.7	-	14.6	4.3	32.1	31.5	370.4	-	-	-	-	-	-	208.5
Lead 210 Dissolved (pCi/L)	3.0	3.2	0.9	3.4	1.9	4.7	15.7	2.5	1.6	3.1	1.5	1.7	1.3	1.4	6.9	2.3	3.2	4.3	4.6	6.8	-	15.3
Lead 210 Suspended (pCi/L)	7.2	2.6	1.3	8.6	1.2	75.0	29.4	25.8	29.7	1.7	1.4	0.8	2.9	1.7	18.5	2.4	7.7	5.2	9.0	8.3	-	18.1
Polonium 210 Dissolved (pCi/L)	<1.0	1.66	1.15	1.086	<1.0	1.6	1.8	1.33	1	<1.0	<1.0	<1.0	<1.0	1.06	6.1	1.17	<1.0	<1	2.0	<1	-	<1
Polonium 210 Suspended (pCi/L)	0.85	1.4	1.18	5.5	<1.0	10.0	12.3	1.6	4.0	<1.0	<1.0	<1.0	1.05	1.13	13.2	1.01	1.6	1.5	1.32	1.725	-	5
Radium 226 Dissolved (pCi/L)	3.8	9.9	2.6	2.4	2.0	16.1	3.2	2.8	4.8	3.0	0.6	0.4	11.4	2.4	5.6	0.9	19.0	5.7	4.3	18.0	8.0	24.5
Radium 226 Suspended (pCi/L)	2.5	0.4	0.2	0.4	<0.2	2.6	0.2	0.3	0.7	0.4	0.4	0.3	1.5	0.5	16.5	1.5	7.8	4.2	14.3	4.8	207.0	56.5
Radium 228 Dissolved (pCi/L)	2.3	1.1	4.0	2.9	1.9	4.2	<1.0	<1	5.4	1.7	1.3	<1.0	1.2	1.1	4.0	1.1	4.3	6.5	3.4	3.5	-	1.6
Thorium 230 Dissolved (pCi/L)	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	0.6	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	1.5	<0.2	0.5	0.2	0.4	<0.2	-	<0.2
Thorium 230 Suspended (pCi/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.7	<0.2	<0.2	<0.2	0.6	0.5	6.0	0.7	1.3	0.8	14.3	9.0	-	4.2

* G-8 data represent one sampling event in March 2013

† Sheep I Shaft data represent one sampling event in March 2013

Note: Wyoming Water Quality Tables can be found in Chapter 1 and 8: http://deq.state.wy.us/wqd/WQDrules/index.asp.

Appendix 3-C
Water Rights

Table 1
Groundwater Rights Within Permit Area and 3 Miles Beyond the Permit Boundary.

Water Right (WR) Number	Twn	Rng	Sec	Qtr-Qtr	Latitude	Longitude	Priority Date	Facility Name	Company / Owner	Total Depth (Ft)	Static Water Level (Ft)	Appropriation (GPM)	Well Log (Y/N)	Uses	Summary Water Right (WR) Status
P102900.0W	027N	092W	10	NE1/4NE1/4	42.33222	-107.7971	7/5/1996	JP-40	GREEN MOUNTAIN MINING VENTURE	38	10.5	0		MON	
P34440.0W	027N	092W	11	NW1/4NW1/4	42.33222	-107.7923	8/19/1976	ROCK WELL #1	GREEN MOUNTAIN MINING VENTURE	358	16.7	0		MIS	Incomplete
P35444.0W	027N	092W	11	NW1/4NW1/4	42.33222	-107.7923	10/29/1976	ROCK WELL #2	GREEN MOUNTAIN MINING VENTURE	99.6	11	0		MON	Complete
P147542.0W	027N	092W	2	SE1/4SE1/4	42.33569	-107.7776	10/21/2002	BEMW-001		98	56	0		MON	Complete
P147588.0W	027N	092W	2	SE1/4SE1/4	42.33572	-107.7778	10/22/2002	BEMW-002		80	51.6	0		MON	Complete
P147589.0W	027N	092W	2	SE1/4SE1/4	42.33572	-107.7778	10/22/2002	BEMW-003		95	73.25	0		MON	Complete
P147590.0W	027N	092W	2	SE1/4SE1/4	42.33572	-107.7778	10/22/2002	BEMW-004	Kennecott Uranium Co.	100	73.2	0		MON	Complete
P147591.0W	027N	092W	2	SE1/4SE1/4	42.33572	-107.7778	10/22/2002	BEMW-005	Kennecott Uranium Co.	120	90.06	0		MON	Complete
P181642.0W	027N	092W	1	NW1/4SW1/4	42.33928	-107.7727	6/8/2007	ENL. ZENITH #1 WELL	GREEN MOUNTAIN MINING VENTURE	850	210	0		MIS	Complete
P41033.0W	027N	092W	1	NW1/4SW1/4	42.33928	-107.7727	4/15/1977	ZENITH #1	GREEN MOUNTAIN MINING VENTURE	850	210	60		MIS	Fully Adjudicated
CR UW03/438	027N	092W	1	NW1/4SW1/4	42.33928	-107.7727	4/15/1977	ZENITH #1	KENNETH L. MARBLE			60		MIS	
P147592.0W	027N	092W	2	NW1/4SE1/4	42.339336	-107.7825	10/22/2002	BEMW-006		170	148.99	0		MON	Complete
P49790.0W	028N	092W	32	SE1/4NE1/4	42.35781	-107.8358	7/25/1979	PIEZO #5	ENERGY FUELS WYOMING INC	440	134.5	0		MON	Complete
P49789.0W	028N	092W	33	NW1/4NW1/4	42.36133	-107.8309	7/25/1979	PIEZO #4	ENERGY FUELS WYOMING INC	220	168	0		MON	Complete
P49788.0W	028N	092W	29	SE1/4SE1/4	42.36493	-107.8357	7/25/1979	PIEZO #3	ENERGY FUELS WYOMING INC	280	129	0		MON	Complete
P33910.0W	028N	092W	29	NE1/4SE1/4	42.368539	-107.8357	5/18/1976	MCINTOSH WELL #2	URANIUM ONE VENTURES	250	160	5	N	MIS	Complete
P43954.0W	028N	092W	29	NE1/4SE1/4	42.368539	-107.8357	6/14/1978	MCINTOSH WELL #3	URANIUM ONE VENTURES	300	120.7	25	N	MIS	Complete
P49786.0W	028N	092W	29	NE1/4SE1/4	42.36854	-107.8357	7/25/1979	PIEZO #1	ENERGY FUELS WYOMING INC	200	101	0		MON	Complete
CR UW04/134	028N	092W	29	NE1/4SE1/4	42.36854	-107.8357	5/18/1976	MCINTOSH WELL #2	WILLIAM MCINTOSH			5		MIS	
CR UW04/135	028N	092W	29	NE1/4SE1/4	42.36854	-107.8357	6/14/1978	MCINTOSH WELL #3	WILLIAM MCINTOSH			25		MIS	
P49787.0W	028N	092W	28	NE1/4SW1/4	42.3691	-107.8243	7/25/1979	PIEZO #2	ENERGY FUELS WYOMING INC	730	236	0		MON	Complete
P44469.0W	028N	092W	28	SW1/4NE1/4	42.37213	-107.8211	7/17/1978	SD 18 16	ENERGY FUELS WYOMING INC	1410	757	20		MIS	Unadjudicated
P28675.0W	028N	092W	20	SE1/4SE1/4	42.37925	-107.8356	8/27/1974	GOLDEN GOOSE II WATER	URANIUM ONE VENTURES	500	0	7	N	IND_GW	Complete
P4158.0W	028N	092W	20	SE1/4SE1/4	42.37925	-107.8356	1/12/1970	YELLOWSANDS NO.1	ENERGY FUELS WYOMING INC	500	200	12		DOM_GW; IND_GW	Unadjudicated
CR UW04/136	028N	092W	20	NE1/4SE1/4	42.38277	-107.8356	8/27/1974	GOLDEN GOOSE II WATER	U.S. ENERGY-CRESTED CORPORATION			7		MIS	
P44886.0W	028N	092W	22	NE1/4SW1/4	42.38296	-107.8065	8/21/1978	PL-21A	ENERGY FUELS WYOMING INC	1410	675	35		MIS	Unadjudicated
P52291.0W	028N	092W	21	SE1/4NW1/4	42.38641	-107.8260	5/30/1980	PZ-8	ENERGY FUELS WYOMING INC	420	304	0		MON	Complete

Water Right (WR) Number	Twn	Rng	Sec	Qtr-Qtr	Latitude	Longitude	Priority Date	Facility Name	Company / Owner	Total Depth (Ft)	Static Water Level (Ft)	Appropriation (GPM)	Well Log (Y/N)	Uses	Summary Water Right (WR) Status
P1490.0W	028N	092W	21	SW1/4NE1/4	42.38647	-107.8211	5/6/1965	GOLDEN GOOSE WATER WELL NO.1	ENERGY FUELS WYOMING INC	800	-1	5		DOM_GW; IND_GW	Incomplete
P192613.0W	028N	092W	20	NE1/4NE1/4	42.389428	-107.8356	1/19/2010	CONGO MW 4	ENERGY FUELS WYOMING INC			0		MON	Incomplete
P192612.0W	028N	092W	21	NE1/4NE1/4	42.389728	-107.8161	1/19/2010	CONGO MW 3	ENERGY FUELS WYOMING INC			0		MON	Incomplete
P52289.0W	028N	092W	20	NW1/4NE1/4	42.389919	-107.8404	5/30/1980	PZ-6C	ENERGY FUELS WYOMING INC	240	123	0		MON	Complete
P145360.0W	028N	092W	20	NE1/4NE1/4	42.38992	-107.8356	5/8/2002	PAY DIRT PIT				2500		MIS	
P52287.0W	028N	092W	20	NE1/4NE1/4	42.38992	-107.8356	5/30/1980	PZ-6A	ENERGY FUELS WYOMING INC	240	123	0		MON	Complete
P52288.0W	028N	092W	20	NW1/4NE1/4	42.390008	-107.8403	5/30/1980	PZ-6B	ENERGY FUELS WYOMING INC	241	124	0		MON	Complete
P52293.0W	028N	092W	21	NE1/4NE1/4	42.39017	-107.8162	5/30/1980	PZ-10	ENERGY FUELS WYOMING INC	400	31.55	0		MON	Complete
P192610.0W	028N	092W	16	SW1/4SW1/4	42.393103	-107.8309	1/19/2010	CONGO MW 1	ENERGY FUELS WYOMING INC			0		MON	Incomplete
P170167.0W	028N	092W	16	SW1/4SW1/4	42.39357	-107.8308	8/24/2005	PZ7	Wyo. State Lands & Investments			25		STK	
P172609.0W	028N	092W	16	SE1/4SW1/4	42.39365	-107.8260	12/14/2005	CONGO PIT NO. 1 WELL	ENERGY FUELS WYOMING INC			25		MIS	
P192611.0W	028N	092W	16	NW1/4SE1/4	42.396836	-107.8209	1/19/2010	CONGO MW 2	ENERGY FUELS WYOMING INC			0		MON	Incomplete
P52292.0W	028N	092W	16	NW1/4SE1/4	42.397633	-107.8206	5/30/1980	PZ-9	ENERGY FUELS WYOMING INC	840	205	0		MON	Complete
P409.0C	028N	092W	18	NE1/4NE1/4	42.4045	-107.8550	7/31/1945	CROOKS GAP STATION WATER WELL	SINCLAIR REFINING CO.	215	10	15		IND_GW	Incomplete
P16758.0W	028N	092W	12	NW1/4NE1/4	42.41883	-107.7630	11/29/1972	BOULDER SPRING #4039		8	-1	10		STK	Complete
P43197.0W	028N	092W	5	NW1/4SE1/4	42.42609	-107.8405	5/9/1978	BORDENS WELL #101		235	140	12		DOM_GW; STK	Complete
P148684.0W	028N	092W	5	SW1/4NE1/4	42.42967	-107.8405	12/3/2002	RIGBY PASTURE NO. 1		100	40	25		DOM_GW; STK	Complete
P7439.0P	029N	092W	33	SW1/4SE1/4	42.43697	-107.8430	5/15/1929	LAZY C S #1	BESSIE A. MCINTOSH	280	20	10		DOM_GW; STK	Complete

Table 2
Surface Water Rights Within 1/2-Mile of the Permit Area Boundary.

Stream Source	Water Right (WR) Number	Twn	Rng	Sec	Qtr-Qtr	Latitude	Longitude	Priority Date	Facility Name	Company / Owner	Facility Type	Total Capacity (AF/Yr)	Diversion Capacity at Headgate (CFS)	Active Capacity (AF)	Inactive Capacity (AF)	Size of Reservoir (AF)	Total Flow (CFS) / Approp. (GPM)	Uses	Summary Water Right (WR) Status
Quaking Asp Creek	CR CR11/187	028N	092W	32	SE1/4NE1/4	42.35781	-107.83578	3/11/1976	McIntosh No. 2 Stock Reservoir	U.S. ENERGY - CRESTED CORP.	Reservoir	14.2		0	0	14.2	0	STO	
Quaking Asp Creek	P8104.0S	028N	092W	32	SE1/4NE1/4	42.357816	-107.835783	3/11/1976	McIntosh No. 2 Stock Reservoir	U.S. ENERGY/CRESTED CORPORATION	Reservoir	14.2		0	0	14.2	0	STO	Fully Adjudicated
McIntosh Draw	P8393.0R	028N	092W	32	SE1/4NE1/4	42.357817	-107.835783	3/13/1981	MCINTOSH PIT RESERVOIR		Reservoir	537.35		0	537.35	537.35	0	STO; WL	Complete
East Hanks Draw	P13991.0R	028N	092W	16	SE1/4SW1/4	42.393167	-107.825611	2/23/1987	CONGO PIT	US ENERGY/CRESTED CORP	Reservoir			0	1234.5	1234.5	0	STO; WL	Incomplete
Sheehan Spring	P22281.0D	028N	092W	28	SW1/4NW1/4	42.372118	-107.830837	6/20/1958	Sheehan Spring Diversion	HEALD PROJECT #2	Spring		0.1	0	0	0	0.1	DOM_SW; MIN	
Sheehan Springs Draw	P7714.0R	028N	092W	29	SE1/4NE1/4	42.372132	-107.835668	3/11/1976	McIntosh No. 1 Reservoir	U.S. ENERGY/CRESTED CORPORATION	Spring	481.36		0	0	481.36	0	MIN; MIS_SW; COMBBU	Unadjudicated
Spring	P17020.0D	028N	092W	15	NE1/4NW1/4	42.404659	-107.806424	8/31/1925	Sheep Creek Pipe Line No. 2	UNION OIL COMPANY OF CALIFORNIA	Spring		0.026	0	0	0	0.03	DOM_SW; DRI; MIS_SW; OIL; STO	Fully Adjudicated
Spring	CR CC45/288	028N	092W	15	NE1/4NW1/4	42.40466	-107.80642	8/31/1925	Sheep Creek Pipe Line No. 2	UNION OIL COMPANY OF CALIFORNIA	Spring			0	0	0	0.03	DOM_SW	
Crook's Creek	CR CC37/076	028N	092W	20	SE1/4SW1/4	42.37938	-107.84526	5/20/1907	Crook's Creek Ditch	RED CREEK SHEEP COMPANY	Stream			0	0	0	1.06	IRR_SW	
Crook's Creek	P7774.0D	028N	092W	20	SE1/4SW1/4	42.379657	-107.84661	5/20/1907	Crook's Creek Ditch	CABRIN LEMMON	Stream		-1	0	0	0	1.06	IRR_SW	Fully Adjudicated
Crook's Creek	P35001.0D	028N	092W	20	SE1/4SW1/4	42.38	-107.846889	5/13/2013	CROOKS GAP WATER HAUL	FREMONT COUNTY TRANSPORTATION DEPARTMENT	Stream			0	0	0	1	TEM	Complete
Crook's Creek	CR CC09/056	028N	092W	20	SW1/4NW1/4	42.38647	-107.8502	5/24/1901	Stevens Ditch No. 3	CHARLES JOHNSON	Stream			0	0	0	0.37	IRR_SW	
Crook's Creek	P3963.0E	028N	092W	19	NE1/4NE1/4	42.389991	-107.855153	1/10/1919	Stevens Ditch No. 3 {Enl. of}	CHARLES JOHNSON	Stream		3.75	0	0	0	1.39	IRR_SW	Unadjudicated
Sheep Creek	CR CC29/283	028N	092W	22	NW1/4NE1/4	42.39021	-107.80159	12/31/1903	Sheep Creek Ditch No. 1	JESSE JOHNSON	Stream			0	0	0	0.78	IRR_SW	
Sheep Creek	CR CC29/284	028N	092W	22	NW1/4NE1/4	42.39021	-107.80159	5/24/1901	Sheep Creek Ditch No. 2	JESSE JOHNSON	Stream			0	0	0	0.8	IRR_SW	
Crook's Creek	P3195.0D	028N	092W	19	NE1/4NE1/4	42.390468	-107.853921	5/24/1901	Stevens Ditch No. 3	GILBERT STEVENS	Stream		-1	0	0	0	1.5	IRR_SW	Fully Adjudicated

Stream Source	Water Right (WR) Number	Twn	Rng	Sec	Qtr-Qtr	Latitude	Longitude	Priority Date	Facility Name	Company / Owner	Facility Type	Total Capacity (AF/Yr)	Diversion Capacity at Headgate (CFS)	Active Capacity (AF)	Inactive Capacity (AF)	Size of Reservoir (AF)	Total Flow (CFS) / Approp. (GPM)	Uses	Summary Water Right (WR) Status
Sheep Creek	P3197.0D	028N	092W	22	NW1/4NE1/4	42.390565	-107.803613	5/24/1901	Sheep Creek Ditch No. 2	MATILDA J. MCLAUGHLIN	Stream		-1	0	0	0	1.14	IRR_SW	Fully Adjudicated
Crook's Creek	P17025.0D	028N	092W	18	NE1/4SE1/4	42.397083	-107.854889	10/5/1925	Crooks Creek 2" Water Line Pipeline	ATLANTIC RICHFIELD CO.	Stream		0.048	0	0	0	0.05	DOM_SW; DRI; MIS_SW; OIL; STO	Fully Adjudicated
Crook's Creek	CR CC45/559	028N	092W	18	NE1/4SE1/4	42.39722	-107.85504	10/5/1925	Crooks Creek 2" Water Line Pipeline	PRODUCERS REFINERS CORPORATION	Stream			0	0	0	0.05	DOM_SW; OIL; STO	
Sheep Creek	P17019.0D	028N	092W	15	NE1/4NW1/4	42.404658	-107.807458	8/31/1925	Sheep Creek Pipe Line No. 1	UNION OIL COMPANY OF CALIFORNIA	Stream		0.026	0	0	0	0.03	DOM_SW; DRI; MIS_SW; OIL; STO	Fully Adjudicated
Sheep Creek	CR CC45/287	028N	092W	15	NE1/4NW1/4	42.40466	-107.80642	8/31/1925	Sheep Creek Pipe Line No. 1	UNION OIL COMPANY OF CALIFORNIA	Stream			0	0	0	0.03	DOM_SW	

Table 3
Surface Water Rights for Any Stream Leaving the Permit Area for a Distance of 3 Miles Downstream.

Stream Source	Water Right (WR) Number	Twn	Rng	Sec	Qtr-Qtr	Latitude	Longitude	Priority Date	Facility Name	Company / Owner	Facility type	Total Capacity (AF/Yr)	Diversion Capacity at Headgate (CFS)	Active Capacity (AF)	Inactive Capacity (AF)	Size of Reservoir (AF)	Total Flow (CFS) / Approp. (GPM)	Uses	Summary Water Right (WR) Status
Quaking Asp Creek	CR CR11/187	028N	092W	32	SE1/4NE1/4	42.35781	-107.83578	3/11/1976	McIntosh No. 2 Stock Reservoir	U.S. ENERGY - CRESTED CORP.	Reservoir	14.2		0	0	14.2	0	STO	
Quaking Asp Creek	P8104.0S	028N	092W	32	SE1/4NE1/4	42.357816	-107.835783	3/11/1976	McIntosh No. 2 Stock Reservoir	U.S. ENERGY/CRESTED CORPORATION	Reservoir	14.2		0	0	14.2	0	STO	Fully Adjudicated
McIntosh Draw	P8393.0R	028N	092W	32	SE1/4NE1/4	42.357817	-107.835783	3/13/1981	MCINTOSH PIT RESERVOIR		Reservoir	537.35		0	537.35	537.35	0	STO; WL	Complete
East Hanks Draw	P13991.0R	028N	092W	16	SE1/4SW1/4	42.393167	-107.825611	2/23/1987	CONGO PIT	US ENERGY/CRESTED CORP	Reservoir			0	1234.5	1234.5	0	STO; WL	Incomplete
Crook's Creek	P4073.0R	028N	092W	5	SW1/4NW1/4	42.429823	-107.849995	9/24/1926	J. M. Reservoir	J. M. KIRK	Reservoir	2.84		0	0	2.84	0	DOM_SW; IRR_SW; STO; COMBBU	
Thompson Gulch	P5429.0R	029N	092W	33	NE1/4SW1/4	42.440644	-107.847541	5/11/1933	Diehl Reservoir	HENRY C. DIEHL	Reservoir	23.19		0	0	23.19	0	DOM_SW; STO; COMBBU	
Sheehan Spring	P22281.0D	028N	092W	28	SW1/4NW1/4	42.372118	-107.830837	6/20/1958	Sheehan Spring Diversion	HEALD PROJECT #2	Spring		0.1	0	0	0	0.1	DOM_SW; MIN	
Sheehan Springs Draw	P7714.0R	028N	092W	29	SE1/4NE1/4	42.372132	-107.835668	3/11/1976	McIntosh No. 1 Reservoir	U.S. ENERGY/CRESTED CORPORATION	Spring	481.36		0	0	481.36	0	MIN; MIS_SW; COMBBU	Unadjudicated
Spring	P17020.0D	028N	092W	15	NE1/4NW1/4	42.404659	-107.806424	8/31/1925	Sheep Creek Pipe Line No. 2	UNION OIL COMPANY OF CALIFORNIA	Spring		0.026	0	0	0	0.03	DOM_SW; DRI; MIS_SW; OIL; STO	Fully Adjudicated
Spring	CR CC45/288	028N	092W	15	NE1/4NW1/4	42.40466	-107.80642	8/31/1925	Sheep Creek Pipe Line No. 2	UNION OIL COMPANY OF CALIFORNIA	Spring			0	0	0	0.03	DOM_SW	
Crook's Creek	CR CC37/076	028N	092W	20	SE1/4SW1/4	42.37938	-107.84526	5/20/1907	Crook's Creek Ditch	RED CREEK SHEEP COMPANY	Stream			0	0	0	1.06	IRR_SW	
Crook's Creek	P7774.0D	028N	092W	20	SE1/4SW1/4	42.379657	-107.84661	5/20/1907	Crook's Creek Ditch	CABRIN LEMMON	Stream		-1	0	0	0	1.06	IRR_SW	Fully Adjudicated
Crook's Creek	P35001.0D	028N	092W	20	SE1/4SW1/4	42.38	-107.846889	5/13/2013	CROOKS GAP WATER HAUL	FREMONT COUNTY TRANSPORTATION DEPARTMENT	Stream			0	0	0	1	TEM	Complete
Crook's Creek	CR CC09/056	028N	092W	20	SW1/4NW1/4	42.38647	-107.8502	5/24/1901	Stevens Ditch No. 3	CHARLES JOHNSON	Stream			0	0	0	0.37	IRR_SW	
Crook's Creek	P3963.0E	028N	092W	19	NE1/4NE1/4	42.389991	-107.855153	1/10/1919	Stevens Ditch No. 3 {Enl. of}	CHARLES JOHNSON	Stream		3.75	0	0	0	1.39	IRR_SW	Unadjudicated
Sheep Creek	CR CC29/283	028N	092W	22	NW1/4NE1/4	42.39021	-107.80159	12/31/1903	Sheep Creek Ditch No. 1	JESSE JOHNSON	Stream			0	0	0	0.78	IRR_SW	
Sheep Creek	CR CC29/284	028N	092W	22	NW1/4NE1/4	42.39021	-107.80159	5/24/1901	Sheep Creek Ditch No. 2	JESSE JOHNSON	Stream			0	0	0	0.8	IRR_SW	
Crook's	P3195.0D	028N	092W	19	NE1/4NE1/4	42.390468	-107.853921	5/24/1901	Stevens Ditch	GILBERT STEVENS	Stream		-1	0	0	0	1.5	IRR_SW	Fully

Stream Source	Water Right (WR) Number	Twn	Rng	Sec	Qtr-Qtr	Latitude	Longitude	Priority Date	Facility Name	Company / Owner	Facility type	Total Capacity (AF/Yr)	Diversion Capacity at Headgate (CFS)	Active Capacity (AF)	Inactive Capacity (AF)	Size of Reservoir (AF)	Total Flow (CFS) / Approp. (GPM)	Uses	Summary Water Right (WR) Status
Creek									No. 3										Adjudicated
Sheep Creek	P3197.0D	028N	092W	22	NW1/4NE1/4	42.390565	-107.803613	5/24/1901	Sheep Creek Ditch No. 2	MATILDA J. MCLAUGHLIN	Stream		-1	0	0	0	1.14	IRR_SW	Fully Adjudicated
Crook's Creek	P17025.0D	028N	092W	18	NE1/4SE1/4	42.397083	-107.854889	10/5/1925	Crooks Creek 2" Water Line Pipeline	ATLANTIC RICHFIELD CO.	Stream		0.048	0	0	0	0.05	DOM_SW; DRI; MIS_SW; OIL; STO	Fully Adjudicated
Crook's Creek	CR CC45/559	028N	092W	18	NE1/4SE1/4	42.39722	-107.85504	10/5/1925	Crooks Creek 2" Water Line Pipeline	PRODUCERS REFINERS CORPORATION	Stream			0	0	0	0.05	DOM_SW; OIL; STO	
Sheep Creek	P17019.0D	028N	092W	15	NE1/4NW1/4	42.404658	-107.807458	8/31/1925	Sheep Creek Pipe Line No. 1	UNION OIL COMPANY OF CALIFORNIA	Stream		0.026	0	0	0	0.03	DOM_SW; DRI; MIS_SW; OIL; STO	Fully Adjudicated
Sheep Creek	CR CC45/287	028N	092W	15	NE1/4NW1/4	42.40466	-107.80642	8/31/1925	Sheep Creek Pipe Line No. 1	UNION OIL COMPANY OF CALIFORNIA	Stream			0	0	0	0.03	DOM_SW	
Crook's Creek	CR CC79/013	028N	092W	7	SE1/4SE1/4	42.40644	-107.85558	9/22/1926	SUPPLY DITCH NO. 4 (AS CHANGED TO KIRK NO. 1 DITCH)	LONNIE J. CLAYTOR	Stream			0	0	0	0	RES	Fully Adjudicated
Crook's Creek	CR CC47/402	028N	092W	7	SE1/4SE1/4	42.40814	-107.85496	9/18/1919	Kirk Ditch No. 1	USDI BUREAU OF RECLAMATION	Stream			0	0	0	1.21	IRR_SW	
Crook's Creek	P15570.0D	028N	092W	7	SE1/4SE1/4	42.408306	-107.855056	9/18/1919	Kirk Ditch No. 1	LONNIE J. CLAYTOR	Stream		4.03	0	0	0	1.21	IRR_SW	Fully Adjudicated
Crook's Creek	CR CC47/403	028N	092W	7	NE1/4SE1/4	42.41175	-107.85493	9/18/1919	Kirk Ditch No. 2	USDI BUREAU OF RECLAMATION	Stream			0	0	0	0.17	IRR_SW	
Crook's Creek	P15571.0D	028N	092W	7	NE1/4SE1/4	42.413417	-107.854611	9/18/1919	Kirk Ditch No. 2	LONNIE J. CLAYTOR	Stream		1.1	0	0	0	0.17	IRR_SW	Fully Adjudicated
Sheep Creek	CR CC29/285	028N	092W	4	SE1/4SE1/4	42.42256	-107.81621	5/20/1907	Sheep Creek Ditch No. 1	MRS. DAVID JOHNSON	Stream			0	0	0	0.57	IRR_SW	
Sheep Creek	CR CC29/286	028N	092W	4	SE1/4SE1/4	42.42256	-107.81621	6/6/1907	Sheep Creek Ditch No. 2	MRS. DAVID JOHNSON	Stream			0	0	0	0.11	IRR_SW	
Crook's Creek	P17409.0D	028N	092W	5	SW1/4SW1/4	42.42263	-107.850089	9/22/1926	Supply Ditch No. 4 (as Changed to Kirk No. 1 Ditch)	LONNIE J. CLAYTOR	Stream		19.6	0	0	0	0	DOM_SW; IRR_SW; RES; STO	Fully Adjudicated
Sheep Creek	P7817.0D	028N	092W	4	SE1/4SE1/4	42.422752	-107.815744	5/20/1907	Sheep Creek Ditch No. 1	A.M. RUSHTON	Stream		-1	0	0	0	0.58	IRR_SW	Fully Adjudicated
Sheep Creek	P7823.0D	028N	092W	4	SE1/4SE1/4	42.422764	-107.815755	6/6/1907	Sheep Creek Ditch No. 2	A.M. RUSHTON	Stream			0	0	0	0.11	IRR_SW	Fully Adjudicated
Sheep Creek	CR CC29/287	028N	092W	4	NE1/4SE1/4	42.42615	-107.81622	5/5/1909	Sheep Creek Ditch No. 4	MRS. DAVID JOHNSON	Stream			0	0	0	0.02	DOM_SW; IRR_SW; STO	
Sheep Creek	CR CC35/125	028N	092W	4	NE1/4SE1/4	42.42615	-107.81622	6/26/1909	Sheep Creek Ditch No. 3	AMANDA M. JOHNSON	Stream			0	0	0	0	DOM_SW; STO	

Stream Source	Water Right (WR) Number	Twn	Rng	Sec	Qtr-Qtr	Latitude	Longitude	Priority Date	Facility Name	Company / Owner	Facility type	Total Capacity (AF/Yr)	Diversion Capacity at Headgate (CFS)	Active Capacity (AF)	Inactive Capacity (AF)	Size of Reservoir (AF)	Total Flow (CFS) / Approp. (GPM)	Uses	Summary Water Right (WR) Status
Sheep Creek	P9136.0D	028N	092W	4	NE1/4SE1/4	42.426209	-107.817422	6/26/1909	Sheep Creek Ditch No. 3	DAVID JOHNSON	Stream		-1	0	0	0	0	DOM_SW; IRR_SW; STO	Fully Adjudicated
Sheep Creek	P8994.0D	028N	092W	4	NE1/4SE1/4	42.42623	-107.817438	5/5/1909	Sheep Creek Ditch No. 4	DAVID JOHNSON	Stream		-1	0	0	0	0.02	DOM_SW; IRR_SW; STO	Fully Adjudicated
Crook's Creek	P17410.0D	028N	092W	5	SW1/4NW1/4	42.427997	-107.847668	9/24/1926	Kirk Pipe Line	J. M. KIRK	Stream		0.03	0	0	0	0.03	DOM_SW; STO	
Crook's Creek	P17412.0D	028N	092W	5	SW1/4NW1/4	42.428015	-107.847651	9/24/1926	Garden Ditch	J. M. KIRK	Stream		2	0	0	0	0	IRR_SW	
Crook's Creek	P17411.0D	028N	092W	5	NW1/4NW1/4	42.433373	-107.850002	9/24/1926	J. M. Ditch	J. M. KIRK	Stream		10	0	0	0	0	DOM_SW; IRR_SW; RES; STO	
Crook's Creek	CR CC09/053	029N	092W	34	NE1/4NW1/4	42.4478	-107.82829	08/10/1897	Rigby Reservoir Supply Ditch	MASON RIGBY	Stream			0	0	0	0	RES	
Crook's Creek	P1565.0D	029N	092W	34	NE1/4NW1/4	42.449083	-107.827417	08/10/1897	Rigby Reservoir Supply Ditch	MASON RIGBY	Stream		-1	0	0	0	0	RES	Fully Adjudicated

Appendix 4-A
Air Quality Technical Support Document

AIR QUALITY TECHNICAL SUPPORT DOCUMENT
FOR THE ENERGY FUELS RESOURCES (USA) INC.
SHEEP MOUNTAIN PROJECT
ENVIRONMENTAL IMPACT STATEMENT

Prepared for

U.S. Department of the Interior
Bureau of Land Management
Lander Field Office
Lander, Wyoming

By

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SLR Consulting
Fort Collins, Colorado

Two Lines, Inc.
Grand Junction, Colorado

Edge Environmental, Inc.
Lakewood, Colorado

August 2014

Table of Contents

List of Tables

List of Figures

List of Maps

List of Appendices

List of Abbreviations and Acronyms

$\mu g/m^3$	micrograms per cubic meter
µeq/l	microequivalents per liter
ANC	Acid Neutralizing Capacity
AQD	Air Quality Division
AQRV	Air Quality Related Values
AQS	Air Quality System
AQTSD	Air Quality Technical Support Document
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BPIP	Building Profile Input Program
Carter Lake	Carter Lake Consulting
CASTNET	Clean Air Status and Trends Network
CBNG	Coal Bed Natural Gas
CD-C	Continental Divide-Creston
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
DATs	deposition analysis thresholds
Ddv	delta deciview
dv	deciview

Edge	Edge Environmental, Inc.
EIS	Environmental Impact Statement
Energy Fuels	Energy Fuels Resources (USA) Inc.
EPA	U.S. Environmental Protection Agency
FEIS	Final Environmental Impact Statement
FLAG	Federal Land Managers Air Quality Related Values Workgroup
FLMs	Federal Land Managers
Forest Service	U.S. Forest Service
GHG	greenhouse gas
HAPs	hazardous air pollutants
K	degrees Kelvin
kg/ha-yr	kilograms per hectare per year
km	kilometers
LAC	level of acceptable change
m	meters
MMIF	Mesoscale Model Interface Program
N	nitrogen
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NED	National Elevation Data
NEPA	National Environmental Policy Act
NO_x	nitrogen oxides
NRC	Nuclear Regulatory Commission
NWS	National Weather Station
O_3	ozone
OLM	Ozone Limiting Method
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns in size
PM_{10}	particulate matter less than or equal to 10 microns in size
ppb	parts per billion
PRISM	Parameter-elevation Regressions on Independent Slopes Model
Project	Sheep Mountain Project
PSD	Prevention of Significant Deterioration
S	sulfur
s	second
SLR	SLR Incorporated
SO_2	sulfur dioxide
TLI	Two Lines, Inc.
VOCs	volatile organic compounds
WAAQS	Wyoming Ambient Air Quality Standards
WDEQ	Wyoming Department of Environmental Quality
WestJumpAQMS	West-wide Jump Start Air Quality Modeling Study
WRAP	Western Regional Air Partnership
WRF	Weather Research and Forecasting
WRIR	Wind River Indian Reservation

1.0 INTRODUCTION

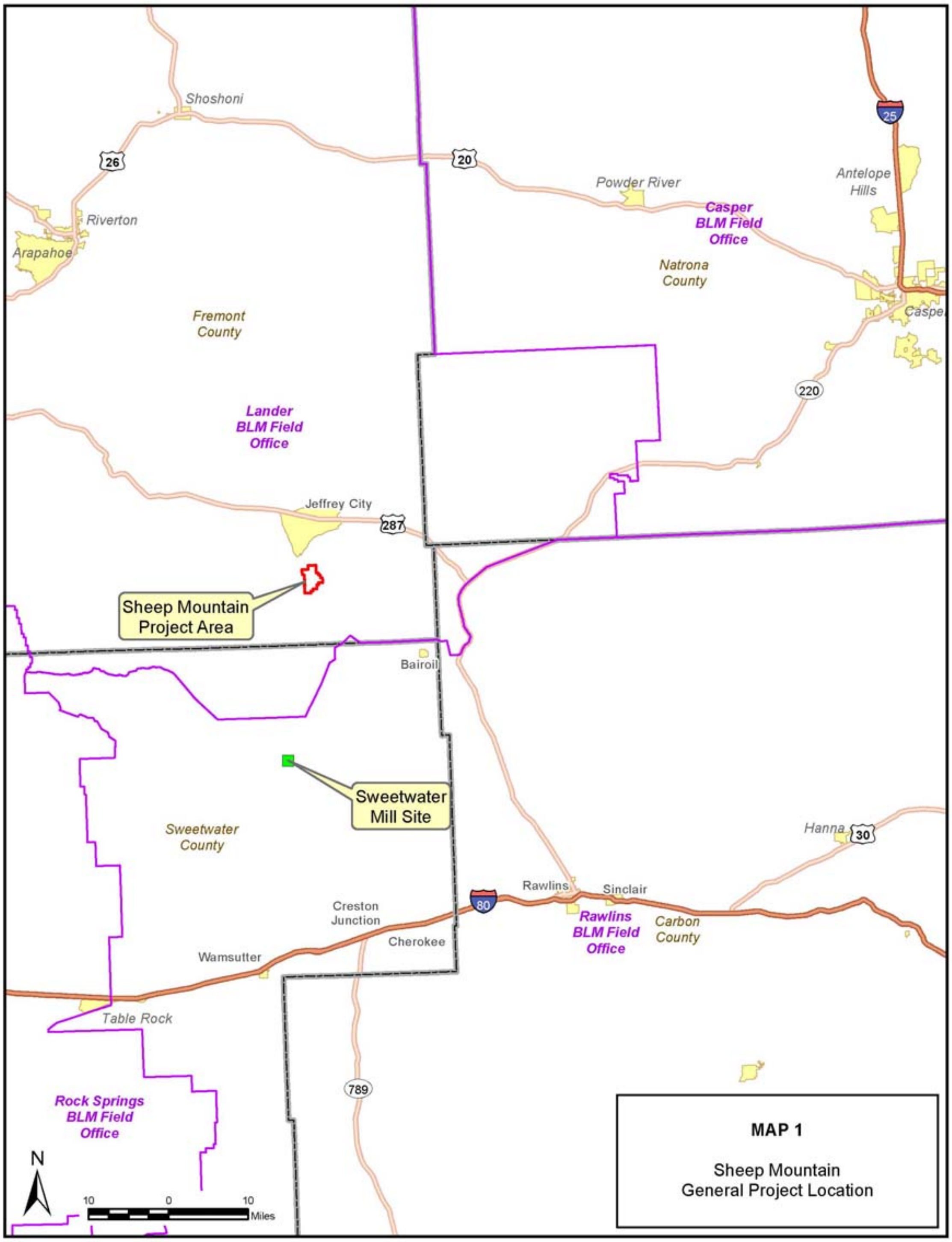
Carter Lake Consulting (Carter Lake), SLR Incorporated (SLR), Two Lines, Inc (TLI), and Edge Environmental, Inc. (Edge) have prepared this Air Quality Technical Support Document (AQTSD) to document the results of an air quality impact assessment conducted to quantify potential air quality impacts from the Energy Fuels Resources (USA) Inc. (Energy Fuels) Sheep Mountain Project (the Project). This assessment follows methodologies set forth in the Air Quality Impact Assessment Protocol prepared for the Bureau of Land Management (BLM) in March 2014 (BLM, 2014a), which documented the approach, input data, and computation methods to be used in the study.

The Sheep Mountain Project Area is located approximately 8 road miles south of Jeffrey City, Wyoming in Fremont County, Township 28 North, Range 92 West, Sections 4, 5, 9, 16, 17, 20, 21, 27, 29, 30, 32 and 33, as shown on Map 1. This area lies approximately 62 road miles southeast of Riverton, approximately 67 miles north of Rawlins, and approximately 105 road miles west of Casper and is located on Jeffrey City and Crooks Peak U.S. Geological Survey 7.5-minute topographic quadrangles. The Project Area includes approximately 3,625 surface acres (approximately 5.7 square miles) of mixed ownership including 2,313 acres of federal surface, 768 acres under state ownership, and 544 acres of fee lands. Approximately 2,836 acres of federal mineral estate is included in the Project Area.

The analysis includes an assessment of the potential near-field and far-field impacts to ambient air quality concentrations from the potential pollutant emissions associated with the Proposed Action and alternatives. The analysis utilizes the U.S. Environmental Protection Agency's (EPA's) Guideline model AERMOD to estimate potential pollutant impacts from proposed project sources within and nearby the Project Area, and the EPA Guideline model CALPUFF to estimate potential air quality and air quality related value (AQRV) impacts (impacts on visibility [regional haze], atmospheric deposition, and potential increases in acidification to acid sensitive lakes) at Prevention of Significant Deterioration (PSD) Class I and sensitive Class II areas of concern that are within 200 kilometers (km) of the Sheep Mountain Project Area.

The cumulative air quality emissions impacts (project source emissions and regional source emissions) are not analyzed herein. The regional modeling analysis for the Continental Divide-Creston (CD-C) Natural Gas Development Project Final Environmental Impact Statement – FEIS (BLM, 2014b) is used for addressing cumulative impacts for the Project. The CD-C Project analysis included a regional air quality assessment (including ozone) and AQRV analysis for southwest Wyoming including the region surrounding the Sheep Mountain Project Area. The analyses were performed using the CAMx model. The cumulative air quality and AQRV results for the CD-C Project FEIS are summarized in the Sheep Mountain Project Environmental Impact Statement (EIS).

Potential radiological impacts to members of the public were calculated for Project radon gas and radioparticulate emissions impacts using the MILDOS model (Version 3.10) (Argonne National Laboratory, 1989). The radiological modeling assessment is provided as Appendix B of this AQTSD.


Shoshoni
26
20
Riverton
Arapahoe
Powder River
Casper
BLM Field
Office
Antelope
Hills
25
Natrona
County
Fremont
County
Lander
BLM Field
Office
220
Jeffrey City
287
Sheep Mountain
Project Area
Bairoil
Sweetwater
Mill Site
Sweetwater
County
Hanna
30
Rawlins
Sinclair
Creston
Junction
80
Rawlins
BLM Field
Office
Carbon
County
Cherokee
Wamsutter
Table Rock
789
Rock Springs
BLM Field
Office
N
10
0
10
Miles
MAP 1
Sheep Mountain
General Project Location

1.1 Project Description

Proposed Action

Energy Fuels proposes to explore for, and develop uranium reserves to extract approximately 1.0 million to 2.0 million pounds of uranium from the ore per year during active operations (estimated at 20 years). Mining would be completed using conventional methods including both open-pit and underground methods. There are three principal phases in the Proposed Action: Construction, Operations, and Reclamation. The Proposed Action would require up to 929 acres of disturbance of which 356.5 acres would be new disturbance and 572.5 acres was previously disturbed.

Construction includes the building of facilities and installation of equipment that would be needed prior to Operations. Operations would include the mining and milling of uranium ore (Map 2). Conventional open pit (Congo Pit) and modified room and pillar underground (Sheep Underground) mining methods would be employed to remove mineralized uranium ore. Ore from both the Congo Pit and underground mine would be stockpiled at the entry to the underground mine on the Ore Stockpile for later transport to:

- An On-Site Ore Processing Facility, which would be licensed by the NRC as a uranium processing mill. Ore would be transported to this Facility via conveyor, which would be within the Project Area. The Facility would include a Heap Leach Pad for dissolution of the uranium from the ore; a series of Treatment Ponds (Holding Pond, Collection Pond, and Raffinate Pond) for the solution from the Pad; an Extraction Plant for removing the ore from solution, and a Precipitation and Packaging Plant.

- An Off-Site Ore Processing Facility. Ore would be transported to this location via truck to the Sweetwater Mill. The Sweetwater Uranium Mill is owned and operated by Kennecott Uranium Company (Kennecott), a division of Rio Tinto Americas, Inc. The mill is located entirely on private lands owned by Kennecott.

The option to pursue off-site processing is a sub-part of the Proposed Action because it is advanced by Energy Fuels. The Sweetwater Uranium Mill (owned and operated by Kennecott Uranium Company - Kennecott, a division of Rio Tinto) is located entirely on private lands owned by Kennecott and permitted with the NRC as an operating license under Source Material License SUA-1350 which allows for production of 4,100,000 pounds of yellowcake per year. Therefore, Kennecott could receive ore and begin operations under the stipulations of their permit at any time. For the purpose of analysis within this EIS, it is assumed that operations at the Sweetwater Mill would occur under the existing license without significant revisions, and impacts associated with the operations of the mill would be similar to those of the operation of the Heap Leach facility at Sheep Mountain and/or the Piñon Ridge Mill in Colorado in relation to applicable resources such as air and human health and safety. The impacts associated with hauling ore to the Sweetwater Mill from the Sheep Mountain site and operating the Sweetwater Mill are disclosed in this EIS because they are connected actions. However, the BLM would not be involved in permitting or authorizing hauling of ore to the Sweetwater Mill along county roads or processing at the Sweetwater Mill.

Reclamation would include decommissioning of facilities, backfilling, and re-vegetating of the mined areas, and covering of the heap leach pad to prepare for long-term care and maintenance by the State of Wyoming or the U.S. Department of Energy (DOE).

<u>No Action Alternative</u>

Under this Alternative, BLM would deny Energy Fuel's Plan of Operations as proposed. Therefore, the BLM would be denying the proponent's right to extract minerals on federal lands from their mining claims. The selection of the No Action Alternative may constitute a taking because it violates valid existing rights under the U.S. Mining laws and result in legal action by the proponent. For these reasons the selection of the No Action Alternative is unlikely, but is described in this document in order to satisfy the requirements under the National Environmental Policy Act (NEPA).

<u>Alternative 3-BLM Mitigation Alternative</u>

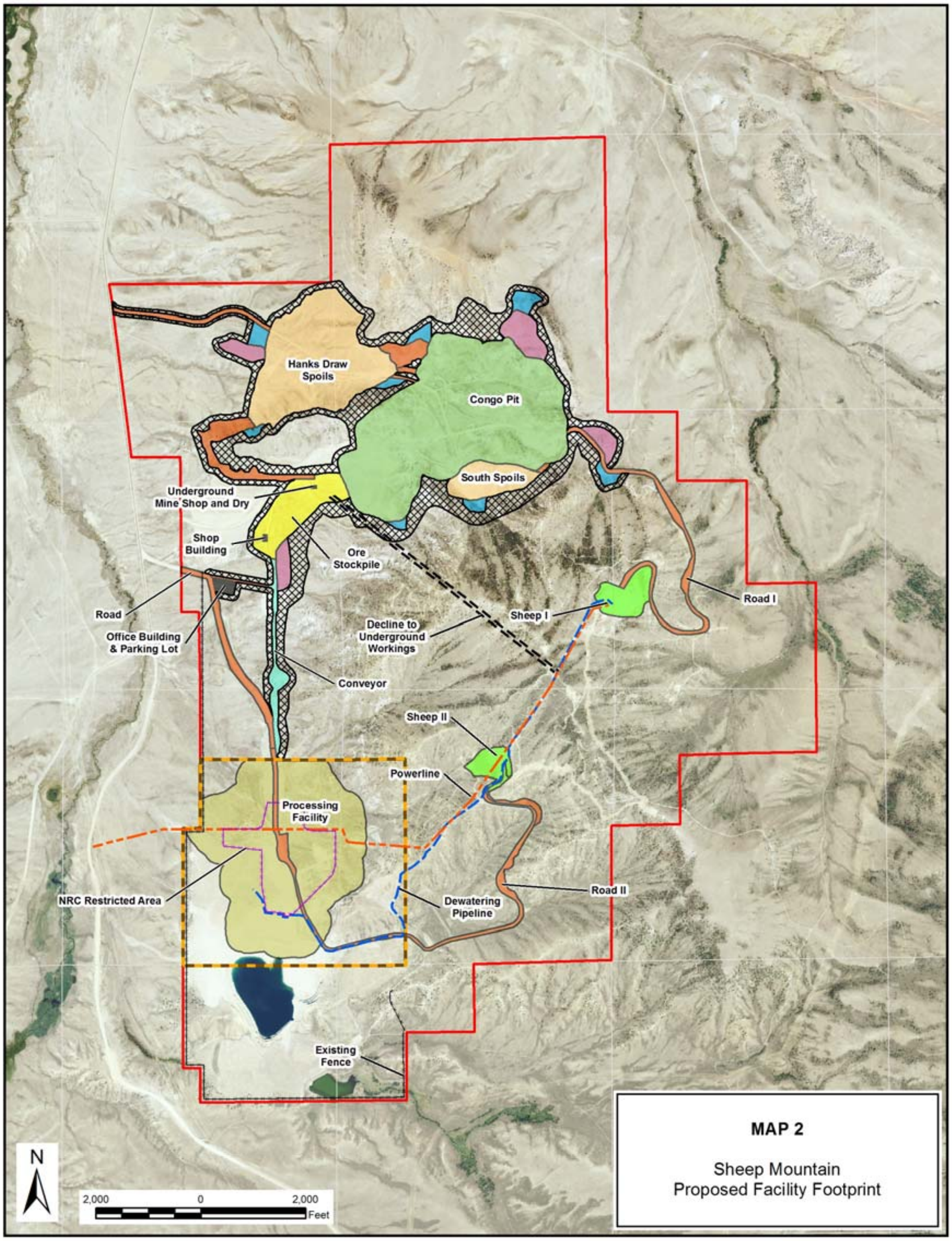
This alternative was developed in response to public and agency input collected during the scoping process in order to potentially reduce the environmental impacts of the Project. This alternative is similar to the Proposed Action Alternative, in that conventional mining techniques would be utilized and uranium would be produced using heap leach and solvent extraction/ion exchange procedures. This alternative would utilize the same processes and take place over the same time period as the Proposed Action but would include changes and mitigation procedures implemented to reduce and/or otherwise offset surface disturbance and potentially limit impacts to human health, safety, and the environment. Changes to the Proposed Action and additional mitigation measures under this alternative would include: revisions to Energy Fuel's proposed reclamation plan and requiring an inventory of existing roads and development of a Travel Management Plan.

1.2 Relationship to Existing Plans and Documents

Available NEPA analyses were used for the air quality assessments for this Project. The following NEPA analyses have been conducted and have relevance, as noted below, to this Project:

Continental Divide – Creston Natural Gas Infill Project Environmental Impact Statement (CD-C) (Ongoing). BP America Production Company, Devon Energy, and other operators propose to develop natural gas resources within the existing Continental Divide, Wamsutter, Creston, and Blue Gap natural gas fields, located in Carbon and Sweetwater counties, Wyoming. The cumulative modeling analysis prepared in support of the FEIS (BLM, 2014b) associated with this project are applicable for addressing cumulative impacts for the Sheep Mountain Project.

Riverton Dome Coal Bed Natural Gas and Conventional Gas Development Project Final Environmental Impact Statement (August 2008). Devon Energy proposed to develop Coal Bed Natural Gas Wells (CBNG) wells and conventional gas wells on existing leases and additional leases approximately 5 miles sourtheast of Riverton on the Wind River Indian Reservation (WRIR), in Fremont County. The air quality analysis prepared for the FEIS analyzed air quality, and AQRVs at several Class I and sensitive Class II areas surrounding the project area (Bureau of Indian Affairs - BIA, 2008). The sensitive Class II area receptors developed for the Riverton Dome study were used for the Sheep Mountain study.


Hanks Draw Spoils
Congo Pit
South Spoils
Underground Mine Shop and Dry
Shop Building
Ore Stockpile
Road
Office Building & Parking Lot
Decline to Underground Workings
Sheep I
Road I
Conveyor
Sheep II
Powerline
Processing Facility
NRC Restricted Area
Dewatering Pipeline
Road II
Existing Fence
N
2,000
0
2,000
Feet
MAP 2
Sheep Mountain
Proposed Facility Footprint

In addition, the Nuclear Regulatory Commission (NRC) has jurisdiction over the heap leach, ponds, and processing facilities within the NRC License Boundary. They will be preparing a separate EIS and will analyze radiological impacts from these sources.

The EPA regulates the radon emissions from uranium byproduct impoundments under 40 CFR Part 61 subpart W, which includes the heap leach and processing ponds. Also, EPA regulates and sets standards on radon emissions from underground uranium mines under 40 CFR Part 61 subpart B.

1.3 Air Quality Assessment Summary

The air quality analysis addresses the impacts on ambient air quality and AQRVs from the potential air emissions from the Sheep Mountain Project. Potential ambient air quality impacts were quantified and compared to applicable state and federal standards, and AQRV impacts (impacts on visibility [regional haze], atmospheric deposition, and potential increases in acidification to acid sensitive lakes) were quantified and compared to applicable thresholds as defined in the Federal Land Managers' (FLMs') Air Quality Related Values Workgroup (FLAG) guidance document (FLAG, 2010), and other state and federal agency guidance. Impact assessment criteria and results of the analysis are discussed in further detail in Section 5.0.

The assessment of impacts included:

- Development of Project construction and production emissions inventory (see Section 2.0).
- Prediction of near-field ambient impacts from Project emissions sources (see Sections 3.0 and 5.1).
- Prediction of far-field impacts from Project emissions sources, including pollutant concentrations, visibility and atmospheric deposition impacts, and potential increases in acidification of acid sensitive lakes at federal Class I and Class II sensitive areas within 200 km of the Project Area (see Sections 4.0 and 5.2).

2.0 PROJECT EMISSIONS

Air pollutant emissions inventories prepared for the Sheep Mountain Project quantify total nitrogen oxides (NO_x), sulfur dioxide (SO_2), carbon monoxide (CO), particulate matter less than or equal to 10 microns in size (PM_{10}), particulate matter less than or equal to 2.5 microns in size ($PM_{2.5}$), volatile organic compounds (VOCs), and the Hazardous Air Pollutants (HAPs); formaldehyde, benzene, toluene, ethyl benzene, and n-hexane. Lead emissions are negligible and have not been calculated in the inventory.

Methane (CH_4), nitrous oxide (N_2O), and carbon dioxide (CO_2) emissions are also included in the project inventory for purposes of quantifying greenhouse gas (GHG) emissions. Total annual CO_2 equivalent (CO_2e) is calculated in the emissions inventory in Appendix A and reported over the life of the Project in the EIS.

Emissions are calculated from construction and operations as part of the Proposed Action Alternative, with operation emissions calculated for both the on-site and off-site ore processing options. Air emissions from the No Action Alternative and Alternative 3 would be equal to or less than those calculated for the Proposed Action; therefore, no emissions inventories were developed for these alternatives.

The emissions inventory was developed using AP-42 (EPA, 1995), Wyoming Department of Environmental Quality (WDEQ) Air Quality Division (AQD) mining emission factors, and other accepted engineering methods combined with equipment specifications, material throughput, and activity and operating rates provided by the operator. Pollutant emission rates were calculated for both annual and short-term periods of operation, and used as input to model pollutant concentrations with corresponding averaging periods.

Annual emissions calculations utilized activity rates and material throughputs representative of a full year of operation. Twenty-four-hour or daily emission rates were calculated based on maximum 24-hour activity rates and hourly emission rates were calculated based on maximum hourly activity rates. For some sources, annual activity rates were equivalent to the hourly and/or daily rate occurring year-round. For other sources, shorter-term emission rates were higher than the annual rate due to operational considerations; for example, certain mobile sources in the fleet could operate concurrently in a worst-case hour, but annually their operation would be more limited. The calculation of both annual and short-term emission rates is shown in the emissions inventories provided in Appendix A.

The specific components of facility construction and production and emissions calculation methodology for these activities are discussed in the following subsections. Emissions inventories for the Proposed Action construction phase and the two operation options are included as Appendix A.

2.1 Construction Emissions

Emission calculations for construction utilize operator-supplied equipment specifications and operating data. Emissions-generating activities occurring during construction include:

- Underground blasting and construction;
- Mine intake air heaters;
- Surface dozing, overburden removal and overburden unloading (similar to surface mining activity occurring during operation);
- Facilties construction;
- Heavy-duty and light-duty vehicles (unpaved road travel);
- Wind erosion of open acres and stockpiles; and
- Mobile source fuel combustion.

2.2 Operation Emissions

Emissions were calculated for 1) operation with on-site processing and 2) operation with off-site processing occurring at the Sweetwater Mill. Calculations rely on operator-provided specifications and operating and throughput data. While most parameters provided by the operator reflected a maximum rate regardless of year, the tons hauled to each spoils pile location varied by year in the mine plan (Energy Fuels, 2014), and calculation of overburden hauling required an estimate of these tons. Operator-provided projections were reviewed to determine a maximum scenario, and year 3 of the mine plan was selected because it exhibited the highest overburden excavation rate of years during which overburden would be hauled to the spoils piles. All throughputs and operating rates are shown in the inventories contained in Appendix A.

Emissions-generating activities occurring during operation are:

- Underground blasting;
- Mine intake air heaters;
- Primary crushers;
- Conveyor transfers;
- Surface dozing, product removal, overburden removal, and unloading of product and overburden;
- Radial stacker transferring material to leach pad;
- Production facility;
- Unpaved road travel;
- Wind erosion of open acres and stockpiles;
- Mobile source fuel combustion;
- Shop, plant, office heating; and
- Ore haul to off-site processing site at Sweetwater Mill (off-site processing option only).

Emissions for the maximum PM_{10} emissions case, production with off-site processing, are shown in Table 1. The primary criteria pollutants to be emitted at and analyzed for the facility are included in Table 1 (NO_x, CO, PM_{10} and $PM_{2.5}$). The complete emissions inventories for construction and both operation cases and construction are included in Appendix A.

Table 1
Annual Emissions by Activity (tons per year)
Proposed Action - Production with Off-Site Processing

Activity	NO_x	CO	PM_{10}	$PM_{2.5}$
Underground Mine Sources				
Blasting	6.35	22.12	0.014	0.0008
Mine Intake Air Heaters	0.05	0.04	0.003	0.0034
Primary Crusher	--	--	0.17	0.02
Coarse ore conveyor transfers	--	--	0.08	0.02
Mobile sources	42.13	44.88	2.55	2.55
Surface Mine Sources				
Dozing	--	--	7.43	3.90
Product removal	--	--	0.33	0.07
Overburden removal	--	--	35.19	7.04
Overburden unloading	--	--	7.58	1.52
Truck dump	--	--	1.88	0.38
Primary Crusher	--	--	0.33	0.05
Overland coarse ore conveyor transfers	--	--	2.41	0.48
Radial stacker to leach pad	--	--	0.73	0.15
Surface facilities heating	0.20	0.17	0.02	0.02
Production facility	0.69	0.48	21.94	3.34
Wind Erosion				
Open acres	--	--	24.62	3.69
Stockpiles	--	--	33.92	5.09
Surface Mobile Sources				
Mine-Wide Unpaved Road Travel	--	--	114.06	11.40
Surface Mobile/Nonroad Sources	151.66	89.09	1.29	1.29
TOTAL	201.08	156.78	254.54	41.01

"- -" means either there are no emissions of that pollutant at all, or there are no emissions of that pollutant accounted for in the line item and are accounted for in mobile source category (for diesel equipment , etc.).

3.0 NEAR-FIELD ANALYSIS

3.1 Modeling Methodology

The near-field ambient air quality impact assessment was performed to quantify maximum pollutant impacts within and near the Project Area resulting from Project-related emissions. Criteria pollutant emissions of PM_{10}, $PM_{2.5}$, NO_x, SO_2, and CO were evaluated as part of the near-field study. Emissions of the HAPs formaldehyde, benzene, toluene, ethylbenzene, and n-hexane are not evaluated given the minimal emissions levels calculated for these pollutants.

Near-field dispersion modeling was conducted for the Proposed Action Alternative. Pollutant emissions from the No Action Alternative and Alternative 3 would be less than the Proposed Action and therefore would produce lower ambient air impacts; the Proposed Action provides the most conservative estimate of maximum annual and short-term near-field impacts.

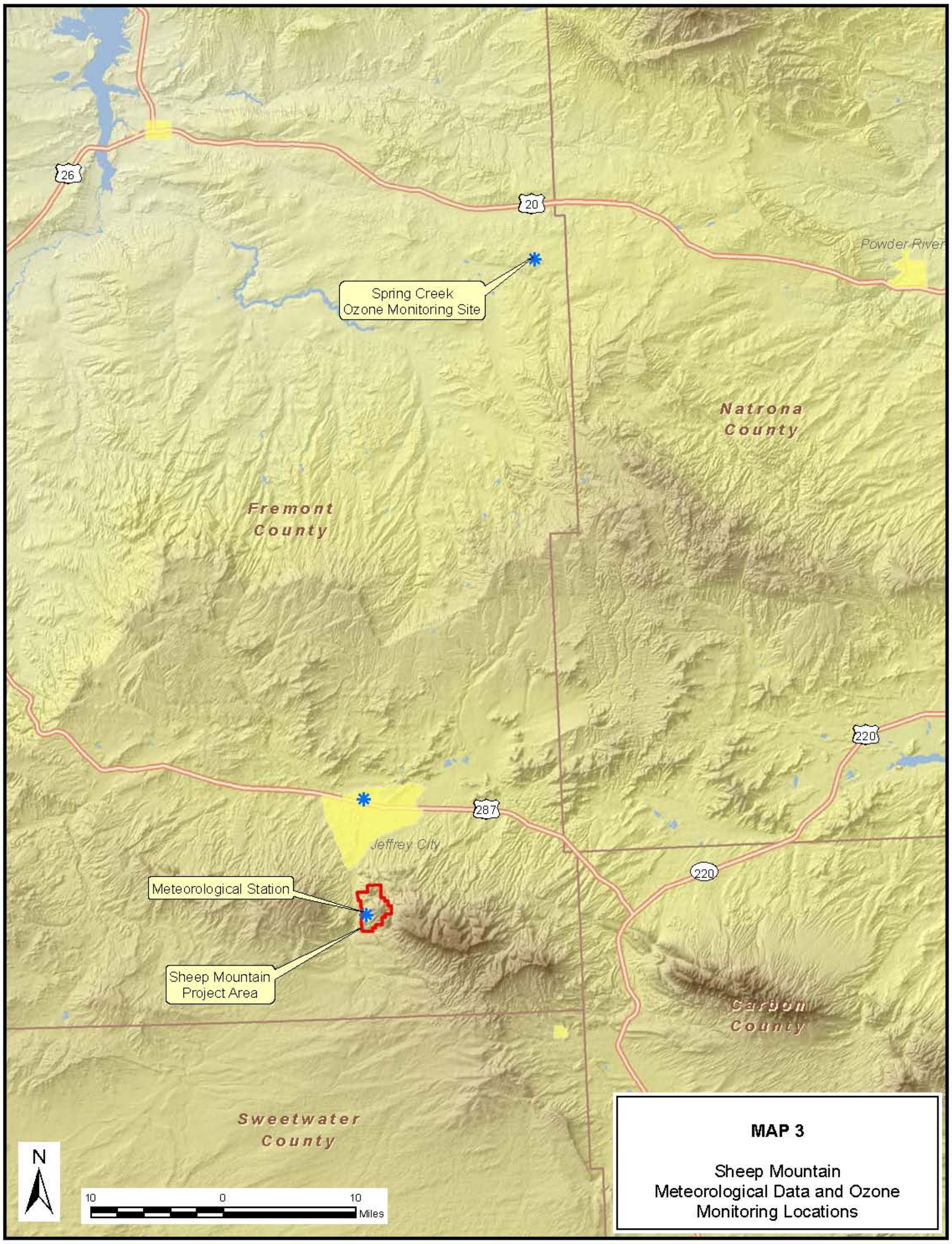
The EPA's Guideline (EPA, 2005) model, AERMOD (Version 13350), was used to assess these near-field impacts. Regulatory model settings was utilized, with the exception of the non-regulatory Ozone Limiting Method (OLM) option, which was used for modeling nitrogen dioxide (NO_2) concentration estimates. Modeling NO_2 utilized hourly ozone concentration data collected at the Spring Creek, Wyoming monitoring station during 2011 and 2012, located 49 miles northeast of the Project Area as shown on Map 3.

Ozone (O_3) formation and impacts were not modeled as part of the air quality assessment, rather a qualitative assessment of the potential contribution to regional ozone formation, based on representative studies in the region (e.g. the CD-C Infill Project Draft EIS), is presented in the EIS document.

3.2 Meteorological Data

Meteorology data collected by Energy Fuels at the Sheep Mountain site is most representative of the meteorological conditions at the site and was used in the near-field analysis. Monitoring at the site began in June 2010. The on-site data include 10 meter level measurements of wind speed, wind direction, standard deviation of wind direction [sigma theta], solar radiation, temperature (10 meter and 2 meter), and temperature difference. The calendar years January 2011 through December 2012 were selected for use in this analysis, the most recent two years of data available. The data meet the 90 percent completeness criteria established by EPA in the “Meteorological Monitoring Guidance for Regulatory Modeling Applications” report (EPA, 2000). The location of the Sheep Mountain on-site meteorological station is shown on Map 3. A wind rose for the on-site station is presented in Figure 1.

The Sheep Mountain meteorological measurements were processed into datasets (surface data and profile data) compatible with the AERMOD dispersion model using the AERMET (Version 13350) meteorological processor. Because temperature difference and solar radiation are collected on-site, AERMET were applied following the Bulk Richardson method switch settings to combine the on-site tower data with twice daily sounding data from the Riverton, Wyoming, National Weather Station (NWS). AERSURFACE (Version 13016) was used to develop twelve sector seasonal surface characteristics for the project area, and these surface characteristics were used in the AERMET processing.



26
20
Powder River
Spring Creek
Ozone Monitoring Site
Natrona
County
Fremont
County
220
287
Jeffrey City
220
Meteorological Station
Sheep Mountain
Project Area
Carbon
County
Sweetwater
County
N
10
0
10
Miles
MAP 3
Sheep Mountain
Meteorological Data and Ozone
Monitoring Locations

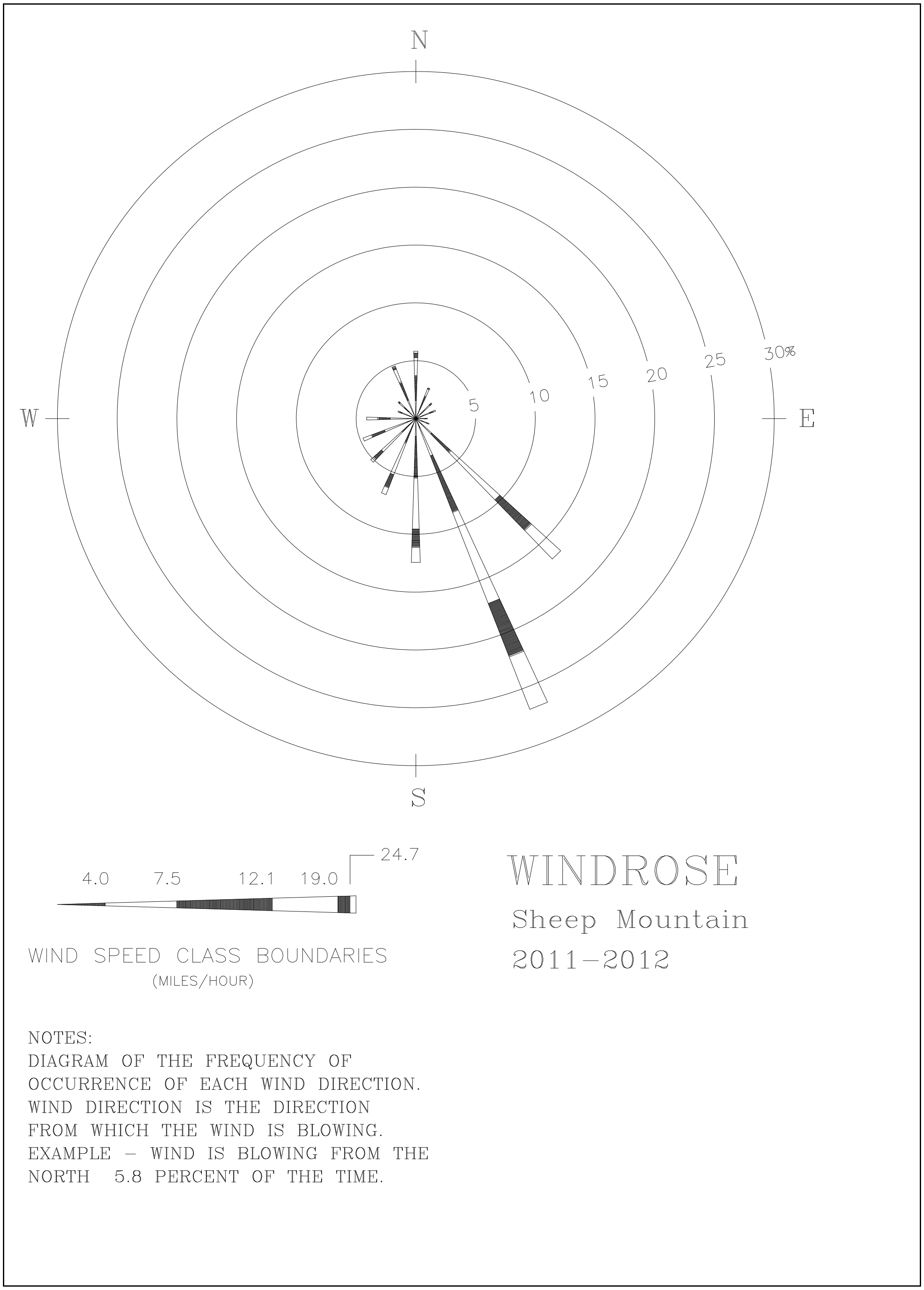


Figure 1
Sheep Mountain Meteorological Data Windrose

3.3 Background Data

Background pollutant concentrations are used as an indicator of existing conditions in the region, and are assumed to include emissions from industrial emission sources in operation and from mobile, urban, biogenic, other non-industrial emission sources, and transport into the region. These background concentrations are added to modeled near-field Project impacts to calculate total ambient air quality impacts. Table 2 presents the background values provided for the region by the WDEQ-AQD (WDEQ, 2014).

Table 2
Near-Field Analysis Background Ambient Air Quality Concentrations

Pollutant	Averaging Period	Measured Background Concentration ($\mu g/m^3$)
Carbon monoxide (CO)[1]	1-hour 8-hour	909 575
Nitrogen dioxide (NO_2)[2]	1-hour Annual	9.4 1.9
PM_{10}[2]	24-hour Annual	49 11
$PM_{2.5}$[3]	24-hour Annual	27 7.0
Sulfur dioxide (SO_2)[1]	1-hour 3-hour	18.3 18.3

[1] Background data collected at Cheyenne, Wyoming during 2012, WDEQ-AQD, 2014.
[2] Background data collected at South Pass, Wyoming during 2012, WDEQ-AQD, 2014.
[3] Background data collected in Rock Springs, Wyoming during 2012, WDEQ-AQD, 2014.

3.4 Criteria Pollutant Modeling

The construction and operation phases of mine life were found to produce maximum pollutant emissions. A near-field criteria pollutant assessment was performed to estimate maximum potential impacts of PM_{10}, $PM_{2.5}$, NO_x, SO_2, and CO from project emission sources active under each modeled construction and production scenario.

A single construction scenario was analyzed, based on a maximum year of construction activity. Two separate production scenarios were analyzed; the on-site processing scenario and the off-site processing scenario. The on-site processing scenario includes all operation activities, with the heap leach and processing operations occurring on-site and within the Project Area boundary. The off-site processing scenario includes the same production activities and emissions, but heap leach and processing would occur off-site at the Sweetwater Mill, and additional unpaved road traffic from the transport of ore off-site was modeled.

Model input for the construction phase, the operations phase with on-site processing, and the operations phase with off-site processing was determined from Energy Fuels-provided field assumptions within the Project Area, and prepared consistent with EPA and WDEQ-AQD guidance. Twenty-four-hour and annual PM_{10} and $PM_{2.5}$ concentrations, 1-hour and annual average NO_2 concentrations, 1-hour and 8-hour CO concentrations, and 1-hour, 3-hour, 24-hour, and annual SO_2 concentrations were predicted. Maximum short-term Project emissions were used for modeling impacts for comparison to short-term air quality standards, with hourly maximum emission rates used for 1-hour, 3-hour, and 8-hour pollutant averaging periods, and 24-hour maximum emissions used for 24-hour pollutant averaging periods. Modeled source configuration and locations within the Project Area for construction, operations with on-site processing , and operations with off-site processing are provided on Maps 4, 5, and 6, respectively.

Point sources were used for modeling emissions from the underground mine exhaust and any stationary sources identified. All point sources were oriented vertically, except for the underground mine exhaust points, Sheep1 and Sheep 2. These exhaust points were horizontal and assumed to be at ambient temperature. Following EPA guidance, the exit velocity was set to a low value and stack diameter increased to conserve the mass of the flow from the vents. Volume sources were used for modeling unpaved road travel and material transfers. Area sources were used to model stockpiles, wind erosion of open acres, and pit activity. Model input parameters for each modeled emissions source and scenario are given in Table 3. The most recent version of the Building Profile Input Program (BPIP-Prime 04274) was used to determine appropriate direction-specific building dimension downwash parameters.

All scenarios include employee transport and bulk delivery truck travel to and from the site on unpaved roads. The production phase off-site processing scenario includes ore haul travel as well. Dispersion modeling includes only the portion of this travel occurring within the ambient air boundary.

As mentioned in Section 3.1, modeling analyses for NO_2 concentration estimates was performed using the OLM methodologies with the AERMOD model. NO_2 modeling utilized hourly ozone concentration data collected at the Spring Creek monitoring station for calendar year 2011-2012. The Spring Creek site is located 49 miles north-northeast of the Project Area, and is the closest representative ozone monitoring station available. These data are concurrent with the 2011-2012 Sheep Mountain meteorological data to be used in the analysis.

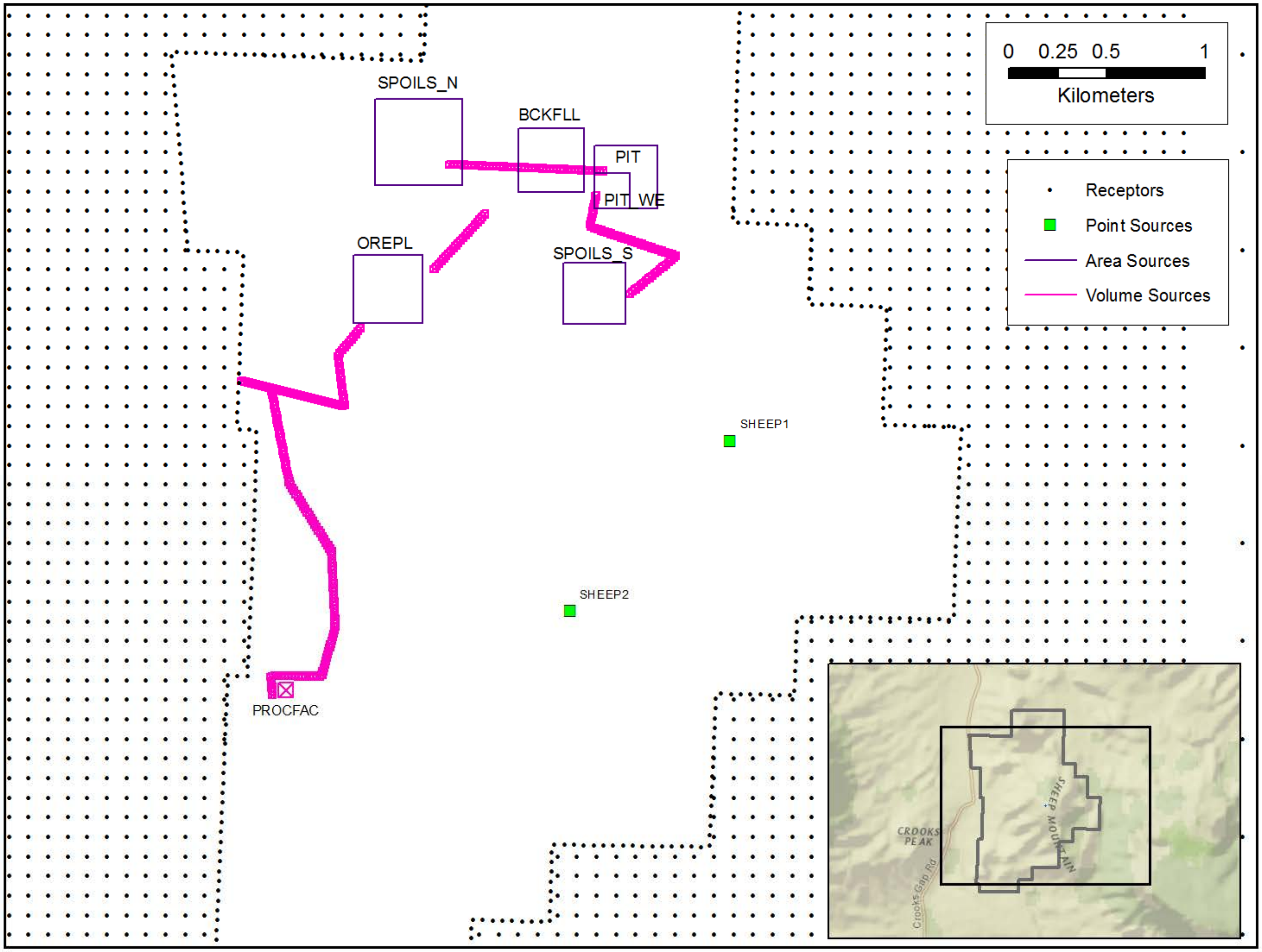
Discrete model receptors were developed in accordance with current WDEQ-AQD modeling guidance (WDEQ, 2010), at locations at and beyond the ambient air boundary. The area within the ambient air boundary is not accessible to the public. Discrete modeling receptors were placed at a minimum of 50-meter intervals along the ambient air boundary, at 100-meter spacing to a distance of 1 kilometer from the facility, and at 500-meter spacing to a distance of 5 kilometers from the facility. Map 7 illustrates receptor locations utilized for the area around the primary mine site for all construction and operations, and the additional model receptors utililized for the off-site processing are shown in Map 8.

Terrain heights for each receptor and source were assigned following EPA guidance, and using the AERMAP (Version 11103) terrain processor. Digital elevation data from the National Elevation Dataset (NED) at a 10-meter resolution were used in conjunction with this processor to assign elevations in meters above sea level to receptors and sources.

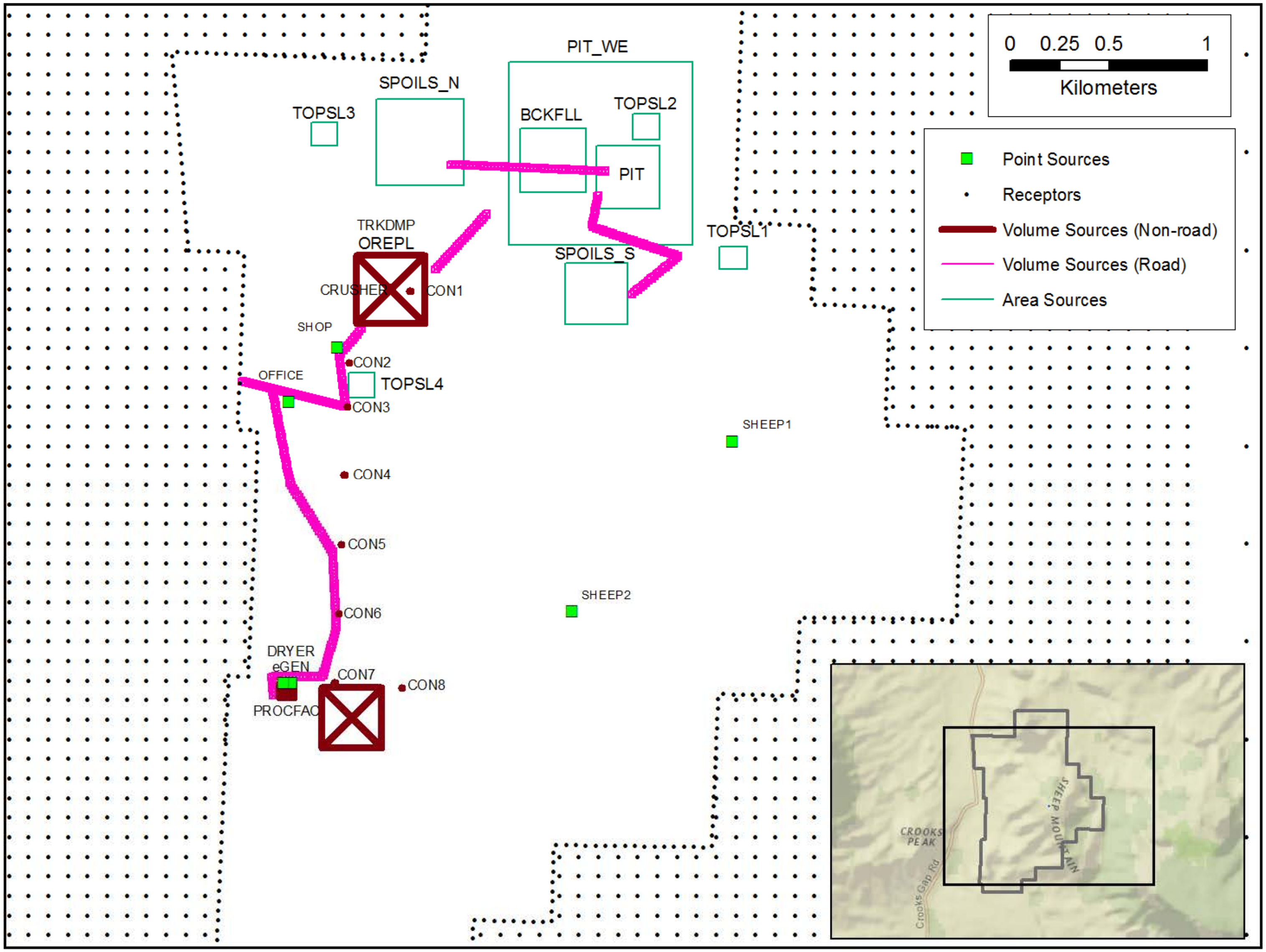
Table 3
Modeled Emissions Source Input Parameters

Type	Model ID	Description	Height (m)	Temp (K)	Velocity (m/s)	Diameter (m)	X Init (m)	Y Init (m)	Angle (deg)	Sigma-y Init (m)	Sz Init (m)
Point	DRYER	Uranium Dryer	10.00	366.48	72.53	0.30					
Point	EMERGEN	Emergency Generator	10.00	800.00	40.00	0.10					
Point	OFFICE	Office Heating	10.00	350.00	20.00	0.10					
Point	SHOP	Shop Heating	10.00	350.00	20.00	0.10					
Point	PROC	Process Building Heating	10.00	350.00	20.00	0.10					
Point	SHEEP1	Underground Mine Exhaust	1.25	0.00	0.01	115.87					
Point	SHEEP2	Underground Mine Exhaust	1.25	0.00	0.01	115.87					
Area	PIT	Mechanical Fugitives At Pit	10.00				325.23	322.89	0.00		4.65
Area	BCKFLL	Mechanical Fugitives From Backfill	10.00				332.25	322.89	0.00		4.65
Area	SPOILS_N	Mechanical Fugitives At Spoils	10.00				446.90	442.23	0.00		4.65
Area	SPOILS_S	Mechanical Fugitives At Spoils	10.00				316.35	314.70	0.00		4.65
Area	OREPL	Wind Erosion At Ore Pile	5.00				351.00	351.00	0.00		2.33
Area	TOPSL(1-4)	Wind Erosion At Topsoil Pile	5.00				138.05	116.99	0.00		2.33
Area	PIT_WE	Wind Erosion At Pit	5.00				935.00	935.00	0.00		2.33
Area	SPOILS_NWE	Wind Erosion At Spoils	5.00				446.90	442.23	0.00		2.33
Area	SPOILS_SWE	Wind Erosion At Spoils	5.00				316.35	314.70	0.00		2.33

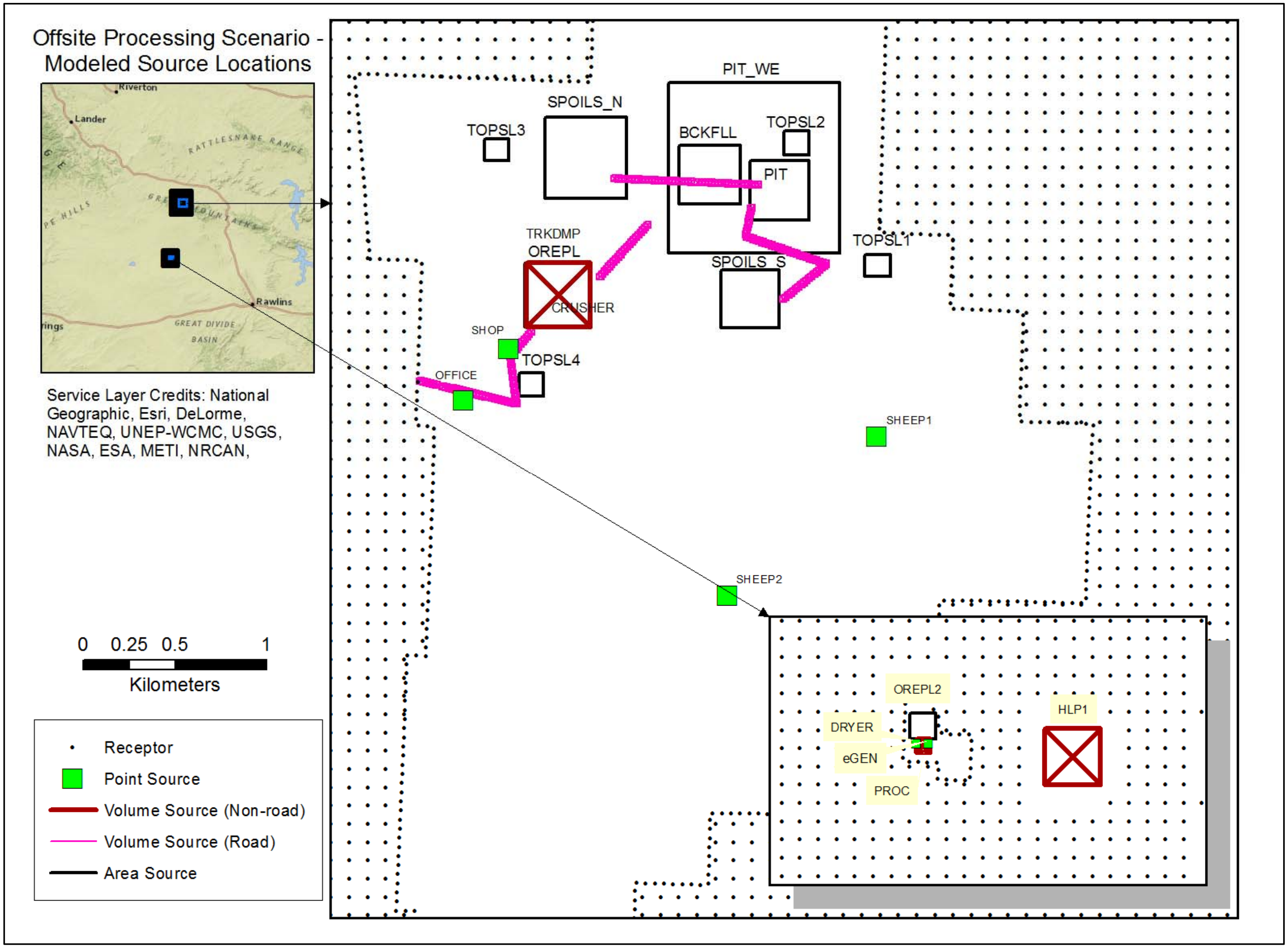
Type	Model ID	Description	Height (m)	Temp (K)	Velocity (m/s)	Diameter (m)	X Init (m)	Y Init (m)	Angle (deg)	Sigma-y Init (m)	Sz Init (m)
Area	PIT_MOB	Tailpipe Emissions At Pit	10.00				325.23	322.89	0.00		4.65
Area	BCKFLL_MOB	Tailpipe Emissions At Backfill	10.00				332.25	322.89	0.00		4.65
Area	SPOILN_MOB	Tailpipe Emission At Spoils	10.00				446.90	442.23	0.00		4.65
Area	SPOILS_MOB	Tailpipe Emission At Spoils	10.00				316.35	314.70	0.00		4.65
Area	OREPL_MOB	Tailpipe Emissions At Ore Pile	10.00				351.00	351.00	0.00		4.65
Volume	HLP1	Heap Leach Pad	4.57							71.16	4.25
Volume	CRUSHER	Crusher	2.50							4.65	2.33
Volume	TRKDMP	Truck Dump	2.50							81.63	2.33
Volume	CONV(1-8)	Conveyor Transfers	6.25							1.16	0.07
Volume	PRODFAC	Production Facility	2.50							17.88	2.33
Volume	RADSTK	Radial Stacker	10.27							0.21	0.06
Volume	HAUL	Haul Roads	5.10							8.46	4.74



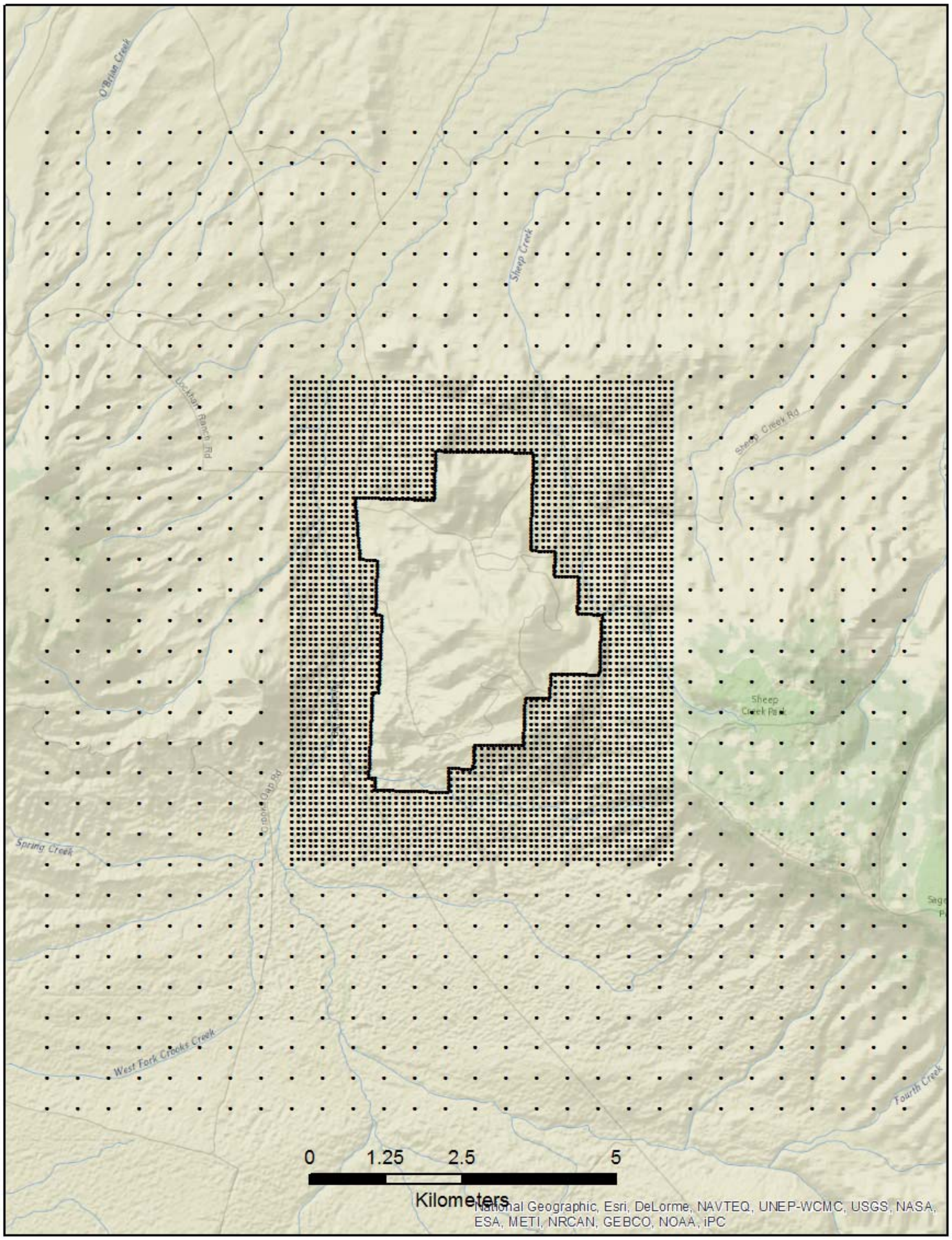
Map 4
Modeled Source Locations – Construction Scenario



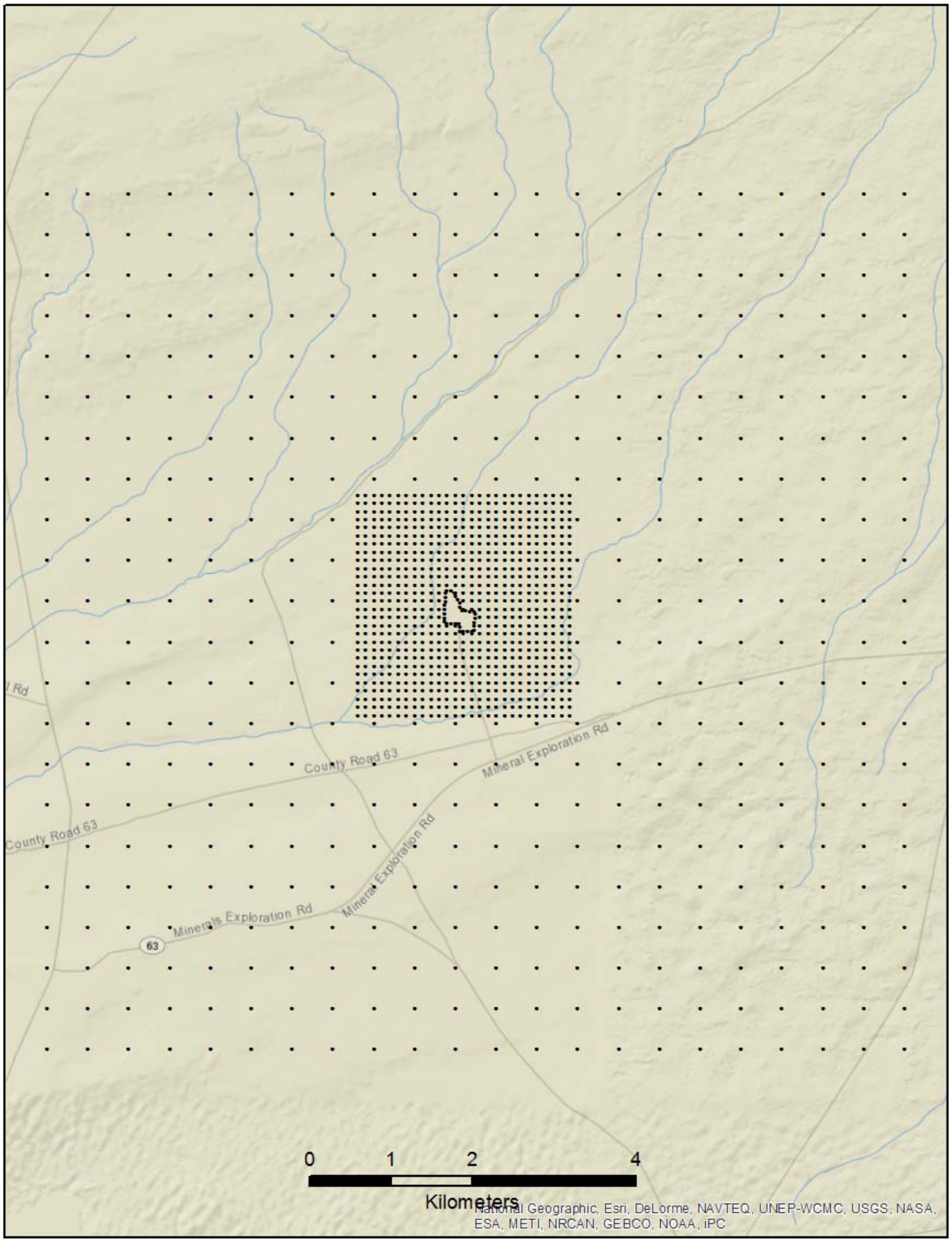
Map 5
Modeled Source Locations – On-Site Processing Scenario



Map 6
Modeled Source Locations – Off-Site Processing Scenario



Map 7
Dispersion Model Receptors – Construction, On-Site and Off-Site Processing Scenarios at the Primary Site



Map 8
Dispersion Model Receptors – Additional Receptors for the Off-Site Processing Scenario

4.0 FAR-FIELD ANALYSIS

The purpose of the far-field analysis is to quantify potential air quality impacts to both ambient air concentrations and AQRVs from air pollutant emissions of NO_x, SO_2, PM_{10} and $PM_{2.5}$ expected to result from construction and operation of the Proposed Action and alternatives. Ambient air quality impacts of NO_2, SO_2, PM_{10}, and $PM_{2.5}$, and AQRVs were analyzed at federal Class I and sensitive Class II areas that are within 200 km of the Project Area. The analyses were performed using the EPA-approved version of the CALPUFF modeling system (Version 5.8.4) with the exception of the use of Mesoscale Model Interface Program (MMIF) Version 3.0 (ENVIRON, 2013) to develop a meteorological windfield rather than CALMET. All CALPUFF model options conform to the 2009 EPA guidance (EPA, 2009) and all CALPOST model options and inputs conform to FLAG 2010 guidance (FLAG, 2010). Maximum Project emissions, described in Section 2.0, were modeled for the far-field analysis. Sources were placed at the same locations used in the near-field analysis as presented in Maps 4 through 6.

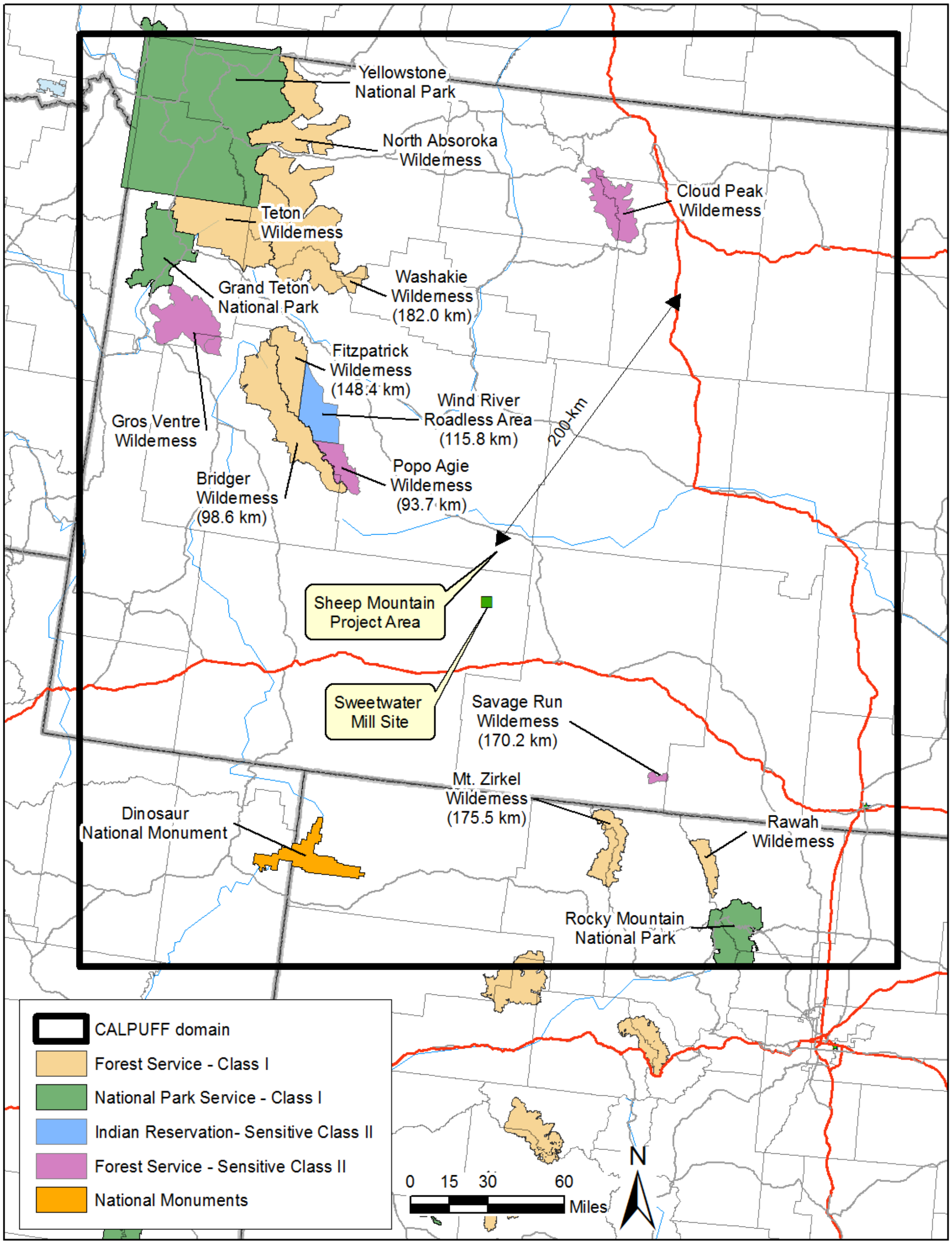
The federal Class I and sensitive Class II areas located within 200 km of the Project Area are listed in Table 4. Table 4 also lists the agency responsible for managing the area, and the PSD classification. Map 9 indicates the proposed CALPUFF modeling domain and shows the Class I and sensitive Class II areas within 200 km of the Project Area. As shown in Map 9, the Project is approximately 94 km from the nearest sensitive area (Class II Popo Agie Wilderness Area).

The receptors for the Class I areas were obtained the FLM receptor database. The receptors for sensitive Class II areas were obtained from prior CALPUFF air quality analyses, i.e. the Riverton Dome EIS (BIA, 2008).

Table 4
Class I and Sensitive Class II Areas

Area of Concern	Managing Agency	PSD Classification
Bridger Wilderness Area	US Forest Service	I
Fitzpatrick Wilderness Area	US Forest Service	I
Mount Zirkel Wilderness Area	US Forest Service	I
Washakie Wilderness Area	US Forest Service	I
Popo Agie Wilderness Area	US Forest Service	II
Savage Run Wilderness Area	US Forest Service	II
Wind River Roadless Area	Bureau of Indian Affairs	II

Ambient air impacts of NO_2, SO_2, PM_{10}, $PM_{2.5}$ and AQRVs (visibility and acid deposition) were analyzed at the each of the Class I and sensitive Class II areas. In addition, ten lakes that are designated as acid sensitive were assessed for potential lake acidification from atmospheric deposition impacts. These include Black Joe, Deep, Hobbs, Lazy Boy, and Upper Frozen lakes in the Bridger Wilderness; Ross Lake in the Fitzpatrick Wilderness; Lake Elbert, Seven Lakes, and Summit Lake in the Mount Zirkel Wilderness; and Lower Saddlebag Lake in the Popo Agie Wilderness.



Map 9
CALPUFF Modeling Domain and Class I and Sensitive Class II Areas within 200km of the Sheep Mountain Project Area

The CALPUFF-predicted concentration impacts were compared with ambient air quality standards and Class I and II Increments, and post-processed to compute: (1) AQRV impacts due to light extinction change for comparison to visibility impact thresholds in Class I and sensitive Class II areas; and (2) AQRV impacts due to deposition rates for comparison to sulfur (S) and nitrogen (N) deposition thresholds, and to calculate change in acid neutralizing capacity (ANC) for sensitive water bodies.

4.1 Meteorological data

The 2008 Weather Research and Forecasting (WRF) meteorological model output produced as part of the Western Regional Air Partnership's (WRAP) West-wide Jump Start Air Quality Modeling Study (WestJumpAQMS) (ENVIRON et. al., 2012) were used as the meteorological dataset for input into the CALPUFF modeling. The WestJumpAQMS WRF model was run for an extensive 4 km domain that focuses on the intermountain West, including the Project location and surrounding areas.

A subset of the WestJumpAQMS modeling output were extracted for the air quality modeling domain and processed into CALPUFF-ready format using the MMIF meteorological preprocessor. The PSD Class I and sensitive Class II areas within 200 km of the Project were contained within the modeling domain along with with sufficient buffer for potential recirculation effects.

The WRF model output was processed with MMIF with the following options selected:

- Output for CALPUFF version 5.8.4;
- The WRF vertical layers were interpolated to the FLM/EPA-recommended vertical layers using the TOP option;
- The PG stability classes were calculated with the Golder option; and
- Planetary boundary layer heights were recalculated.

This resulted in the CALPUFF-ready meteorological files with the following specifications:

- Projection of LCC with RLAT0 = 40N, RLON0 = 97W, XLAT1 = 33N and XLAT2 = 45N;
- Datum = NWS-84;
- NX =130;
- NY =148;
- NZ =10;
- DGRIDKM = 4.; and
- ZFACE = 0., 20., 40., 80., 160., 320., 640., 1200., 2000., 3000., 4000.

The MMIF output, for the entire year of 2008, was consistent with both the original WRF model output and EPA-recommended settings as applicable.

4.2 Ozone and Ammonia Data

Representative ozone and ammonia data is required for use in the chemical transformation of primary pollutant emissions. Hourly ozone is used by CALPUFF to oxidize NO_X and SO_2 emissions within the modeling domain to nitric acid and sulfuric acid, respectively. The predicted nitric acid and sulfuric acid are then partitioned in CALPUFF between the gaseous and particulate nitrate and sulfate phases based on the available ammonia, and ambient temperature and relative humidity.

Hourly ozone data from EPA Air Quality System (AQS) and Clean Air Status and Trends Network (CASTNET) ozone sites within the modeling domain was used in the analysis.

The background ammonia value used in the CALPUFF modeling was 1.0 parts per billion (ppb) for each month of the year following FLAG 2010 guidance for arid lands.

4.3 Visibility

CALPUFF predicted 24-hour concentrations of nitrate, sulfate, PM_{10} and $PM_{2.5}$ at each of the analyzed Class I and sensitive Class II areas were processed using CALPOST following the procedures described in the FLAG 2010 document to estimate potential change in light extinction. Analyses were conducted using the methodology recommended in the FLAG 2010 report for the 20^{th} percentile best natural visibility conditions. Applicable background visibility data and monthly relative humidity factors used in the calculations are defined in the FLAG report. Natural background and relative humidity factors are available for the Class I Bridger, Fitzpatrick, Washakie, and Mount Zirkel Wilderness Areas only. For the Popo Agie and Wind River Roadless sensitive Class II areas the data for the Bridger Wilderness Area were used. For the Savage Run Wilderness, the data for the Mount Zirkel Wilderness Area were used.

4.4 Deposition

The POSTUTIL and CALPOST processor were used to determine annual deposition of total S and total N from CALPUFF modeled deposition results at each Class I and sensitive Class II area. The results were expressed in kilograms per hectare per year (kg/ha-yr).

4.5 Lake Chemistry

CALPUFF modeled annual N and S deposition impacts at sensitive lake locations were used to estimate changes in ANC. The changes in ANC were calculated following the January 2000, U.S. Forest Service (Forest Service) Rocky Mountain Region's *Screening Methodology for Calculating ANC Change to High Elevation Lakes, User's Guide* (Forest Service, 2000). The most recent lake chemistry background ANC data available from the Forest Service for the ten sensitive lakes listed in Section 4.0 are shown in Table 5. The 10th percentile lowest ANC values were calculated for each lake following procedures provided by the Forest Service. Of the ten lakes listed in Table 5, two lakes (Lazy Boy and Upper Frozen) are considered by the Forest Service as extremely sensitive to atmospheric deposition because the background ANC values are less than 25 microequivalents per liter (µeq/l). Annual precipitation data for each lake were obtained from the Parameter-elevation Regressions on Independent Slopes Model (PRISM) (PRISM, 2014) climate mapping system data base, and these precipitation values were used in the calculation of ANC changes.

Table 5
Background ANC Values for Acid Sensitive Lakes[1]

Wilderness Area	Lake	Latitude (Degs)	Longitude (Degs)	10th Percentile Lowest ANC Value (µeq/l)[2]	Number of Samples	Monitoring Period
Bridger	Black Joe	42.739	109.171	62.6	78	1984-2009
Bridger	Deep	42.719	109.172	57.7	68	1984-2009
Bridger	Hobbs	43.035	109.673	69.9	80	1984-2009
Bridger	Lazy Boy	43.332	109.729	9.1	5	1997-2009
Bridger	Upper Frozen	42.687	109.161	7.5	12	1997-2009
Fitzpatrick	Ross	43.393	109.658	53.0	61	1988-2010
Mount Zirkel	Lake Elbert	40.634	106.707	56.9	68	1985-2007
Mount Zirkel	Seven Lakes (LG East)	40.896	106.682	36.2	67	1985-2007
Mount Zirkel	Summit Lake	40.545	106.682	48.0	107	1985-2007
Popo Agie	Lower Saddlebag	42.623	108.995	54.6	64	1989-2010

[1] Source: Forest Service, 2014.
[2] 10th Percentile Lowest ANC Values reported.

5.0 AIR QUALITY IMPACTS

5.1 Near-Field

5.1.1 Criteria Pollutant Impacts

Near-field modeling for criteria pollutants PM_{10}, $PM_{2.5}$, NO_x, and CO was performed for: construction, operations with on-site processing, and operations with off-site processing. The results of this modeling is presented in this section.

Wyoming Ambient Air Quality Standards (WAAQS), National Ambient Air Quality Standards (NAAQS), and applicable PSD Class II increments are shown in Table 6. Near-field modeled concentrations are combined with ambient air quality background concentrations shown in Table 2 and compared to the corresponding NAAQS and WAAQS in the equivalent form of the standard and equivalent units.

Maximum predicted pollutant concentrations from Project emissions sources combined with existing ambient air quality background concentrations and compared to the NAAQS and WAAQS as shown in Table 7 for construction; Table 8 for operations with on-site processing; and Table 9 for operations with off-site processing. All total predicted concentrations were found to be below applicable NAAQS and WAAQS.

Project-only impacts for the operations are compared to PSD Class II increments and are shown in Table 10 for on-site processing and Table 11 for off-site processing. The impacts from construction activities were not compared to PSD increments because construction actvitites are temporary sources and would not consume PSD increment. The predicted pollutant concentrations from stationary sources were found to be below PSD Class II Increments. Predicted impacts from all sources, including both stationary and fugitive sources, were found to be below PSD Class II Increments with the exception of the 24-hour averaging period for PM_{10} and $PM_{2.5}$. Under the operations with on-site processing case, 24-hour PM_{10} concentrations from both stationary and fugitive sources were 11 percent above the PM_{10} 24-hour PSD Class II Increment and 61 percent above the $PM_{2.5}$ 24-hour PSD Class II Increment. Under the operations with off-site processing case, 24-hour PM_{10} concentrations from both stationary and fugitive sources were 77 percent above the 24-hour PM_{10} PSD Class II Increment and 35 percent above the 24-hour $PM_{2.5}$ PSD Class II Increment. This PSD demonstration is for information only and is not a regulatory PSD Increment consumption analysis, which would be completed as necessary during the WDEQ permitting process. The 24-hour PM_{10} and $PM_{2.5}$ impacts are controlled by fugitive sources such as the mining pit and roads associated with operations.

Table 6
NAAQS, WAAQS, and PSD Class II Increments for Comparison to Analysis Results (μg/m³)[1]

Pollutant/Averaging Time	NAAQS	WAAQS	PSD Class I Increment[1]	PSD Class II Increment[2]
CO				
1-hour[3]	40,000	40,000	--[4]	--[4]
8-hour[3]	10,000	10,000	--[4]	--[4]
NO_2				
1-hour[5]	188	188	--[4]	--[4]
Annual[6]	100	100	2.5	25
PM_{10}				
24-hour[3]	150	150	8	30
Annual[6]	--[7]	50	4	17
$PM_{2.5}$				
24-hour[8]	35	35	2	9
Annual[6]	12	15[9]	1	4
SO_2				
1-hour[10]	196	196	--[4]	--[4]
3-hour[3]	1,300	1,300	25	512
24-hour[3]	--[7]	--[11]	5	91
Annual[6]	--[7]	--[11]	2	20

1 For gaseous pollutants, NAAQS and WAAQS conversion from ppm or ppb was performed assuming standard conditions (25 degs C and 29.92 inches Hg).
2 The PSD demonstrations serve information purposes only and do not constitute a regulatory PSD increment consumption analysis.
3 No more than one exceedance per year.
4 No PSD increments have been established for this pollutant–averaging time.
5 An area is in compliance with the standard if the 98th percentile of daily maximum 1-hour NO_2 concentrations in a year, averaged over 3 years, is less than or equal to the level of the standard.
6 Annual arithmetic mean.
7 The NAAQS for this averaging time for this pollutant has been revoked by EPA.
8 An area is in compliance with the standard if the maximum 24-hour PM2.5 concentrations in a year, averaged over 3 years, is less than or equal to the level of the standard.
9 The EPA revised the NAAQS for this pollutant (effective March 18 2013) and the WDEQ has not yet adopted the revised NAAQS as part of their rulemaking. All compliance demonstrations of modeled concentrations will use the more stringent NAAQS value.
10 An area is in compliance with the standard if the 99th percentile of daily maximum 1-hour SO_2 concentrations in a year, averaged over 3 years, is less than or equal to the level of the standard.
11 No standards are established for this pollutant-averaging time.

Table 7
Construction - Near-Field Criteria Pollutant Concentrations Compared to NAAQS and WAAQS

Pollutant	Averaging Period	Predicted Impact (μg/m^3)	Background (μg/m^3)	Total Impact (μg/m^3)	NAAQS (μg/m^3)	WAAQS (μg/m^3)	Percent of NAAQS
CO	1-hour [1]	1048.1	909.0	1957.2	40,000	40,000	5
	8-hour [1]	266.7	575.0	841.7	10,000	10,000	8
NO_2	1-hour [2]	170.2	9.4	179.6	188	188	96
	Annual	10.5	1.9	12.4	100	100	12
PM_{10}	24-hour [1]	47.5	49.0	96.5	150	150	64
	Annual	2.1	11.0	13.1	n/a	50	n/a
$PM_{2.5}$	24-hour [3]	5.3	27.0	32.3	35	35	92
	Annual	0.4	7.0	7.4	12	15	62
SO_2	1-hour [4]	6.3	18.3	24.6	196	196	13
	3-hour [1]	5.0	18.3	23.3	1,300	1,300	2

[1] Highest second-high value.
[2] Two-year average of the 98th percentile daily maximum 1-hour concentrations.
[3] Maximum 98th percentile concentration.
[4] Maximum 99th percentile daily maximum concentration.

Table 8
On-Site Processing - Near-Field Criteria Pollutant Concentrations Compared to NAAQS and WAAQS

Pollutant	Averaging Period	Predicted Impact (μg/m^3)	Background (μg/m^3)	Total Impact (μg/m^3)	NAAQS (μg/m^3)	WAAQS (μg/m^3)	Percent of NAAQS
CO	1-hour [1]	1048.1	909.0	1957.1	40,000	40,000	5
	8-hour [1]	159.4	575.0	734.4	10,000	10,000	7
NO_2	1-hour [2]	137.9	9.4	147.3	188	188	78
	Annual	8.0	1.9	9.9	100	100	10
PM_{10}	24-hour [1]	33.4	49.0	82.4	150	150	55
	Annual	4.9	11.0	15.9	n/a	50	n/a
$PM_{2.5}$	24-hour [3]	4.3	27.0	31.4	35	35	90
	Annual	0.7	7.0	7.7	12	15	64
SO_2	1-hour [4]	6.3	18.3	24.6	196	196	13
	3-hour [1]	3.3	18.3	21.6	1,300	1,300	2

[1] Highest second-high value.
[2] Two-year average of the 98th percentile daily maximum 1-hour concentrations.
[3] Maximum 98th percentile concentration.
[4] Maximum 99th percentile daily maximum concentration.

Table 9
Off-Site Processing - Near-Field Criteria
Pollutant Concentrations Compared to NAAQS and WAAQS

Pollutant	Averaging Period	Predicted Impact (μg/m^3)	Background (μg/m^3)	Total Impact (μg/m^3)	NAAQS (μg/m^3)	WAAQS (μg/m^3)	Percent of NAAQS
CO	1-hour [1]	1069.0	909.0	1978.0	40,000	40,000	5
	8-hour [1]	185.5	575.0	760.5	10,000	10,000	8
NO_2	1-hour [2]	145.2	9.4	154.6	188	188	82
	Annual	8.6	1.9	10.5	100	100	11
PM_{10}	24-hour [1]	53.0	49.0	102.0	150	150	68
	Annual	12.3	11.0	23.3	n/a	50	n/a
$PM_{2.5}$	24-hour [3]	5.7	27.0	32.7	35	35	93
	Annual	1.3	7.0	8.3	12	15	69
SO_2	1-hour [4]	9.3	18.3	27.6	196	196	14
	3-hour [1]	7.6	18.3	25.9	1,300	1,300	2

[1] Highest second-high value.
[2] Two-year average of the 98th percentile daily maximum 1-hour concentrations.
[3] Maximum 98th percentile concentration.
[4] Maximum 99th percentile daily maximum concentration.

Table 10
On-Site Processing - Near-Field Criteria Pollutant
Concentrations Compared to PSD Class II Increments

Pollutant	Averaging Period	Predicted Impact (μg/m^3)	Class II Increment (μg/m^3)	Percent of Increment
NO_2	Annual [1]	8.0	25	32
PM_{10}	24-hour [1]	33.4	30	111
	Annual	4.9	17	29
$PM_{2.5}$	24-hour [1]	14.5	9	161
	Annual	0.7	4	18
SO_2	3-hour [1]	3.3	512	1
	24-hour [1]	1.1	91	1
	Annual	0.03	20	0.1

[1] Highest second high value.

Table 11
Off-Site Processing - Near-Field Criteria Pollutant Concentrations Compared to PSD Class II Increments

Pollutant	Averaging Period	Predicted Impact ($\mu g/m^3$)	Class II Increment ($\mu g/m^3$)	Percent of Increment
NO_2	Annual [1]	8.6	25	34
PM_{10}	24-hour [1]	53.0	30	177
	Annual	12.3	17	72
$PM_{2.5}$	24-hour [1]	12.1	9	135
	Annual	1.3	4	32
SO_2	3-hour [1]	7.6	512	1
	24-hour [1]	3.1	91	3
	Annual	0.03	20	0.1
[1] Highest second high value.				

5.2 Far-Field

5.2.1 Ambient Concentration Impacts

Modeled direct project pollutant concentrations predicted to occur at the nearby PSD Class I and Sensitive Class II areas are compared to PSD Increments in Table 12 through 14 for construction, operations with on-site processing, and operations off-site processing, respectively. Although construction activities are temporary sources and would not consume increment, for informational purposes, the comparison of modeled construction impacts to PSD increments is provided in Table 12.

For all modeling scenarios air quality concentration impacts are well below the applicable PSD Increments at each of the PSD Class I and Sensitive Class II areas analyzed. The PSD demonstrations are for information only and are not regulatory PSD Increment consumption analyses, which would be completed as necessary by the WDEQ.

Table 12
Construction - Far-Field Criteria Pollutant Impacts Compared to PSD Increments

Location	Pollutant	Averaging Time	Direct Modeled ($\mu g/m^3$)	PSD Increment ($\mu g/m^3$)
Bridger WA	NO_2	Annual	1.86E-04	2.5
	SO_2	3-hour 24-hour Annual	7.39E-03 9.46E-04 5.77E-06	25 5 2
	PM_{10}	24-hour Annual	1.27E-02 2.65E-04	8 4
	$PM_{2.5}$	24-hour Annual	7.75E-03 1.43E-04	2 1
Fitzpatrick WA	NO_2	Annual	1.46E-05	2.5
	SO_2	3-hour 24-hour Annual	1.73E-04 3.87E-05 7.58E-07	25 5 2
	PM_{10}	24-hour Annual	8.48E-03 1.06E-04	8 4
	$PM_{2.5}$	24-hour Annual	6.00E-03 6.71E-05	2 1
Mount Zirkel WA	NO_2	Annual	1.51E-04	2.5
	SO_2	3-hour 24-hour Annual	1.94E-03 2.44E-04 3.87E-06	25 5 2
	PM_{10}	24-hour Annual	1.14E-02 3.74E-04	8 4
	$PM_{2.5}$	24-hour Annual	8.29E-03 2.47E-04	2 1
Washakie WA	NO_2	Annual	9.03E-06	2.5
	SO_2	3-hour 24-hour Annual	9.64E-05 6.90E-05 8.73E-07	25 5 2
	PM_{10}	24-hour Annual	1.81E-02 1.52E-04	8 4
	$PM_{2.5}$	24-hour Annual	1.21E-02 9.67E-05	2 1
Popo Agie WA	NO_2	Annual	2.41E-04	2.5
	SO_2	3-hour 24-hour Annual	1.16E-02 1.48E-03 7.39E-06	25 5 2
	PM_{10}	24-hour Annual	1.83E-02 3.17E-04	8 4
	$PM_{2.5}$	24-hour Annual	8.49E-03 1.68E-04	2 1
Savage Run WA	NO_2	Annual	2.21E-04	25
	SO_2	3-hour 24-hour Annual	6.81E-03 8.57E-04 6.24E-06	512 91 20
	PM_{10}	24-hour Annual	2.99E-02 5.14E-04	30 17
	$PM_{2.5}$	24-hour Annual	2.67E-02 3.46E-04	9 4
Wind River RA	NO_2	Annual	3.84E-05	25
	SO_2	3-hour 24-hour Annual	3.31E-04 6.61E-05 1.64E-06	512 91 20
	PM_{10}	24-hour Annual	9.32E-03 1.86E-04	30 17
	$PM_{2.5}$	24-hour Annual	6.60E-03 1.08E-04	9 4

Table 13
On-Site Processing - Far-Field Criteria Pollutant Impacts Compared to PSD Increments

Location	Pollutant	Averaging Time	Direct Modeled (µg/m^3)	PSD Increment (µg/m^3)
Bridger WA	NO_2	Annual	1.86E-04	2.5
	SO_2	3-hour	7.39E-03	25
		24-hour	9.46E-04	5
		Annual	5.78E-06	2
	PM_{10}	24-hour	2.37E-02	8
		Annual	4.34E-04	4
	$PM_{2.5}$	24-hour	7.96E-03	2
		Annual	1.72E-04	1
Fitzpatrick WA	NO_2	Annual	1.47E-05	2.5
	SO_2	3-hour	1.73E-04	25
		24-hour	3.89E-05	5
		Annual	7.62E-07	2
	PM_{10}	24-hour	1.15E-02	8
		Annual	1.54E-04	4
	$PM_{2.5}$	24-hour	6.55E-03	2
		Annual	7.59E-05	1
Mount Zirkel WA	NO_2	Annual	1.51E-04	2.5
	SO_2	3-hour	1.94E-03	25
		24-hour	2.44E-04	5
		Annual	3.88E-06	2
	PM_{10}	24-hour	1.54E-02	8
		Annual	5.26E-04	4
	$PM_{2.5}$	24-hour	8.84E-03	2
		Annual	2.73E-04	1
Washakie WA	NO_2	Annual	9.04E-06	2.5
	SO_2	3-hour	9.69E-05	25
		24-hour	6.93E-05	5
		Annual	8.78E-07	2
	PM_{10}	24-hour	2.49E-02	8
		Annual	2.17E-04	4
	$PM_{2.5}$	24-hour	1.33E-02	2
		Annual	1.08E-04	1
Popo Agie WA	NO_2	Annual	2.41E-04	2.5
	SO_2	3-hour	1.16E-02	25
		24-hour	1.48E-03	5
		Annual	7.40E-06	2
	PM_{10}	24-hour	3.81E-02	8
		Annual	5.60E-04	4
	$PM_{2.5}$	24-hour	1.14E-02	2
		Annual	2.08E-04	1
Savage Run WA	NO_2	Annual	2.22E-04	25
	SO_2	3-hour	6.81E-03	512
		24-hour	8.55E-04	91
		Annual	6.25E-06	20
	PM_{10}	24-hour	3.36E-02	30
		Annual	7.00E-04	17
	$PM_{2.5}$	24-hour	2.74E-02	9
		Annual	3.78E-04	4
Wind River RA	NO_2	Annual	3.84E-05	25
	SO_2	3-hour	3.33E-04	512
		24-hour	6.65E-05	91
		Annual	1.65E-06	20
	PM_{10}	24-hour	1.25E-02	30
		Annual	2.87E-04	17
	$PM_{2.5}$	24-hour	7.18E-03	9
		Annual	1.26E-04	4

Table 14
Off-Site Processing - Far-Field Criteria Pollutant Impacts Compared to PSD Increments

Location	Pollutant	Averaging Time	Direct Modeled (µg/m^3)	PSD Increment (µg/m^3)
Bridger WA	NO_2	Annual	1.59E-04	2.5
	SO_2	3-hour	7.38E-03	25
		24-hour	9.44E-04	5
		Annual	5.75E-06	2
	PM_{10}	24-hour	2.19E-02	8
		Annual	3.87E-04	4
	$PM_{2.5}$	24-hour	7.03E-03	2
		Annual	1.01E-04	1
Fitzpatrick WA	NO_2	Annual	1.14E-05	2.5
	SO_2	3-hour	1.71E-04	25
		24-hour	3.86E-05	5
		Annual	7.54E-07	2
	PM_{10}	24-hour	9.50E-03	8
		Annual	1.32E-04	4
	$PM_{2.5}$	24-hour	4.46E-03	2
		Annual	4.77E-05	1
Mount Zirkel WA	NO_2	Annual	1.19E-04	2.5
	SO_2	3-hour	1.94E-03	25
		24-hour	2.44E-04	5
		Annual	3.86E-06	2
	PM_{10}	24-hour	1.29E-02	8
		Annual	4.72E-04	4
	$PM_{2.5}$	24-hour	7.93E-03	2
		Annual	1.84E-04	1
Washakie WA	NO_2	Annual	7.01E-06	2.5
	SO_2	3-hour	9.60E-05	25
		24-hour	6.87E-05	5
		Annual	8.68E-07	2
	PM_{10}	24-hour	2.08E-02	8
		Annual	1.82E-04	4
	$PM_{2.5}$	24-hour	9.22E-03	2
		Annual	7.10E-05	1
Popo Agie WA	NO_2	Annual	2.04E-04	2.5
	SO_2	3-hour	1.16E-02	25
		24-hour	1.48E-03	5
		Annual	7.37E-06	2
	PM_{10}	24-hour	3.64E-02	8
		Annual	5.06E-04	4
	$PM_{2.5}$	24-hour	6.65E-03	2
		Annual	1.18E-04	1
Savage Run WA	NO_2	Annual	1.83E-04	25
	SO_2	3-hour	6.81E-03	512
		24-hour	8.57E-04	91
		Annual	6.23E-06	20
	PM_{10}	24-hour	3.04E-02	30
		Annual	6.27E-04	17
	$PM_{2.5}$	24-hour	2.59E-02	9
		Annual	2.67E-04	4
Wind River RA	NO_2	Annual	3.01E-05	25
	SO_2	3-hour	3.29E-04	512
		24-hour	6.57E-05	91
		Annual	1.64E-06	20
	PM_{10}	24-hour	1.03E-02	30
		Annual	2.48E-04	17
	$PM_{2.5}$	24-hour	4.91E-03	9
		Annual	7.59E-05	4

5.2.2 Visibility

Change in atmospheric light extinction relative to background conditions is used to measure regional haze. Analysis thresholds for atmospheric light extinction are set forth in FLAG (2010), with the results reported in percent change in light extinction and change in deciview (dv or delta deciview [ddv]). A 5 percent change in light extinction [approximately equal to a 0.5 change in dv (Δdv)] is the threshold recommended in FLAG (2010) and is considered to contribute to regional haze visibility impairment. A 10 percent change in light extinction (approximately equal to 1.0 Δdv) is considered to represent a noticeable change in visibility when compared to background conditions. The BLM considers a 1.0 Δdv change as a significant adverse impact; however, there are no applicable local, state, tribal, or federal regulatory visibility standards. It is the responsibility of the jurisdictional FLM or Tribal government responsible for that land to determine when adverse impacts are significant or not, and these may differ from BLM levels for significant adverse impacts.

Visibility impacts were calculated for the each scenario of the Project (Proposed Action) and were evaluated at each Class I and sensitive Class II area of concern to determine if the maximum and 98th percentile change in light extinction exceeds either the 0.5 and 1.0 delta deciview thresholds (equivalent to 5 percent and 10 percent change in light extinction). Results are presented in Table 15 for construction; Table 16 for operations with on-site processing; and Table 17. for operations with off-site processing. The results were reported for each threshold using the 20th percentile best visibility background conditions. The results indicate that, for all modeling scenarios, impacts are below the thresholds of concern at all Class I and sensitive Class II areas.

Table 15
Construction - Far-Field Visibility Impacts Using the 20th Percentile Cleanest Backgrounds

Area of Concern	Days Greater Than 0.5 Δdv	Days Greater Than 1.0 Δdv	Maximum Δdv	98th Percentile Δdv
Bridger Wilderness Area	0	0	0.032	0.010
Fitzpatrick Wilderness Area	0	0	0.036	0.005
Mount Zirkel Wilderness Area	0	0	0.049	0.020
Washakie Wilderness Area	0	0	0.071	0.013
Popo Agie Wilderness Area	0	0	0.028	0.013
Savage Run Wilderness Area	0	0	0.048	0.005
Wind River Roadless Area	0	0	0.030	0.006

Table 16
On-Site Processing - Far-Field Visibility Impacts Using the 20th Percentile Cleanest Backgrounds

Area of Concern	Days Greater Than 0.5 Δdv	Days Greater Than 1.0 Δdv	Maximum Δdv	98th Percentile Δdv
Bridger Wilderness Area	0	0	0.037	0.014
Fitzpatrick Wilderness Area	0	0	0.039	0.006
Mount Zirkel Wilderness Area	0	0	0.052	0.022
Washakie Wilderness Area	0	0	0.076	0.015
Popo Agie Wilderness Area	0	0	0.051	0.020
Savage Run Wilderness Area	0	0	0.052	0.006
Wind River Roadless Area	0	0	0.043	0.008

Table 17
Off-Site Processing - Far-Field Visibility Impacts Using the 20th Percentile Cleanest Backgrounds

Area of Concern	Days Greater Than 0.5 ∆dv	Days Greater Than 1.0 ∆dv	Maximum ∆dv	98th Percentile ∆dv
Bridger Wilderness Area	0	0	0.032	0.011
Fitzpatrick Wilderness Area	0	0	0.030	0.004
Mount Zirkel Wilderness Area	0	0	0.046	0.017
Washakie Wilderness Area	0	0	0.060	0.011
Popo Agie Wilderness Area	0	0	0.032	0.011
Savage Run Wilderness Area	0	0	0.046	0.004
Wind River Roadless Area	0	0	0.025	0.005

5.2.3 Deposition

FLAG (2010) recommends that applicable sources assess impacts of N and S deposition at Class I areas. The guidance does recommends the use of deposition analysis thresholds (DATs) developed by the National Park Service and the U.S. Fish and Wildlife Service. The DATs represent screening level values for N and S deposition from project alone emission sources below which estimated impacts are considered insignificant. The DAT established for both N and S in western Class I areas is 0.005 kg/ha-yr. Impacts are presented in Table 18 for construction; Table 19 for operations with on-site processing; and Table 20. for operations with off-site processing. The results indicate that, for all modeling scenarios, impacts are below the DATs at the areas of concern.

Table 18
Construction - Deposition Impacts Compared to the DAT

Area of Concern	Maximum Nitrogen Impact (kg/ha-yr)	Maximum Sulfur Impact (kg/ha-yr)	DAT (kg/ha-yr)	Nitrogen Percent of DAT	Sulfur Percent of DAT
Bridger Wilderness Area	0.0002	0.000005	0.005	4	0.1
Fitzpatrick Wilderness Area	0.0002	0.000004	0.005	3	0.1
Mt Zirkel Wilderness Area	0.0002	0.000002	0.005	4	0.05
Popo Agie Wilderness Area	0.0002	0.000006	0.005	5	0.1
Savage Run Wilderness Area	0.0004	0.000004	0.005	7	0.1
Washakie Wilderness Area	0.0001	0.000002	0.005	2	0.04
Wind River Roadless Area	0.0002	0.000004	0.005	3	0.1

Table 19
On-Site Processing - Deposition Impacts Compared to the DAT

Area of Concern	Maximum Nitrogen Impact (kg/ha-yr)	Maximum Sulfur Impact (kg/ha-yr)	DAT (kg/ha-yr)	Nitrogen Percent of DAT	Sulfur Percent of DAT
Bridger Wilderness Area	0.0002	0.000005	0.005	4	0.10
Fitzpatrick Wilderness Area	0.0002	0.000004	0.005	3	0.10
Mt Zirkel Wilderness Area	0.0002	0.000002	0.005	4	0.05
Popo Agie Wilderness Area	0.0002	0.000006	0.005	5	0.10
Savage Run Wilderness Area	0.0004	0.000004	0.005	7	0.10
Washakie Wilderness Area	0.0001	0.000002	0.005	2	0.04
Wind River Roadless Area	0.0002	0.000004	0.005	3	0.10

Table 20
Off-Site Processing - Deposition Impacts Compared to the DAT

Area of Concern	Maximum Nitrogen Impact (kg/ha-yr)	Maximum Sulfur Impact (kg/ha-yr)	DAT (kg/ha-yr)	Nitrogen Percent of DAT	Sulfur Percent of DAT
Bridger Wilderness Area	0.0002	0.000005	0.005	3	0.10
Fitzpatrick Wilderness Area	0.0001	0.000004	0.005	3	0.10
Mt Zirkel Wilderness Area	0.0002	0.000002	0.005	3	0.05
Popo Agie Wilderness Area	0.0002	0.000006	0.005	4	0.10
Savage Run Wilderness Area	0.0003	0.000004	0.005	6	0.10
Washakie Wilderness Area	0.0001	0.000002	0.005	1	0.04
Wind River Roadless Area	0.0001	0.000004	0.005	3	0.10

5.2.4 ANC

The CALPUFF-predicted annual deposition fluxes of S and N at sensitive lake receptors listed in Section 4.5 were used to estimate the change in ANC. The predicted changes in ANC were compared with the Forest Service's Level of Acceptable Change (LAC) thresholds of a 10 percent change in ANC for lakes with ANC values equal to or greater than 25 µeq/l and 1 µeq/l for lakes with ANC values of 25 µeq/l and less. Results are presented in Table 21 for construction; Table 22 for operations with on-site processing; and Table 23. for operations with off-site processing. The results indicate that, for all modeling scenarios, impacts are below the thresholds of concern at each of the sensitive lakes.

Table 21
Construction ANC Impacts

Sensitive Lake	Annual Precipitation[1] (meters)	ANC Value[2] (µeq/l)	N (kg/ha-yr)	S (kg/ha-yr)	ANC Relative Change[3] (percent)	ANC Absolute Change[3] (µeq/l)
Black Joe Lake	1.6	62.6	1.52E-04	3.05E-06	0.002	n/a
Deep Lake	1.4	57.7	1.55E-04	3.34E-06	0.002	n/a
Hobbs Lake	1.1	69.9	8.45E-05	1.42E-06	0.001	n/a
Lazy Boy	1.1	9.1	1.06E-04	2.30E-06	n/a	0.001
Lower Saddlebag Lake	1.1	54.6	2.06E-04	5.13E-06	0.004	n/a
Ross Lake	1.1	53.0	1.23E-04	2.74E-06	0.002	n/a
Upper Frozen Lake	0.8	7.5	1.57E-04	3.58E-06	n/a	0.002
Lake Elbert	1.7	56.9	1.90E-04	1.57E-06	0.002	n/a
Seven Lakes	1.3	36.2	2.10E-04	1.93E-06	0.005	n/a
Summit Lake	1.4	48	1.96E-04	1.49E-06	0.003	n/a

[1] 2008 annual precipitation for these sites from PRISM.
[2] 10th Percentile Lowest ANC Values reported.
[3] For lakes with baseline ANC values less than 25 µeq/l, the threshold is 1 µeq/l. For lakes with baseline ANC values equal to or greater than 25 µeq/l the threshold is a 10 percent change in ANC.

Table 22
On-Site Processing ANC Impacts

Sensitive Lake	Annual Precipitation[1] (meters)	ANC Value[2] (µeq/l)	N (kg/ha-yr)	S (kg/ha-yr)	ANC Relative Change[3] (percent)	ANC Absolute Change[3] ((µeq/l)
Black Joe Lake	1.6	62.6	1.52E-04	3.06E-06	0.002	n/a
Deep Lake	1.4	57.7	1.56E-04	3.35E-06	0.002	n/a
Hobbs Lake	1.1	69.9	8.47E-05	1.43E-06	0.001	n/a
Lazy Boy	1.1	9.1	1.06E-04	2.31E-06	n/a	0.001
Lower Saddlebag Lake	1.1	54.6	2.06E-04	5.14E-06	0.004	n/a
Ross Lake	1.1	53.0	1.23E-04	2.76E-06	0.002	n/a
Upper Frozen Lake	0.8	7.5	1.57E-04	3.60E-06	n/a	0.002
Lake Elbert	1.7	56.9	1.90E-04	1.58E-06	0.002	n/a
Seven Lakes	1.3	36.2	2.11E-04	1.94E-06	0.005	n/a
Summit Lake	1.4	48	1.96E-04	1.49E-06	0.003	n/a

[1] 2008 annual precipitation for these sites from PRISM.
[2] 10th Percentile Lowest ANC Values reported.
[3] For lakes with baseline ANC values less than 25 µeq/l, the threshold is 1 µeq/l. For lakes with baseline ANC values equal to or greater than 25 µeq/l the threshold is a 10 percent change in ANC.

Table 23
Off-Site Processing ANC Impacts

Sensitive Lake	Annual Precipitation[1] (meters)	ANC Value[2] (µeq/l)	N (kg/ha-yr)	S (kg/ha-yr)	ANC Relative Change[3] (percent)	ANC Absolute Change[3] (µeq/l)
Black Joe Lake	1.6	62.6	1.21E-04	3.04E-06	0.001	n/a
Deep Lake	1.4	57.7	1.25E-04	3.33E-06	0.002	n/a
Hobbs Lake	1.1	69.9	6.62E-05	1.42E-06	0.001	n/a
Lazy Boy	1.1	9.1	8.30E-05	2.29E-06	n/a	0.001
Lower Saddlebag Lake	1.1	54.6	1.70E-04	5.12E-06	0.003	n/a
Ross Lake	1.1	53.0	9.57E-05	2.73E-06	0.002	n/a
Upper Frozen Lake	0.8	7.5	1.28E-04	3.58E-06	n/a	0.002
Lake Elbert	1.7	56.9	1.48E-04	1.57E-06	0.002	n/a
Seven Lakes	1.3	36.2	1.64E-04	1.92E-06	0.004	n/a
Summit Lake	1.4	48	1.52E-04	1.48E-06	0.002	n/a

[1] 2008 annual precipitation for these sites from PRISM.
[2] 10th Percentile Lowest ANC Values reported.
[3] For lakes with baseline ANC values less than 25 µeq/l, the threshold is 1 µeq/l. For lakes with baseline ANC values equal to or greater than 25 µeq/l the threshold is a 10 percent change in ANC.

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APPENDIX A

AIR POLLUTANT EMISSIONS INVENTORY
SHEEP MOUNTAIN MINE

Appendix A
Sheep Mountain Air Emissions Inventory
Table of Contents

Sheep Mountain Mine
Construction Phase
Air Emissions Summary

Appendix A - Table C1

Source ID Number	Description	General Location	Point, Fugitive or Nonroad	Annual PM_{10} Emissions (tpy) [1]	24-Hour PM_{10} Emissions (lb/day)	Annual $PM_{2.5}$ Emissions (tpy) [1]	24-Hour $PM_{2.5}$ Emissions (lb/day)	Annual NO_x Emissions (tpy) [1]	24-Hour NO_x Emissions (lb/day)	Annual CO Emissions (tpy) [1]	24-Hour CO Emissions (lb/day)	Annual SO_2 Emissions (tpy) [1]	24-Hour SO_2 Emissions (lb/day)	Annual VOC Emissions (tpy) [1]	24-Hour VOC Emissions (lb/day)	Annual H2SO4 Emissions (tpy)	Annual H2SO4 Emissions (lb/day)	Annual CH_2O Emissions (tpy)	24-Hour CH_2O Emissions (lb/day)	Annual CO2e Emissions (metric tpy)	Annual Benzene Emissions (tpy)	Annual Toluene Emissions (tpy)	Annual Ethylbenzene Emissions (tpy)	Annual n-hexane Emissions (tpy)
1.0	**Mine Sources**																							
	Blasting - Particulate	Underground	F	0.0139	0.0802	0.0008	0.0046	--	--	--	--	--	--	--	--	--	--	--	--	--				
	Blasting - Gaseous	Underground	F	--	--	--	--	6.3450	34.8100	22.1225	121.4600	0.6025	3.3100	--	--	--	--	--	--	--				
	Natural Gas Heaters - Mine Intake	Underground	P	0.0034	0.0187	0.0034	0.0187	0.0450	0.2466	0.0378	0.2071	0.0003	0.0015	0.0025	0.0136	--	--	3.38E-05	1.85E-04	49.1022	9.45E-07	1.53E-06	--	8.10E-04
	Underground Mine Construction	Underground	F	0.0772	0.4232	0.0154	0.0846	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Underground Mobile Sources	Underground	N	2.5472	19.5936	2.5472	19.5936	42.1337	324.1051	44.8769	345.2073	--	--	5.1356	39.5043	--	--	0.8408	6.4680	4684.5710	0.0537	0.0780	0.0092	0.0000
																					--	--	--	--
2.0	**Surface Sources**																				--	--	--	--
	Dozing	Pit	F	7.4264	57.1264	3.8996	29.9973	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Overburden Removal	Pit	F	1.6560	9.0720	0.3312	1.8144	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Overburden Unloading	Spoils	F	0.3566	1.9537	0.0713	0.3907	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Facility Construction	Facility	F	0.5280	5.8667	0.0792	0.8800	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Facilities Material Removal	Facility	F	2.6550	14.5485	0.5310	2.9097	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Facilities Material Unloading	Facility	F	0.5718	3.1332	0.1144	0.6266	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3.0	**Unpaved Roads**																							
	Water Trucks	Haul Routes	F	5.3053	63.1579	0.5305	6.3158	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Support Vehicles	Unpaved Access Road	F	0.9034	197.6076	0.0903	19.7608	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Bulk Delivery Trucks	Unpaved Access Road	F	0.3733	3.2661	0.0373	0.3266	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Misc. Delivery Trucks	Unpaved Access Road	F	0.2277	1.9922	0.0228	0.1992	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Material Delivery Trucks	Unpaved Access Road	F	0.1923	3.0088	0.0192	0.3009	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Light Vehicles	Unpaved Access Road	F	5.7736	173.6126	0.5774	17.3613	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4.0	**Wind Erosion**																							
	Open Acres	Mine-Wide	F	9.9180	54.3452	1.4877	8.1518	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Stockpiles	Mine-Wide	F	2.7945	15.3121	0.4192	2.2968	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5.0	**Surface Mobile Sources**																							
	Surface Mobile/Nonroad Sources	Mine-Wide	N/M	1.9890	10.9288	1.9890	10.9288	199.0330	1093.5880	119.6273	657.2928	0.1057	0.5793	14.0182	77.0229	--	--	5.2987	29.1136	6354.8006	0.4270	0.2066	0.0496	0.0996
	Total Point Source Emissions			0.0034	0.0187	0.0034	0.0187	0.0450	0.2466	0.0378	0.2071	0.0003	0.0015	0.0025	0.0136	--	--	3.38E-05	1.85E-04	49.1022	9.45E-07	1.53E-06	--	8.10E-04
	Total Fugitive Source Emissions			38.7729	604.5065	8.2274	91.4212	6.3450	34.8100	22.1225	121.4600	0.6025	3.3100	--	--	--	--	--	--	--	--	--	--	--
	Total Nonroad/Mobile Source Emissions			4.5362	30.5224	4.5362	30.5224	241.1667	1417.6931	164.5042	1002.5000	0.1057	0.5793	19.1537	116.5272	--	--	6.1395	35.5816	11039.3717	0.4807	0.2845	0.0588	0.0996
	Total Construction Phase			43.31		12.77		247.56		186.66		0.71		19.16		0.00		6.14		11088.47	0.4807	0.2845	0.0588	0.1005

1. Annual emission rates may not be equivalent to daily emission rates x 365 days/year due to limitations on annual operating schedule, fuel input, or other factors. See individual calculation sheets for source-specific details.

Data Provided by Energy Fuels
October 29, 2013

Appendix A - Table C2

CONSTRUCTION

Construction	Underground	UG Blasting - Particulate	Area blasted (ft2)	150
			Annual blasts (blasts/yr)	2080
			max daily blasts (blasts/day)	6
		UG Blasting - Gaseous	ANFO Use (annual tpy)	575
			ANFO Use (max daily tpd)	1.58
			High Explosives Use (annual tpy)	55
			High Explosives Use (max daily tpd)	0.15
		Surface Blasting - Particulate	Area blasted (ft2), annual blasts (blasts/yr), max daily blasts (blasts/day)	none
		Surface Blasting - Gaseous	ANFO Use (need annual tpy, max daily tpd)	none
			High Explosives Use (need annual tpy, max daily tpd)	none
		Coarse Ore Transfer	Annual Material Throughput (tpy)	386000
			Max Daily Material Throughput (tpd)	1058
		Natural Gas Heaters - Mine Intake	Natural gas use (scf/yr)	900,000
		Underground Mobile Sources	HP	see calc sheet
			Quantity	see calc sheet
			Annual operating hours	see calc sheet
Construction	Surface	Dozing	Annual operating hours (hrs/year)	10400
			Maximum Daily Operating hours (hrs/day)	20
		Overburden Removal	Annual Throughput (tpy)	736000
			Max Daily Throughput (tpd)	2016
		Overburden Unloading	Annual Throughput (tpy)	736000
			Max Daily Throughput (tpd)	2016
Construction	Facilities Construction	General Construction Activity	Annual Area (acres)	0.8
		Cut and Fill Material Movement	Annual Material (tpy)	1180000
			Max Daily Material (tpd)	3233
Construction	Unpaved Roads	Surface Ore Haul to Truck Dump	Annual Throughput (tpy)	736000
			Max Daily Throughput (tpd)	2016
			Round Trips per day	64
			Round Trip Distance (average miles)	0.5
		Water Trucks	--	see calc sheet
		Haul Road Repair	--	see calc sheet
		Bulk Delivery Trucks	--	see calc sheet
		Material Delivery Trucks	Round Trips per year	302
		Employee Traffic	Employees per day	236
Construction	Wind Erosion	Open Acres	Area (acres)	87
		Stockpiles	Area (m2)	60,705
Production	Surface Combustion	Surface Mobile/Nonroad Sources	HP	see calc sheet
			Quantity	see calc sheet
			Annual operating hours	see calc sheet
		Mine-Wide Diesel Combustion	Mine-wide annual diesel fuel consumption (gal)	1077975

Sheep Mountain Mine **Appendix A - Table C3**

Blasting - Particulate Emissions

Activity	Area Blasted[1]	Blasts per Year	Blasts per Day	PM_{10} Emission Factor[2]	$PM_{2.5}$ Emission Factor[2]	Annual PM_{10} Emissions	Max 24-Hr PM_{10} Emissions	Annual $PM_{2.5}$ Emissions	Max 24-Hr $PM_{2.5}$ Emissions	Max Hourly PM10	Max Hourly PM2.5
	(ft^2)			(lb/blast)	(lb/blast)	(tpy)	(lb/day)	(tpy)	(lb/day)	(lb/hr)	(lb/hr)
Underground	150	2,080	6.00	0.013	0.0008	0.0139	0.0802	0.0008	0.0046	0.0134	0.0008

Notes:

[1] Estimated.

[2] AP-42, 11.9, Western Surface Coal Mining, Table 11.9-1.

PM_{10} Emission Factor = $(0.000014)A^{1.5} * 0.52$ (lb/blast)

$PM_{2.5}$ Emission Factor = $(0.000014)A^{1.5} * 0.03$ (lb/blast)

[3] Maximum hourly emissions based on lb/blast emission factor, one blast per hour.

Sheep Mountain Mine **Appendix A - Table C4**

Blasting - Gaseous Emissions

Explosive	Pollutant	Annual Explosive Usage (tpy)	Daily Explosive Usage[1] (tons/day)	Emission Factor[2] (lb/ton)	Annual Emissions (tpy)	Max 24-Hr Emissions (lb/day)	Max Hourly Emissions[3] (lb/hr)
ANFO	NO_x	575	1.58	17	4.8875	26.8600	4.4767
	CO	575	1.58	67	19.2625	105.8600	17.6433
	SO_2	575	1.58	2	0.5750	3.1600	0.5267
High Explosive	NO_x	55	0.15	53	1.4575	7.9500	1.3250
	CO	55	0.15	104	2.8600	15.6000	2.6000
	SO_2	55	0.15	1	0.0275	0.1500	0.0250
Total	NO_x				6.3450	34.8100	5.8017
	CO				22.1225	121.4600	20.2433
	SO_2				0.6025	3.3100	0.5517

Note:

[1] Daily use calculated as annual use (tpy) / 365 days per year.

[2] AP-42 (EPA, 1980), Table 13.3-1, "Emission Factors for Detonation Explosives."
Emission factors selected for ammonium nitrate combined with fuel oil.
Emission factors selected for high explosives are those for gelatin dynamite with a range of 20-100% nitroglycerine.

[3] Maximum hourly rate based on daily usage / 6 blasts per day, equivalent to 1 blast/hour.

Sheep Mountain Mine **Appendix A - Table C5**

Natural Gas-Fired Mine Intake Air Heaters

Pollutant	Emission Factor[1]	Natural Gas	Annual Emissions[2]	Max.24-Hour Emissions	Max Hourly Emissions[3]
	(lb/10^6 scf)	(10^6 scf/day)	(tpy)	(lb/day)	(lb/hr)
PM_{10}	7.6	0.00247	0.0034	0.0187	0.0008
$PM_{2.5}$	7.6	0.00247	0.0034	0.0187	0.0008
NO_x	100.0	0.00247	0.0450	0.2466	0.0103
CO	84.0	0.00247	0.0378	0.2071	0.0086
VOC	5.5	0.00247	0.0025	0.0136	0.0006
SO_2	0.6	0.00247	0.0003	0.0015	0.0001
Benzene	0.0021	0.00247	9.45E-07	5.18E-06	2.16E-07
Toluene	0.0034	0.00247	1.53E-06	8.38E-06	3.49E-07
Hexane	1.8	0.00247	8.10E-04	4.44E-03	1.85E-04
CH_2O	0.075	0.00247	3.38E-05	1.85E-04	7.71E-06

Notes:

[1] AP-42 (EPA, 1998), Section 1.4, "Natural Gas Combustion." Uncontrolled small natural gas boilers.

[2] Annual fuel use estimated based on similar underground operation.

[3] Maximum hourly emissions based on daily emission rate / 24 hours.

Sheep Mountain Mine **Appendix A - Table C6**

UG Mine Construction

Ore Handling Activity	Annual Throughput[4]	24-Hour Throughput	Number of Transfers	Moisture Content	Emission Control Efficiency[1]	PM_{10} Emission Factor[2]	Annual PM_{10} Emissions	Max 24-hr PM_{10} Emissions	Annual $PM_{2.5}$ Emissions	Max 24-hr $PM_{2.5}$ Emissions	Max Hourly PM_{10} Emissions[5]	Max Hourly $PM_{2.5}$ Emissions[5]
	(tpy)	(tons/day)		(%)	(%)	(lb/ton)	(tpy)	(lbs/day)	(tpy)	(lbs/day)	(lb/hr)	(lb/hr)
Underground Coarse Ore Transfer [3]	386,000	1,058	1	5	90	0.004	0.0772	0.4232	0.0154	0.0846	0.0212	0.0042
Total Coarse Ore Transfers							0.0772	0.4232	0.0154	0.0846	0.0212	0.0042

Notes:

[1] Water spray control on underground transfers = 90%.

[2]Transfers: AP-42 (EPA, 1982), Section 11.24-2, "Metallic Mineral Processing."
Annual emissions calculated as: Emission factor (lb/ton) x tons per year material / 2000 lb/ton x [100-control efficiency (%))/100].
moisture content (%).

[3] Underground material transfer.

[4] Annual throughputs provided by Energy Fuels in letter dated October 28, 2013.
Mining activities for maximum year of production assumed to reflect mine decline development per Energy Fuels letter dated October 28, 2013.

[5] Maximum hourly emissions reflect daily emission rate / 20 hours/day work schedule.

Sheep Mountain Mine **Appendix A - Table C7**

Surface Mine Construction

Mining Activity	Maximum Annual Throughput[5]	Maximum 24-Hour Throughput	Maximum Annual Operation	Equipment Quantity	Maximum Daily Schedule per Unit	Maximum Daily Rate	Moisture Content	Silt Content	Wind Speed [2]	Emission Control Efficiency	PM_{10} Emission Factor[1]	Units	$PM_{2.5}$ Emission Factor [4]	Units	Annual PM_{10} Emissions	Max 24-hr PM_{10} Emissions	Annual $PM_{2.5}$ Emissions	Max 24-hr $PM_{2.5}$ Emissions	Max Hourly PM_{10} Emissions[6]	Max Hourly $PM_{2.5}$ Emissions[6]
	(tpy)	(tons/day)	(hrs/year)		(hrs/day)	(hrs/day)	(%)	(%)	(mph)	(%)					(tpy)	(lbs/day)	(tpy)	(lbs/day)	(lb/hr)	(lb/hr)
Dozing	--	--	10,400	2	20	40	5	6.9	--	0	1.4282	lb/hr	0.7499	lb/hr	7.4264	57.1264	3.8996	29.9973	1.4282	0.7499
Overburden Removal [3]	736,000	2,016	--	--	--	--	5	--	--	0	0.0045	lb/ton	9.00E-04	lb/ton	1.6560	9.0720	0.3312	1.8144	0.4536	0.0907
Overburden Unloading [3]	736,000	2,016	--	--	--	--	5	--	12.0	0	0.00097	lb/ton	1.94E-04	lb/ton	0.3566	1.9537	0.0713	0.3907	0.0977	0.0195
Total Surface Activites															9.4391	68.1521	4.3022	32.2024	1.9794	0.8602

Notes:

[1] Emission factor sources:

Dozing, AP-42 11.9-1 "Western Surface Coal Mining". Site material moisture, mean silt content taken from Table 11.9-3.

Emission factor: $[1.0(s)^{1.5}] / (M)^{1.4}$ lb/hr x scaling factor. Where s=material silt content (%), M=material moisture content (%), scaling factors = 0.75 for PM10 and 0.105 for PM2.5.

Annual emissions calculated as: Emission Factor (lb/hr) x hours/year / 2000 lb/ton.

Overburden removal, WDEQ-AQD Memorandum Re: Fugitive Dust Emission Factors, January 24, 1979. OB removal truck/shovel. Applied 0.30 PM10/TSP ratio.

Annual emissions calculated as: Emission factor (lb/ton) x tons per year / 2000 lb/ton

Overburden unloading, AP-42 13.2.4 "Aggregate Handling and Storage Piles". Site-specific material moisture, wind speed Casper average 2002-2006.

Emission factor: $k(0.0032) \times (U/5)^{1.3} / (M/2)^{1.4}$ lb/ton. Where k=particle size multiplier of 0.35 (PM10) or 0.053 (PM2.5), U=mean wind speed (mph), and M=material moisture content (%).

Annual emissions calculated as: Emission factor (lb/ton) x tons per year / 2000 lb/ton

[2] Mean wind speed at Casper, Wyoming, 2002-2006.

[3] Annual cubic yards provided by Energy Fuels in letter dated October 28, 2013.

[4] $PM_{2.5}$ for Product Removal, Overburden Removal, and Overburden Unloading calculated using PM2.5/PM10 ratio of 0.20 from Western Regional Air Partnership guidance for agricultural tilling, from "Proposed Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors", Cowherd et al, Midwest Research Institute, 2006.

[5] Mining activities for maximum year of production assumed to reflect mine development/construction case, per Energy Fuels letter dated October 28, 2013.

[6] Maximum hourly emission rates for all activities but dozing based on maximum daily emission rate / 20 hours/day work schedule.

Construction of SX Building and Plant

Activity	Area	PM_{10} Emission Factor[2]	$PM_{2.5}$ Emission Factor[3]	Annual PM_{10} Emissions	Max 24-Hr PM_{10} Emissions	Annual $PM_{2.5}$ Emissions	Max 24-Hr $PM_{2.5}$ Emissions
	(acres)	(ton/acre/mo)	(ton/acre/mo)	(tpy)	(lb/day)	(tpy)	(lb/day)
Facility Construction[1]	0.8	0.11	0.0165	0.5280	5.8667	0.0792	0.8800

Notes:

[1] Total acres of SX building and central plant.

[2] PM10 emission factor from the WRAP Fugitive Dust Handbook, Section 3.2.1, PM Emissions from Construction (September 7, 2006).

[3] PM2.5 to PM10 ratio of 0.15 used (MRI, 2005) (WRAP, 2005).

[4] Maximum hourly emission rates based on maximum daily emission rate / 20 hours/day work schedule.

Sheep Mountain Mine

Facilities Construction - Cut and Fill Material Movement

Appendix A - Table C9

Mining Activity	Maximum Annual Throughput[5]	Maximum 24-Hour Throughput	Maximum Annual Operation	Maximum 24-Hour Operation	Moisture Content	Silt Content	Wind Speed [2]	Emission Control Efficiency	PM_{10} Emission Factor[1]	Units	$PM_{2.5}$ Emission Factor [4]	Units	Annual PM_{10} Emissions	Max 24-hr PM_{10} Emissions	Annual $PM_{2.5}$ Emissions	Max 24-hr $PM_{2.5}$ Emissions	Max Hourly PM_{10} Emissions[5]	Max Hourly $PM_{2.5}$ Emissions[5]
	(tpy)	(tons/day)	(hrs/year)	(hrs/day)	(%)	(%)	(mph)	(%)					(tpy)	(lb/day)	(tpy)	(lb/day)	(lb/hr)	(lb/hr)
Facilities Material Removal [3]	1,180,000	3,233	--	--	5	--	--	0	0.0045	lb/ton	9.00E-04	lb/ton	2.6550	14.5485	0.5310	2.9097	0.7274	0.1455
Facilities Material Unloading [3]	1,180,000	3,233	--	--	5	--	12.0	0	0.00097	lb/ton	1.94E-04	lb/ton	0.5718	3.1332	0.1144	0.6266	0.1567	0.0313
Total Material Movement Activites													3.2268	17.6817	0.6454	3.5363	0.8841	0.1768

Notes:

[1] Emission factor sources:

Material removal, WDEQ-AQD Memorandum Re: Fugitive Dust Emission Factors, January 24, 1979. OB removal truck/shovel. Applied 0.30 PM10/TSP ratio.

Annual emissions calculated as: Emission factor (lb/ton) x tons per year / 2000 lb/ton

Material unloading, AP-42 13.2.4 "Aggregate Handling and Storage Piles". Site-specific material moisture, wind speed Casper average 2002-2006.

Emission factor: $k(0.0032) \times (U/5)^{1.3} / (M/2)^{1.4}$ lb/ton. Where k=particle size multiplier of 0.35 (PM10) or 0.053 (PM2.5), U=mean wind speed (mph), and M=material moisture content (%).

Annual emissions calculated as: Emission factor (lb/ton) x tons per year / 2000 lb/ton

[2] Mean wind speed at Casper, Wyoming, 2002-2006.

[3] Annual tons per year provided by Energy Fuels in page two of data request response letter dated October 28, 2013.

[4] $PM_{2.5}$ calculated using PM2.5/PM10 ratio of 0.20 from Western Regional Air Partnership guidance for agricultural tilling, from "Proposed Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors", Cowherd et al, Midwest Research Institute, 2006.

[5] Maximum hourly emission rates based on maximum daily emission rate / 20 hours/day work schedule.

Sheep Mountain Mine **Appendix A - Table C10**

Unpaved Roads

Vehicle Type	Average Vehicle Weight[1]	Silt Content[2]	Emission Control[5]	Annual Precip >0.01 in[10]	24-Hour Round Trips	Annual Round Trips	Average Round Trip Distance[11]	Annual Vehicle Miles Traveled	24-Hour Vehicle Miles Traveled	PM_{10} Emission Factor[3]	PM2.5 Emission Factor[3]	Annual PM_{10} Emissions[4]	24-Hour PM_{10} Emissions[4]	Annual $PM_{2.5}$ Emissions[4]	24-Hour $PM_{2.5}$ Emissions[4]	Max Hourly PM_{10} Emissions[12]	Max Hourly $PM_{2.5}$ Emissions[12]
	(tons)	(%)	(%)	(days)	(rt/day)	(rt/yr)	(miles)	(VMT)	(VMT)	(lb/VMT)	(lb/VMT)	(tpy)	(lb/day)	(tpy)	(lb/day)	(lb/hr)	(lb/hr)
Water Truck	17	5.1	50	--	20	3,360	--	14,000	83	0.76	0.076	5.3053	63.1579	0.5305	6.3158	3.1579	0.3158
Support Vehicles [7]	4	5.1	50	56	--	--	--	5,400	500	0.40	0.040	0.9034	197.6076	0.0903	19.7608	9.8804	0.9880
Bulk Delivery Trucks[6]	18	5.1	50	56	2	540	2.1	1,134	4	0.78	0.078	0.3733	3.2661	0.0373	0.3266	0.1633	0.0163
Misc. Delivery Trucks[8]	6	5.1	50	56	2	540	2.1	1,134	4	0.47	0.047	0.2277	1.9922	0.0228	0.1992	0.0996	0.0100
Material Delivery Trucks[9]	15	5.1	50	56	2	302	2.1	634	4	0.72	0.072	0.1923	3.0088	0.0192	0.3009	0.1504	0.0150
Light Vehicles	3	5.1	50	56	90	18,706	2.1	39,283	500	0.35	0.035	5.7736	173.6126	0.5774	17.3613	8.6806	0.8681
											Totals	12.7755	442.6452	1.2775	44.2645	22.1323	2.2132

Notes:

[1] Vehicle weights based on data provided by Proponent.

[2] AP-42, Table 13.2.2-1, western surface coal mine haul roads.

[3] AP-42 (EPA, 2003), Section 13.2.2, "Unpaved Roads." (Ore and water trucks)

[4] Calculated as Emissions in (lb/VMT) x Vehicle Miles Traveled (VMT).

[5] Dust control provided by frequent water application, control efficiency from MRI 2001. Technical Memorandum from G. Muleski, Midwest Research Institute, Kansas City, MO, to B. Kuykendal, U. S. EPA, Research Triangle Park, NC, Subject "Unpaved Roads," September 27, 2001.

[6] Bulk reagent delivery, weight based on Wyoming maximum GVW for tandem-axle highway trucks.

[7] Support vehicle mileage for 10 vehicles based on 2 mi/day each vehicle, 30 days/month, 9 month construction schedule.

[8] Includes UPS 3/week, mine parts 5/week, tire truck 1/week, service 1/week, total of 10/week or 2/day, 5 days/week.

[9] Material delivery based on construction materials delivered from Table 3.5.2 of August 2013 POO.

[10] Average annual days with precipitation greater than 0.01" observed at Jeffrey City, Wyoming from 1964-2005. Precipitation factor applied to all vehicles except water trucks.

[11] Round-trip distance off-site is based on the distance from south edge of ore stockpile to the point at which the road exits BLM lands.

[12] Maximum hourly emission rates based on maximum daily emission rate / 20 hours/day work schedule.

Sheep Mountain Mine
Wind Erosion of Open Acres

Appendix A - Table C11

Activity	Area	PM_{10} Emission Factor[2]	$PM_{2.5}$ Emission Factor[3]	Annual PM_{10} Emissions	Max 24-Hr PM_{10} Emissions	Annual $PM_{2.5}$ Emissions	Max 24-Hr $PM_{2.5}$ Emissions
	(acres)	(ton/acre/yr)	(ton/acre/yr)	(tpy)	(lb/day)	(tpy)	(lb/day)
Open Acres[1]	87	0.114	0.0171	9.9	54.3	1.4877	8.1518

Notes:

[1] Total non-stockpile open acres subject to wind erosion over life of pit provided by Energy Fuels in page two of October 28, 2013 data request letter.

[2] Emission factor from AP-42 Western Surface Coal Mining, Table 11.9-4 of 0.38 x PM10/TSP ratio of 0.30.

[3] PM2.5 to PM10 ratio of 0.15 used for wind-blown fugitive dust (MRI, 2006).
MRI, 2006. Background document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors, Midwest Research Institute for Western Regional Air Partnership, November 1, 2006.

Sheep Mountain Mine
Wind Erosion of Stockpiles

Appendix A - Table C12

Stockpile	Area [4]	Emission Factor[1]	Annual PM_{10} Emissions[2]	24-Hr PM_{10} Emissions[2]	Annual $PM_{2.5}$ Emissions[3]	24-Hr $PM_{2.5}$ Emissions[3]
	(m^2)	($lb/yr/m^2$)	(tpy)	(lb/day)	(tpy)	(lb/day)
Stockpiles [1]	60,705	0.092067	2.7945	15.3121	0.4192	2.2968
			2.7945	15.3121	0.4192	2.2968

Notes:

[1] Emission factor derived from unit emission rate calculated using AP-42 Section 13.2.5, Industrial Wind Erosion, combined with 2011-12 hourly on-site surface wind speed data.

[2] Emissions calculated using methodology from AP-42 Section 13.2.5, Industrial Wind Erosion, combined with 2011-12 hourly on-site surface wind speed data.
Emission factor (lb/yr/m2) x area (m2) / 2000 lb/ton = tons per year.

[3] $PM_{2.5}$ calculated based on PM2.5/PM10 ratio of 0.15 for fugitive dust (MRI, 2006).
MRI, 2006. Background document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors, Midwest Research Institute for Western Regional Air Partnership, November 1, 2006.

[4] Stockpile areas from Energy Fuels response to Sheep Mountain AQ Data Request dated 10-23-13.

Sheep Mountain Mine
Mobile and Nonroad Source Diesel Combustion Emissions

Appendix A - Table C13

Source	Typical Engine Model	Engine Horsepower (hp)	Number of Units	Fuel Consumption[3] (gal/yr)	NO_x Emission Factor (g/hp-hr)	CO Emission Factor (g/hp-hr)	PM Emission Factor (g/hp-hr)	SO_2 Emission Factor (g/hp-hr)	VOC Emission Factor (g/hp-hr)	CH_2O Emission Factor[4] (g/hp-hr)	Emission Factor Basis[5]	Equipment Availability and Utilization[1]	Load Factor[2]	Daily Operating Rate per Unit[6] (hr/day)	Max Hourly Operating Hours (hours)	Daily Operating Hours[6] (hr/day)	Annual Operating Hours[6] (hr/yr)
OPEN PIT MININING																	
MAJOR EQUIPMENT																	
330 LX Linkbelt Excavator		268	2	40,000	4.50	2.6	0.015	--	0.40	0.12	Tier 2	0.81	0.21	20	2	40	14560
16M CAT Motor Grader		297	1	22,500	4.50	2.6	0.015	--	0.40	0.12	Tier 2	0.81	0.59	20	1	20	7280
140 CAT Motor Grader		150	1	15,000	4.50	3.7	0.015	--	0.40	0.12	Tier 2	0.81	0.59	20	1	20	7280
D-8 CAT track Dozer		347	1	46,250	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	1	20	7280
D-9 CAT Track Dozer		460	1	61,250	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	1	20	7280
A30D Volvo Atriculated Truck	*Assume CAT D30D	435	2	76,000	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	2	40	14560
980 CAT Wheel Loader		393	1	23,750	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	1	20	7280
637 CAT Twin Engine Scraper		783	3	245,000	4.50	2.6	0.075	--	0.30	0.12	Tier 2	0.81	0.59	20	3	60	21840
623 CAT Self Loading Scraper		330	1	28,750	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	1	20	7280
Water truck 3000 gallons	*Assume half CAT 613	200	1	8,125	4.50	2.6	0.015	--	0.40	0.12	Tier 2	0.81	0.59	20	1	20	7280
Water Truck 8000 gallons	*Assume CAT 613	500	1	16,250	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	1	20	7280
MINE SUPPORT VEHICLES																	
Fuel/lube truck	Assume 3/4 ton diesel	400	1	37.5	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	1	20	7280
Mechanical Service Truck	Assume 3/4 ton diesel	400	1	37.5	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	1	20	7280
Rubber tire backhoe CAT 414e w/forklift attachme	*Assume 416c	62	1	20,750	5.20	3.7	0.015	--	0.40	0.12	Tier 2	0.81	0.21	20	1	20	7280
Pickup Trucks 4WD, 3/4-ton	*Assume 400 miles per 6 hrs. as per multiple 350 engines	315	8	300	0.0167	0.0567	0.015	--	0.004	negl.	MOBILE6	0.81	1.0	20	8	160	58240
				604,000													
CONSTRUCTION VEHICLES																	
D-6R CAT LGP track dozer		185	2	30,000	4.50	3.7	0.015	--	0.40	0.12	Tier 2	0.81	0.59	20	2	40	14560
D-7R CAT track dozer		230	1	20,000	4.50	2.6	0.015	--	0.40	0.12	Tier 2	0.81	0.59	20	1	20	7280
420E CAT backhoe loader		93	1	10,000	4.50	3.7	0.015	--	0.40	0.12	Tier 2	0.81	0.59	20	1	20	7280
637G CAT tractor-scraper		783	3	245,000	4.50	2.6	0.075	--	0.30	0.12	Tier 2	0.81	0.59	20	3	60	21840
730 CAT articulated truck		325	3	28,750	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	3	60	21840
CS-563E CAT smooth drum compactor		144	2	30,000	4.50	3.7	0.015	--	0.40	0.12	Tier 2	0.81	0.59	20	2	40	14560
Mobile construction crane		300	1	25,000	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	1	20	7280
				388,750													
UNDERGROUND MINING																	
MAJOR EQUIPMENT																	
Model Boomer SL1 Face Drill	*Assume CAT D4B, similar power/weight/engine	150	3	26,250	4.50	3.7	0.22	--	0.40	0.12	Tier 2/MSHA	0.81	0.40	20	3	60	15600
104 Face Drill	*Assume CAT D3, similar power/weight/engine	150	1	7,500	4.50	3.7	0.22	--	0.40	0.12	Tier 2/MSHA	0.81	0.40	20	1	20	5200
Model Boomer S10-DH Face Drill	*Assume CAT D4B, similar power/weight/engine	150	1	8,750	4.50	3.7	0.22	--	0.40	0.12	Tier 2/MSHA	0.81	0.40	20	1	20	5200
Model Boltec SL Bolter	*Assume CAT D4B, similar power/weight/engine	74	7	43,750	5.20	3.7	0.3	--	0.40	0.12	Tier 2/MSHA	0.81	0.21	20	7	140	36400
Model Boltec 235 Bolter	*Assume CAT D4B, similar power/weight/engine	74	2	17,500	5.20	3.7	0.3	--	0.40	0.12	Tier 2/MSHA	0.81	0.21	20	2	40	10400
Model ST7LP Scooptram	*Assume CAT AD45, Fluid specs not in handbook 38	210	4	105,000	6.90	8.5	0.4	--	1.00	0.12	Tier 1/MSHA	0.81	0.21	20	4	80	20800
Model ST7 Scooptram	*Assume CAT R1300G, Fluid specs not in handbook 38	210	2	25,000	6.90	8.5	0.4	--	1.00	0.12	Tier 1/MSHA	0.81	0.21	20	2	40	10400
MINE SUPPORT VEHICLES																	
Power Buggies	*Assume Whiteman Series WBH16AEWD 18 hp Gas Engine.	50	2	4,100	5.20	3.7	0.3	--	0.40	0.12	Tier 2/MSHA	0.81	0.21	20	2	40	10400
Bobcat Skidsteer	*Assume CAT D3B	50	2	15,000	5.20	3.7	0.3	--	0.40	0.12	Tier 2/MSHA	0.81	0.21	20	2	40	10400
Utility Truck-flatbed		50	1	37.5	5.20	3.7	0.3	--	0.40	0.12	Tier 2/MSHA	0.81	0.59	20	1	20	5200
Scissor Truck	Assume same as the Bolter	50	8	8,750	5.20	3.7	0.3	--	0.40	0.12	Tier 2/MSHA	0.81	0.21	20	8	160	41600
Man trips	Assume same as Powerbuggy	74	6	24,600	5.20	3.7	0.3	--	0.40	0.12	Tier 2/MSHA	0.81	0.21	20	6	120	31200
Pickup trucks, 4 WD, 3/4-ton	Assume same specs as the Conventional Mine	315	8	187.5	0.0167	0.0567	0.015	--	0.004	negl.	Mobile 6	0.81	1.0	20	8	160	41600
Fuel/lube truck		400	1	37.5	6.90	8.5	0.4	--	1.00	0.12	Tier 1/MSHA	0.81	0.59	20	1	20	5200
Forklift		400	1	37.5	6.90	8.5	0.4	--	1.00	0.12	Tier 1/MSHA	0.81	0.59	20	1	20	5200
Mechanical Service Truck		400	1	75.0	6.90	8.5	0.4	--	1.00	0.12	Tier 1/MSHA	0.81	0.21	20	1	20	5200
				286,575													

Source	NOx Maximum Hourly Emissions (lb/hr)	NOx Maximum 24-Hr Emissions (lb/day)	NOx Annual Average Emissions (tpy)	CO Maximum Hourly Emissions (lb/hr)	CO Maximum 24-Hr Emissions (lb/day)	CO Annual Average Emissions (tpy)	PM Maximum Hourly Emissions (lb/hr)	PM Maximum 24-Hr Emissions (lb/day)	PM Annual Average Emissions (tpy)	SO2 Maximum Hourly Emissions (lb/hr)	SO2 Maximum 24-Hr Emissions (lb/day)	SO2 Annual Average Emissions (tpy)	VOC Maximum Hourly Emissions (lb/hr)	VOC Maximum 24-Hr Emissions (lb/day)	VOC Annual Average Emissions (tpy)	CH_2O Maximum Hourly Emissions (lb/hr)	CH_2O Maximum 24-Hr Emissions (lb/day)	CH_2O Annual Average Emissions (tpy)
OPEN PIT MININING																		
MAJOR EQUIPMENT																		
330 LX Linkbelt Excavator	1.1167	18.0900	3.2924	0.6452	10.4520	1.9023	0.0037	0.0603	0.0110	0.0006	0.0233	0.0043	0.0993	1.6080	0.2927	0.0298	0.4824	0.0878
16M CAT Motor Grader	1.7384	28.1620	5.1255	1.0044	16.2714	2.9614	0.0058	0.0939	0.0171	0.0007	0.0131	0.0024	0.1545	2.5033	0.4556	0.0464	0.7510	0.1367
140 CAT Motor Grader	0.8780	14.2232	2.5886	0.7219	11.6946	2.1284	0.0029	0.0474	0.0086	0.0004	0.0088	0.0016	0.0780	1.2643	0.2301	0.0234	0.3793	0.0690
D-8 CAT track Dozer	2.0311	32.9030	5.9884	1.1735	19.0106	3.4599	0.0068	0.1097	0.0200	0.0014	0.0270	0.0049	0.1354	2.1935	0.3992	0.0542	0.8774	0.1597
D-9 CAT Track Dozer	2.6925	43.6179	7.9385	1.5556	25.2014	4.5867	0.0090	0.1454	0.0265	0.0018	0.0357	0.0065	0.1795	2.9079	0.5292	0.0718	1.1631	0.2117
A30D Volvo Atriculated Truck	5.0923	82.4946	15.0140	2.9422	47.6636	8.6748	0.0170	0.2750	0.0500	0.0011	0.0444	0.0081	0.3395	5.4996	1.0009	0.1358	2.1999	0.4004
980 CAT Wheel Loader	2.3003	37.2648	6.7822	1.3291	21.5308	3.9186	0.0077	0.1242	0.0226	0.0007	0.0139	0.0025	0.1534	2.4843	0.4521	0.0613	0.9937	0.1809
637 CAT Twin Engine Scraper	13.7491	222.7355	40.5379	7.9439	128.6916	23.4219	0.2292	3.7123	0.6756	0.0024	0.1430	0.0261	0.9166	14.8490	2.7025	0.3666	5.9396	1.0810
623 CAT Self Loading Scraper	1.9315	31.2911	5.6950	1.1160	18.0793	3.2904	0.0064	0.1043	0.0190	0.0008	0.0168	0.0031	0.1288	2.0861	0.3797	0.0515	0.8344	0.1519
Water truck 3000 gallons	1.1706	18.9643	3.4515	0.6764	10.9571	1.9942	0.0039	0.0632	0.0115	0.0002	0.0047	0.0009	0.1041	1.6857	0.3068	0.0312	0.5057	0.0920
Water Truck 8000 gallons	2.9266	47.4107	8.6288	1.6909	27.3929	4.9855	0.0098	0.1580	0.0288	0.0005	0.0095	0.0017	0.1951	3.1607	0.5753	0.0780	1.2643	0.2301
MINE SUPPORT VEHICLES																		
Fuel/lube truck	2.3413	37.9286	6.9030	1.3527	21.9143	3.9884	0.0078	0.1264	0.0230	0.0000	0.0000	0.0000	0.1561	2.5286	0.4602	0.0624	1.0114	0.1841
Mechanical Service Truck	2.3413	37.9286	6.9030	1.3527	21.9143	3.9884	0.0078	0.1264	0.0230	0.0000	0.0000	0.0000	0.1561	2.5286	0.4602	0.0624	1.0114	0.1841
Rubber tire backhoe CAT 414e w/forklift attachme	0.1493	2.4180	0.4401	0.1062	1.7205	0.3131	0.0004	0.0070	0.0013	0.0006	0.0121	0.0022	0.0115	0.1860	0.0339	0.0034	0.0558	0.0102
Pickup Trucks 4WD, 3/4-ton	0.0928	1.5030	0.2735	0.3150	5.1030	0.9287	0.0833	1.3500	0.2457	0.0000	0.0002	0.0000	0.0222	0.3600	0.0655	negl.	negl.	negl.
CONSTRUCTION VEHICLES																		
D-6R CAT LGP track dozer	2.1657	35.0839	6.3853	1.7807	28.8468	5.2501	0.0072	0.1169	0.0213	0.0004	0.0175	0.0032	0.1925	3.1186	0.5676	0.0578	0.9356	0.1703
D-7R CAT track dozer	1.3462	21.8089	3.9692	0.7778	12.6007	2.2933	0.0045	0.0727	0.0132	0.0006	0.0117	0.0021	0.1197	1.9386	0.3528	0.0359	0.5816	0.1058
420E CAT backhoe loader	0.5443	8.8184	1.6049	0.4476	7.2507	1.3196	0.0018	0.0294	0.0053	0.0003	0.0058	0.0011	0.0484	0.7839	0.1427	0.0145	0.2352	0.0428
637G CAT tractor-scraper	13.7491	222.7355	40.5379	7.9439	128.6916	23.4219	0.2292	3.7123	0.6756	0.0024	0.1430	0.0261	0.9166	14.8490	2.7025	0.3666	5.9396	1.0810
730 CAT articulated truck	5.7068	92.4509	16.8261	3.2973	53.4161	9.7217	0.0190	0.3082	0.0561	0.0003	0.0168	0.0031	0.3805	6.1634	1.1217	0.1522	2.4654	0.4487
CS-563E CAT smooth drum compactor	1.6857	27.3086	4.9702	1.3860	22.4537	4.0866	0.0056	0.0910	0.0166	0.0004	0.0175	0.0032	0.1498	2.4274	0.4418	0.0450	0.7282	0.1325
Mobile construction crane	1.7560	28.4464	5.1773	1.0146	16.4357	2.9913	0.0059	0.0948	0.0173	0.0007	0.0146	0.0027	0.1171	1.8964	0.3452	0.0468	0.7586	0.1381
UNDERGROUND MINING																		
MAJOR EQUIPMENT																		
Model Boomer SL1 Face Drill	1.7857	28.9286	3.7607	1.4683	23.7857	3.0921	0.0873	1.4143	0.1839	0.0004	0.0153	0.0028	0.1587	2.5714	0.3343	0.0476	0.7714	0.1003
104 Face Drill	0.5952	9.6429	1.2536	0.4894	7.9286	1.0307	0.0291	0.4714	0.0613	0.0003	0.0044	0.0008	0.0529	0.8571	0.1114	0.0159	0.2571	0.0334
Model Boomer S10-DH Face Drill	0.5952	9.6429	1.2536	0.4894	7.9286	1.0307	0.0291	0.4714	0.0613	0.0004	0.0051	0.0009	0.0529	0.8571	0.1114	0.0159	0.2571	0.0334
Model Boltec SL Bolter	1.2470	20.2020	2.6263	0.8873	14.3745	1.8687	0.0719	1.1655	0.1515	0.0003	0.0255	0.0047	0.0959	1.5540	0.2020	0.0288	0.4662	0.0606
Model Boltec 235 Bolter	0.3563	5.7720	0.7504	0.2535	4.1070	0.5339	0.0206	0.3330	0.0433	0.0004	0.0102	0.0019	0.0274	0.4440	0.0577	0.0082	0.1332	0.0173
Model ST7LP Scooptram	2.6833	43.4700	5.6511	3.3056	53.5500	6.9615	0.1556	2.5200	0.3276	0.0011	0.0613	0.0112	0.3889	6.3000	0.8190	0.0467	0.7560	0.0983
Model ST7 Scooptram	1.3417	21.7350	2.8256	1.6528	26.7750	3.4808	0.0778	1.2600	0.1638	0.0005	0.0146	0.0027	0.1944	3.1500	0.4095	0.0233	0.3780	0.0491
MINE SUPPORT VEHICLES																		
Power Buggies	0.2407	3.9000	0.5070	0.1713	2.7750	0.3608	0.0139	0.2250	0.0293	0.0001	0.0024	0.0004	0.0185	0.3000	0.0390	0.0056	0.0900	0.0117
Bobcat Skidsteer	0.2407	3.9000	0.5070	0.1713	2.7750	0.3608	0.0139	0.2250	0.0293	0.0003	0.0088	0.0016	0.0185	0.3000	0.0390	0.0056	0.0900	0.0117
Utility Truck-flatbed	0.3382	5.4786	0.7122	0.2406	3.8982	0.5068	0.0195	0.3161	0.0411	0.0000	0.0000	0.0000	0.0260	0.4214	0.0548	0.0078	0.1264	0.0164
Scissor Truck	0.9630	15.6000	2.0280	0.6852	11.1000	1.4430	0.0556	0.9000	0.1170	0.0000	0.0051	0.0009	0.0741	1.2000	0.1560	0.0222	0.3600	0.0468
Man trips	1.0689	17.3160	2.2511	0.7606	12.3210	1.6017	0.0617	0.9990	0.1299	0.0002	0.0144	0.0026	0.0822	1.3320	0.1732	0.0247	0.3996	0.0519
Pickup trucks, 4 WD, 3/4-ton	0.0928	1.5030	0.1954	0.3150	5.1030	0.6634	0.0833	1.3500	0.1755	0.0000	0.0001	0.0000	0.0222	0.3600	0.0468	negl.	negl.	negl.
Fuel/lube truck	3.5899	58.1571	7.5604	4.4224	71.6429	9.3136	0.2081	3.3714	0.4383	0.0000	0.0000	0.0000	0.5203	8.4286	1.0957	0.0624	1.0114	0.1315
Forklift	3.5899	58.1571	7.5604	4.4224	71.6429	9.3136	0.2081	3.3714	0.4383	0.0000	0.0000	0.0000	0.5203	8.4286	1.0957	0.0624	1.0114	0.1315
Mechanical Service Truck	1.2778	20.7000	2.6910	1.5741	25.5000	3.3150	0.0741	1.2000	0.1560	0.0000	0.0000	0.0000	0.1852	3.0000	0.3900	0.0222	0.3600	0.0468
Total Surface	67.5054	1093.5880	199.0330	40.5736	657.2928	119.6273	0.6746	10.9288	1.9890	0.0163	0.5793	0.1057	4.7545	77.0229	14.0182	1.7971	29.1136	5.2987
Total Underground	20.0065	324.1051	42.1337	21.3091	345.2073	44.8769	1.2095	19.5936	2.5472	0.0038	0.1672	0.0305	2.4385	39.5043	5.1356	0.3993	6.4680	0.8408
Total Mine	87.5119	1417.6931	241.1667	61.8827	1002.5000	164.5042	1.8841	30.5224	4.5362	0.0202	0.7466	0.1362	7.1930	116.5272	19.1537	2.1964	35.5816	6.1395

Notes:
[1] 90% availability, 90% utilization.
Availability means: availability of unit due to maintenance or other mechanical downtime. This is typically 85% for underground operations, 90% was used for this analysis.
Use of availability (utilization) means: percent of available unit operation time due non-mechanical reasons such as employee lunch and break time. 90% was conservatively used in this analysis.
Total availability = 90% availability x 90% utilization = 0.81
[2] Engine load factors from EPA/420-P-02-014. Load factors indicate the average proportion of rated power used. Rated power is the maximum power level that an engine is designed to produce at its rated speed.
[3] Equipment details, quantity, horsepower, and fuel consumption for all except construction vehicles from Proponent, "2011 POO Equipment Consumption.xls". Construction equipment fuel consumption estimated.
[4] Formaldehyde emission factor from AP-42 Volume II.
[5] Undergound equipment emissions maximum allowable under MSHA, codified in 30 CFR Section 57.5067.
[6] Operating rates and annual hours based on surface mine operating schedule of two, 10-hour daily shifts, seven days per week, and underground mine operating schedule of two, 10-hour daily shifts, five days per week.

Sheep Mountain Mine

Mobile and Nonroad Source Diesel Combustion HAP Emissions

Appendix A - Table C14

Source	Typical Engine Model	Engine Horsepower	Number of Units	Fuel Consumption[3]	VOC Emission Factor	Benzene in VOC by Weight[6]	Toluene in VOC by Weight[6]	Ethylbenzene in VOC by Weight[6]	n-hexane in VOC by Weight[6]	CH_2O Emission Factor[4]	Emission Factor Basis[5]	Equipment Availability and Utilization [1]	Load Factor[2]	Daily Operating Rate per Unit[6]	Daily Operating Hours[7]	Annual Operating Hours[7]	VOC Maximum 24-Hr Emissions	VOC Annual Average Emissions	Benzene Maximum 24-Hr Emissions	Benzene Annual Average Emissions	Toluene Maximum 24-Hr Emissions	Toluene Annual Average Emissions	Ethylbenzene Maximum 24-Hr Emissions	Ethylbenzene Annual Average Emissions	n-Hexane Maximum 24-Hr Emissions	n-Hexane Annual Average Emissions	CH_2O Maximum 24-Hr Emissions	CH_2O Annual Average Emissions
		(hp)		(gal/yr)	(g/hp-hr)	(%)	(%)	(%)	(%)	(g/hp-hr)				(hr/day)	(hr/day)	(hr/yr)	(lb/day)	(tpy)	(lb/day)	(tpy)	(lb/day)	(tpy)	(lb/day)	(tpy)	(lb/day)	(tpy)	(lb/day)	(tpy)
OPEN PIT MININING																												
MAJOR EQUIPMENT																												
330 LX Linkbelt Excavator		268	2	40,000	0.40	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.21	20	40	14560	1.6080	0.2927	0.0515	0.0094	0.0236	0.0043	0.0059	0.0011	0.0123	0.0022	0.4824	0.0878
16M CAT Motor Grader		297	1	22,500	0.40	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	20	7280	2.5033	0.4556	0.0802	0.0146	0.0368	0.0067	0.0092	0.0017	0.0192	0.0035	0.7510	0.1367
140 CAT Motor Grader		150	1	15,000	0.40	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	20	7280	1.2643	0.2301	0.0405	0.0074	0.0186	0.0034	0.0047	0.0008	0.0097	0.0018	0.3793	0.0690
D-8 CAT track Dozer		347	1	46,250	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	20	7280	2.1935	0.3992	0.0703	0.0128	0.0322	0.0059	0.0081	0.0015	0.0168	0.0031	0.8774	0.1597
D-9 CAT Track Dozer		460	1	61,250	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	20	7280	2.9079	0.5292	0.0932	0.0170	0.0427	0.0078	0.0107	0.0019	0.0223	0.0041	1.1631	0.2117
A30D Volvo Atriculated Truck	*Assume CAT D30D	435	2	76,000	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	40	14560	5.4996	1.0009	0.1762	0.0321	0.0808	0.0147	0.0202	0.0037	0.0422	0.0077	2.1999	0.4004
980 CAT Wheel Loader		393	1	23,750	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	20	7280	2.4843	0.4521	0.0796	0.0145	0.0365	0.0066	0.0091	0.0017	0.0190	0.0035	0.9937	0.1809
637 CAT Twin Engine Scraper		783	3	245,000	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	60	21840	14.8490	2.7025	0.4757	0.0866	0.2183	0.0397	0.0546	0.0099	0.1138	0.0207	5.9396	1.0810
623 CAT Self Loading Scraper		330	1	28,750	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	20	7280	2.0861	0.3797	0.0668	0.0122	0.0307	0.0056	0.0077	0.0014	0.0160	0.0029	0.8344	0.1519
Water truck 3000 gallons	*Assume half CAT 613	200	1	8,125	0.40	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	20	7280	1.6857	0.3068	0.0540	0.0098	0.0248	0.0045	0.0062	0.0011	0.0129	0.0024	0.5057	0.0920
Water Truck 8000 gallons	*Assume CAT 613	500	1	16,250	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	20	7280	3.1607	0.5753	0.1013	0.0184	0.0465	0.0085	0.0116	0.0021	0.0242	0.0044	1.2643	0.2301
MINE SUPPORT VEHICLES																												
Fuel/lube truck	Assume 3/4 ton diesel	400	1	37.5	0.30	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2	0.81	0.59	20	20	7280	2.5286	0.4602	0.0264	0.0048	0.0384	0.0070	0.0045	0.0008	0.0000	0.0000	1.0114	0.1841
Mechanical Service Truck	Assume 3/4 ton diesel	400	1	37.5	0.30	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2	0.81	0.59	20	20	7280	2.5286	0.4602	0.0264	0.0048	0.0384	0.0070	0.0045	0.0008	0.0000	0.0000	1.0114	0.1841
Rubber tire backhoe CAT 414e w/forklift attachme	*Assume 416c	62	1	20,750	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2	0.81	0.21	20	20	7280	0.1860	0.0339	0.0019	0.0004	0.0028	0.0005	0.0003	0.0001	0.0000	0.0000	0.0558	0.0102
Pickup Trucks 4WD, 3/4-ton	*Assume 400 miles per 6 hrs, as per multiple 350 engines	315	8	300	0.004	1.0450	1.5179	0.1793	0.0000	negl.	MOBILE6	0.81	1.0	20	160	58240	0.3600	0.0655	0.0038	0.0007	0.0055	0.0010	0.0006	0.0001	0.0000	0.0000	negl.	negl.
				604,000																								
CONSTRUCTION VEHICLES																												
D-6R CAT LGP track dozer		185	2	30,000	0.40	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	40	14560	3.1186	0.5676	0.0999	0.0182	0.0458	0.0083	0.0115	0.0021	0.0239	0.0044	0.9356	0.1703
D-7R CAT track dozer		230	1	20,000	0.40	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	20	7280	1.9386	0.3528	0.0621	0.0113	0.0285	0.0052	0.0071	0.0013	0.0149	0.0027	0.5816	0.1058
420E CAT backhoe loader		93	1	10,000	0.40	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	20	7280	0.7839	0.1427	0.0251	0.0046	0.0115	0.0021	0.0029	0.0005	0.0060	0.0011	0.2352	0.0428
637G CAT tractor-scraper		783	3	245,000	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	60	21840	14.8490	2.7025	0.4757	0.0866	0.2183	0.0397	0.0546	0.0099	0.1138	0.0207	5.9396	1.0810
730 CAT articulated truck		325	3	28,750	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	60	21840	6.1634	1.1217	0.1974	0.0359	0.0906	0.0165	0.0227	0.0041	0.0472	0.0086	2.4654	0.4487
CS-563E CAT smooth drum compactor		144	2	30,000	0.40	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	40	14560	2.4274	0.4418	0.0778	0.0142	0.0357	0.0065	0.0089	0.0016	0.0186	0.0034	0.7282	0.1325
Mobile construction crane		300	1	25,000	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	20	7280	1.8964	0.3452	0.0608	0.0111	0.0279	0.0051	0.0070	0.0013	0.0145	0.0026	0.7586	0.1381
				388,750																								
UNDERGROUND MINING																												
MAJOR EQUIPMENT																												
Model Boomer SL1 Face Drill	*Assume CAT D4B, similar power/weight/engine	150	3	26,250	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.40	20	60	15600	2.5714	0.3343	0.0269	0.0035	0.0390	0.0051	0.0046	0.0006	0.0000	0.0000	0.7714	0.1003
104 Face Drill	*Assume CAT D3, similar power/weight/engine	150	1	7,500	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.40	20	20	5200	0.8571	0.1114	0.0090	0.0012	0.0130	0.0017	0.0015	0.0002	0.0000	0.0000	0.2571	0.0334
Model Boomer S10-DH Face Drill	*Assume CAT D4B, similar power/weight/engine	150	1	8,750	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.40	20	20	5200	0.8571	0.1114	0.0090	0.0012	0.0130	0.0017	0.0015	0.0002	0.0000	0.0000	0.2571	0.0334
Model Boltec SL Bolter	*Assume CAT D4B, similar power/weight/engine	74	7	43,750	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.21	20	140	36400	1.5540	0.2020	0.0162	0.0021	0.0236	0.0031	0.0028	0.0004	0.0000	0.0000	0.4662	0.0606
Model Boltec 235 Bolter	*Assume CAT D4B, similar power/weight/engine	74	2	17,500	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.21	20	40	10400	0.4440	0.0577	0.0046	0.0006	0.0067	0.0009	0.0008	0.0001	0.0000	0.0000	0.1332	0.0173
Model ST7LP Scooptram	*Assume CAT AD45, Fluid specs not in handbook 38	210	4	105,000	1.00	1.0450	1.5179	0.1793	0.0000	0.12	Tier 1/MSHA	0.81	0.21	20	80	20800	6.3000	0.8190	0.0658	0.0086	0.0956	0.0124	0.0113	0.0015	0.0000	0.0000	0.7560	0.0983
Model ST7 Scooptram	*Assume CAT R1300G, Fluid specs not in handbook 38	210	2	25,000	1.00	1.0450	1.5179	0.1793	0.0000	0.12	Tier 1/MSHA	0.81	0.21	20	40	10400	3.1500	0.4095	0.0329	0.0043	0.0478	0.0062	0.0056	0.0007	0.0000	0.0000	0.3780	0.0491
MINE SUPPORT VEHICLES																												
Power Buggies	*Assume Whiteman Series WBH16AEWD 18 hp Gas Engine.	50	2	4,100	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.21	20	40	10400	0.3000	0.0390	0.0031	0.0004	0.0046	0.0006	0.0005	0.0001	0.0000	0.0000	0.0900	0.0117
Bobcat Skidsteer	*Assume CAT D3B	50	2	15,000	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.21	20	40	10400	0.3000	0.0390	0.0031	0.0004	0.0046	0.0006	0.0005	0.0001	0.0000	0.0000	0.0900	0.0117
Utility Truck-flatbed		50	1	37.5	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.59	20	20	5200	0.4214	0.0548	0.0044	0.0006	0.0064	0.0008	0.0008	0.0001	0.0000	0.0000	0.1264	0.0164
Scissor Truck	Assume same as the Bolter	50	8	8,750	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.21	20	160	41600	1.2000	0.1560	0.0125	0.0016	0.0182	0.0024	0.0022	0.0003	0.0000	0.0000	0.3600	0.0468
Man trips	Assume same as Powerbuggy	74	6	24,600	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.21	20	120	31200	1.3320	0.1732	0.0139	0.0018	0.0202	0.0026	0.0024	0.0003	0.0000	0.0000	0.3996	0.0519
Pickup trucks, 4 WD, 3/4-ton	Assume same specs as the Conventional Mine	315	8	187.5	0.004	1.0450	1.5179	0.1793	0.0000	negl.	Mobile 6	0.81	1.0	20	160	41600	0.3600	0.0468	0.0038	0.0005	0.0055	0.0007	0.0006	0.0001	0.0000	0.0000	negl.	negl.
Fuel/lube truck		400	1	37.5	1.00	1.0450	1.5179	0.1793	0.0000	0.12	Tier 1/MSHA	0.81	0.59	20	20	5200	8.4286	1.0957	0.0881	0.0115	0.1279	0.0166	0.0151	0.0020	0.0000	0.0000	1.0114	0.1315
Forklift		400	1	37.5	1.00	1.0450	1.5179	0.1793	0.0000	0.12	Tier 1/MSHA	0.81	0.59	20	20	5200	8.4286	1.0957	0.0881	0.0115	0.1279	0.0166	0.0151	0.0020	0.0000	0.0000	1.0114	0.1315
Mechanical Service Truck		400	1	75.0	1.00	1.0450	1.5179	0.1793	0.0000	0.12	Tier 1/MSHA	0.81	0.21	20	20	5200	3.0000	0.3900	0.0314	0.0041	0.0455	0.0059	0.0054	0.0007	0.0000	0.0000	0.3600	0.0468
				286,575																								
																Total Surface	77.0229	14.0182	2.3464	0.4270	1.1349	0.2066	0.2727	0.0496	0.5475	0.0996	29.1136	5.2987
																Total Underground	39.5043	5.1356	0.4128	0.0537	0.5996	0.0780	0.0708	0.0092	0.0000	0.0000	6.4680	0.8408
																Total Mine	116.5272	19.1537	2.7592	0.4807	1.7346	0.2845	0.3436	0.0588	0.5475	0.0996	35.5816	6.1395

Notes:

[1] 90% availability, 90% utilization.
Availability means: availability of unit due to maintenance or other mechanical downtime. This is typically 85% for underground operations, 90% was used for this analysis.
Use of availability (utilization) means: percent of available unit operation time due non-mechanical reasons such as employee lunch and break time. 90% was conservatively used in this analysis.
Total availability = 90% availability x 90% utilization = 0.81

[2] Engine load factors from EPA/420-P-02-014. Load factors indicate the average proportion of rated power used. Rated power is the maximum power level that an engine is designed to produce at its rated speed.

[3] Equipment details, quantity, horsepower, and fuel consumption for all except construction vehicles from Proponent, "2011 POO Equipment Consumption.xls". Construction equipment fuel consumption estimated.

[4] Formaldehyde emission factor from AP-42 Volume II.

[5] Undergound equipment emissions maximum allowable under MSHA, codified in 30 CFR Section 57.5067.

[6] HAP % by weight in total VOC emissions from U.S. EPA SPECIATE database. Large diesel equipment % from "Diesel exhaust emissions from Pre-2007 Model Year Heavy-duty Diesel Trucks" (Number 8774).
Mine support vehicles % from "Diesel Exhaust - Medium Duty Trucks (Number 4674).

[7] Operating rates and annual hours based on surface mine operating schedule of two, 10-hour daily shifts, seven days per week, and underground mine operating schedule of two, 10-hour daily shifts, five days per week.

Sheep Mountain Mine
Diesel Combustion GHG Emissions

Appendix A - Table C15

Emissions Source	Fuel	Fuel Rate	Fuel HHV	Part 98 CO_2 Emission Factor	Part 98 CH_4 Emission Factor	Part 98 N_2O Emission Factor	CO_2 Emissions (kg/yr)	CH_4 Emissions (kg/yr)	N_2O Emissions (kg/yr)	Part 98 CH_4 GWP	Part 98 N_2O GWP	CO_2e Emissions (mtpy)
Mine-Wide Diesel Combustion	Distillate Fuel Oil #2	1,077,975 gal/yr	0.138 mmBTU/gal Table C-1 default	73.96 kg/mmBtu Table C-1	0.003 kg/mmBtu Table C-2	0.0006 kg/mmBtu Table C-2	11,002,330	446.2817	89.2563	21.0000	310.0000	11,039.3717
Mine Intake Air Heaters	Natural Gas	900,000 scf/yr	0.001028 mmBTU/scf Table C-1 default	53.02 kg/mmBtu Table C-1	0.001 kg/mmBtu Table C-2	0.0001 kg/mmBtu Table C-2	49,054	0.9252	0.0925	21.0000	310.0000	49.1022
									Total CO_2e Emission Rate (metric tons/year)			11,088.4739

Notes:
Fuel HHV from 40 CFR Part 98 Table C-1.
Emission factors from 40 CFR Part 98 Table C-1 and Table C-2.
mtpy = Metric Tons per Year
GWP - Global Warming Potential (for CO_2e calculation of non-CO_2 emissions).
CO_2e emissions calculated as CO_2 + (CH_4 x CH_4 GWP) + (N_2O x N_2O GWP).
CO_2 calculations based on 40 CFR 98.33(a)(1) Eq. C-1.
CH_4, N_2O calculations based on 40 CFR 98.33(c)(1) Eq C-8.
Diesel fuel consumption rates from Energy Fuels letter dated October 28, 2013.
Natural gas consumption rates from Energy Fuels letter dated October 28, 2013.

Sheep Mountain Mine
Production Phase with On-Site Processing
Air Emissions Summary

Appendix A - Table PN1

Source ID Number	Description	General Location	Point, Fugitive or Nonroad	Annual PM_{10} Emissions (tpy) [1]	24-Hour PM_{10} Emissions (lb/day)	Annual $PM_{2.5}$ Emissions (tpy) [1]	24-Hour $PM_{2.5}$ Emissions (lb/day)	Annual NO_x Emissions (tpy) [1]	24-Hour NO_x Emissions (lb/day)	Annual CO Emissions (tpy) [1]	24-Hour CO Emissions (lb/day)	Annual SO_2 Emissions (tpy) [1]	24-Hour SO_2 Emissions (lb/day)	Annual VOC Emissions (tpy) [1]	24-Hour VOC Emissions (lb/day)	Annual H2SO4 Emissions (tpy)	Annual H2SO4 Emissions (lb/day)	Annual CH_2O Emissions (tpy)	24-Hour CH_2O Emissions (lb/day)	Annual CO2e Emissions (metric tpy)	Annual Benzene Emissions (tpy)	Annual Toluene Emissions (tpy)	Annual Ethylbenzene Emissions (tpy)	Annual n-hexane Emissions (tpy)
1.0	**Mine Sources**																							
	Blasting - Particulate	Underground	F	0.0139	0.0802	0.0008	0.0046	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Blasting - Gaseous	Underground	F	--	--	--	--	6.3450	34.8100	22.1225	121.4600	0.6025	3.3100	--	--	--	--	--	--	--	--	--	--	--
	Natural Gas Heaters - Mine Intake	Underground	P	0.0034	0.0187	0.0034	0.0187	0.0450	0.2466	0.0378	0.2071	0.0003	0.0015	0.0025	0.0136	--	--	3.38E-05	1.85E-04	49.10	9.45E-07	1.53E-06	--	8.10E-04
	Primary Crusher	Underground	P	0.1656	1.3500	0.0248	0.2025	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Coarse Ore Conveyor Transfers	Underground	P	0.0772	0.4230	0.0154	0.0846	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Underground Mobile Sources	Underground	N	2.5472	19.5936	2.5472	19.5936	42.1337	324.1051	44.8769	345.2073	--	--	5.1356	39.5043	--	--	0.8408	6.4680	3441.2291	0.0537	0.0780	0.0092	0.0000
2.0	**Surface Sources**																							
	Dozing	Pit	F	7.4264	57.1264	3.8996	29.9973	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Product Removal	Pit	F	0.3312	1.8144	0.0662	0.3629	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Overburden Removal	Pit	F	35.1897	192.8250	7.0379	38.5650	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Overburden Unloading	Spoils	F	7.5784	41.5267	1.5157	8.3053	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Truck Dump	Truck Dump	P	1.8768	10.2838	0.3754	2.0568	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Primary Crusher	Crusher	P	0.3312	2.7000	0.0497	0.4050	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Overland Coarse Ore Conveyor	Crusher to Pad	P	2.4128	13.2208	0.4826	2.6442	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Radial Stacker to Leach Pad	Leach Pad	F	0.7307	4.0039	0.1461	0.8008	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Surface Facilities Heating	Shop, Plant, Office	P	0.0150	0.0822	0.0150	0.0822	0.1975	1.0822	0.1659	0.9090	0.0012	0.0065	0.0109	0.0595	--	--	0.0001	0.0008	215.5042	4.15E-06	6.72E-06	--	0.0036
	Production Facility-Point Sources	Plant	P	0.0520	5.5306	0.0519	5.5302	0.6925	77.7132	0.4844	18.5827	0.0135	4.9622	41.7635	234.7306	0.0000	0.0000	--	--	--	--	--	--	--
	Production Facility-Fugitive Sources	Plant	F	21.8880	119.9342	3.2832	17.9901	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3.0	**Unpaved Roads**																							
	Surface Ore Haul to Truck Dump	Pit to Truck Dump	F	4.0838	29.3626	0.4084	2.9363	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Surface OB Haul to Hanks Draw Spoils	Pit to Hanks Draw Spoils	F	49.1143	317.8920	4.9114	31.7892	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Surface OB Haul to South Spoils	Pit to South Spoils	F	27.0201	174.8871	2.7020	17.4887	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Water Trucks	Haul Routes	F	5.3053	63.1579	0.5305	6.3158	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Haul Road Repair	Haul Routes	F	0.4781	3.8250	0.0433	0.6585	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Light Vehicles	Unpaved Roads	F	2.0577	28.9354	0.2058	2.8935	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Bulk Delivery Trucks	Haul Routes	F	0.3594	6.5322	0.0359	0.6532	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4.0	**Wind Erosion**																							
	Open Acres	Mine-Wide	F	24.6240	134.9260	3.6936	20.2389	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Stockpiles	Mine-Wide	F	33.9248	185.8894	5.0887	27.8834	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5.0	**Surface Mobile Sources**																							
	Surface Mobile/Nonroad Sources	Mine-Wide	N/M	1.2406	6.8164	1.2406	6.8164	136.6471	750.8085	80.4140	441.8353	0.0674	0.3692	9.4829	52.1038	--	--	3.6350	19.9728	7598.1426	0.2818	0.1399	0.0330	0.0649
	Total Point Source Emissions			4.9340	33.6092	1.0182	11.0243	0.9350	79.0419	0.6881	19.6989	0.0150	4.9702	41.7768	234.8036	0.0000	0.0000	0.0002	0.0010	264.6064	5.09E-06	8.25E-06	--	0.0044
	Total Fugitive Source Emissions			220.1259	1362.7185	33.5694	206.8836	6.3450	34.8100	22.1225	121.4600	0.6025	3.3100	--	--	--	--	--	--	--	--	--	--	--
	Total Nonroad/Mobile Source Emissions			3.7878	26.4100	3.7878	26.4100	178.7808	1074.9136	125.2910	787.0426	0.0674	0.3692	14.6185	91.6081	0.0000	0.0000	4.4759	26.4408	11039.3717	0.3354	0.2178	0.0422	0.0649
	Total Annual Emissions Production Phase			228.8476		38.3753		186.0609		148.1016		0.6849		56.3953		0.0000		4.4761		11303.9780	0.3354	0.2178	0.0422	0.0692

1. Annual emission rates may not be equivalent to daily emission rates x 365 days/year due to limitations on annual operating schedule, fuel input, or other factors. See individual calculation sheets for source-specific details.

Sheep Mountain Mine
Activity Data

Appendix A - Table PN2

Phase	Location	Activity	Parameter Description	Value
Production	Underground	UG Blasting - Particulate	Area blasted (ft2)	150
			Annual blasts (blasts/yr)	2080
			max daily blasts (blasts/day)	6
		UG Blasting - Gaseous	ANFO Use (annual tpy)	575
			ANFO Use (max daily tpd)	1.58
			High Explosives Use (annual tpy)	55
			High Explosives Use (max daily tpd)	0.15
		Surface Blasting - Particulate	Area blasted (ft2), annual blasts (blasts/yr), max daily blasts (blasts/day)	none
		Surface Blasting - Gaseous	ANFO Use (need annual tpy, max daily tpd)	none
			High Explosives Use (need annual tpy, max daily tpd)	none
		Natural Gas Heaters - Mine Intake	Natural gas use (scf/yr)	900,000
		Primary Crusher	Annual Throughput (tpy)	368,000
			Max Daily Throughput (tpd)	1500
		Coarse Ore Conveyor Transfers UG	Annual Throughput (tpy)	386000
			Max Daily Throughput (tpd)	1058
			Conveyor Transfers (number of transfers)	1
		Underground Mobile Sources	HP	See calculation
			Quantity	See calculation
			Annual operating hours	See calculation
Production	Surface	Dozing	Annual operating hours (hrs/year)	10400
			Maximum Daily Operating hours (hrs/day)	20
		Product Removal	Annual Throughput (tpy)	736000
			Max Daily Throughput (tpd)	2016
		Overburden Removal	Annual Throughput (tpy)	15639886
			Max Daily Throughput (tpd)	42850
		Overburden Unloading	Annual Throughput (tpy)	15639886
			Max Daily Throughput (tpd)	42850
		Truck Dump from Surface	Annual Throughput (tpy)	736000
			Max Daily Throughput (tpd)	2016
		Primary Crusher	Annual Throughput (tpy)	736000
			Max Daily Throughput (tpd)	3000
		Overland Coarse Ore Conveyor	Annual Throughput (tpy)	1508000
			Max Daily Throughput (tpd)	4132
			Conveyor Transfers (number of transfers)	8
		Radial Stacker to Leach Pad	Annual Throughput (tpy)	1508000
			Max Daily Throughput (tpd)	2066
		Surface Facilities Heating	Natural gas use (scf/yr)	3950000
			Or unit-specific data, if available (heat input mmbtu/hr or max fuel consumption, operating hours)	
Production	Unpaved Roads	Surface Ore Haul to Truck Dump	Annual Throughput (tpy)	736000
			Max Daily Throughput (tpd)	2016
			Round Trips per day	64

			Round Trip Distance (average miles)	0.5
		Water Trucks	--	See calculation
		Haul Road Repair	--	See calculation
		Bulk Delivery Trucks	--	See calculation
		Employee Traffic	--	See calculation
Production	Wind Erosion	Open Acres (acres)	--	230
		Alternate Spoils 1 and Spoils 2 (m2)	--	578,700
		Topsoil Stockpile (acres)	--	36.1
Production	Surface Combustion	Surface Mobile/Nonroad Sources	HP	See calculation
			Quantity	See calculation
			Annual operating hours	See calculation
		Mine-Wide Diesel Combustion	Mine-wide annual diesel fuel consumption (gal)	1077975
Production	On-Site Ore Processing	Uranium Dryer	Design capacity (mmbtu/hr)	1.25
		Emergency Generator	kW or hp rating	75 / 100.5
		Diluent Tank	Annual throughput (gal)	115,500
		Organic Holding Tank No. 1	Annual throughput (gal)	115,500
		Organic Holding Tank No. 2	Annual throughput (gal)	115,500
		Sulfuric Acid Tank	Annual throughput (gal)	3,120,000
		Holding Pond Evaporation Pond	Liquid entry rate (lb/hr)	25,000
		Collection Pond	Average surface area (50% full)	43,100
		Raffinate Pond	Average surface area (50% full)	29,200
		DE Bag Breaking	DE used (lb/day)	250
		Heap Leach Wind Erosion	Area (acres)	40
Production	Off-Site Ore Processing	Ore Truck Loading	Annual Throughput (tpy)	736000
			Max Daily Throughput (tpd)	2016
		Ore Truck Travel Off-Site	Round Trips per day	80
			Round Trip Distance - Total (average miles)	68
			Round Trip Distance - from load-out, on BLM Lands (average miles)	2.06
Data Source: Data provided to CLC by Energy Fuels, October 23, 2013 in "Sheep Mountain AQ Data Request 10-23-13_EFR.xlsx".				

Sheep Mountain Mine **Appendix A - Table PN3**

Blasting - Particulate Emissions

Activity	Area Blasted[1]	Blasts per Year	Blasts per Day	PM_{10} Emission Factor[2]	$PM_{2.5}$ Emission Factor[2]	Annual PM_{10} Emissions	Max 24-Hr PM_{10} Emissions	Annual $PM_{2.5}$ Emissions	Max 24-Hr $PM_{2.5}$ Emissions	Max Hourly PM10	Max Hourly PM2.5
	(ft^2)			(lb/blast)	(lb/blast)	(tpy)	(lb/day)	(tpy)	(lb/day)	(lb/hr)	(lb/hr)
Underground	150	2,080	6.00	0.013	0.0008	0.0139	0.0802	0.0008	0.0046	0.0134	0.0008

Notes:

[1] Estimated.

[2] AP-42, 11.9, Western Surface Coal Mining, Table 11.9-1.

PM_{10} Emission Factor = $(0.000014)A^{1.5}$ * 0.52 (lb/blast)

$PM_{2.5}$ Emission Factor = $(0.000014)A^{1.5}$ * 0.03 (lb/blast)

[3] Maximum hourly emissions based on lb/blast emission factor, one blast per hour.

Sheep Mountain Mine
Blasting - Gaseous Emissions

Appendix A - Table PN4

Explosive	Pollutant	Annual Explosive Usage	Daily Explosive Usage[1]	Emission Factor[2]	Annual Emissions	Max 24-Hr Emissions	Max Hourly Emissions[3]
		(tpy)	(tons/day)	(lb/ton)	(tpy)	(lb/day)	(lb/hr)
ANFO	NO_x	575	1.58	17	4.8875	26.8600	4.4767
	CO	575	1.58	67	19.2625	105.8600	17.6433
	SO_2	575	1.58	2	0.5750	3.1600	0.5267
High Explosive	NO_x	55	0.15	53	1.4575	7.9500	1.3250
	CO	55	0.15	104	2.8600	15.6000	2.6000
	SO_2	55	0.15	1	0.0275	0.1500	0.0250
Total	NO_x				6.3450	34.8100	5.8017
	CO				22.1225	121.4600	20.2433
	SO_2				0.6025	3.3100	0.5517

Note:
[1] Daily use calculated as annual use (tpy) / 365 days per year.
[2] AP-42 (EPA, 1980), Table 13.3-1, "Emission Factors for Detonation Explosives."
Emission factors selected for ammonium nitrate combined with fuel oil.
Emission factors selected for high explosives are those for gelatin dynamite with a range of 20-100% nitroglycerine.
[3] Maximum hourly rate based on daily usage / 6 blasts per day, equivalent to 1 blast/hour.

Sheep Mountain Mine **Appendix A - Table PN5**

Natural Gas-Fired Mine Intake Air Heaters

Pollutant	Emission Factor[1]	Natural Gas	Annual Emissions[2]	Max.24-Hour Emissions	Max Hourly Emissions[3]
	(lb/10^6 scf)	(10^6 scf/day)	(tpy)	(lb/day)	(lb/hr)
PM_{10}	7.6	0.00247	0.0034	0.0187	0.0008
$PM_{2.5}$	7.6	0.00247	0.0034	0.0187	0.0008
NO_x	100.0	0.00247	0.0450	0.2466	0.0103
CO	84.0	0.00247	0.0378	0.2071	0.0086
VOC	5.5	0.00247	0.0025	0.0136	0.0006
SO_2	0.6	0.00247	0.0003	0.0015	0.0001
Benzene	0.0021	0.00247	9.45E-07	5.18E-06	2.16E-07
Toluene	0.0034	0.00247	1.53E-06	8.38E-06	3.49E-07
Hexane	1.8	0.00247	8.10E-04	4.44E-03	1.85E-04
CH_2O	0.075	0.00247	3.38E-05	1.85E-04	7.71E-06

Notes:

[1] AP-42 (EPA, 1998), Section 1.4, "Natural Gas Combustion." Uncontrolled small natural gas boilers.

[2] Annual fuel use estimated based on similar underground operation.

[3] Maximum hourly emissions based on daily emission rate / 24 hours.

Sheep Mountain Mine **Appendix A - Table PN6**

Natural Gas-Fired Heaters - Office, Shop and Plant Facilities

Pollutant	Emission Factor[1]	Natural Gas	Annual Emissions[2]	Max.24-Hour Emissions	Max Hourly Emissions[3]
	(lb/10^6 scf)	(10^6 scf/day)	(tpy)	(lb/day)	(lb/hr)
PM_{10}	7.6	0.0108	0.0150	0.0822	0.0034
$PM_{2.5}$	7.6	0.0108	0.0150	0.0822	0.0034
NO_x	100.0	0.0108	0.1975	1.0822	0.0451
CO	84	0.0108	0.1659	0.9090	0.0379
VOC	5.5	0.0108	0.0109	0.0595	0.0025
SO_2	0.6	0.0108	0.0012	0.0065	0.0003
Benzene	0.0021	0.0108	4.15E-06	2.27E-05	9.47E-07
Toluene	0.0034	0.0108	6.72E-06	3.68E-05	1.53E-06
Hexane	1.8	0.0108	3.56E-03	1.95E-02	8.12E-04
CH_2O	0.075	0.0108	1.48E-04	8.12E-04	3.38E-05

Notes:

[1] AP-42 (EPA, 1998), Section 1.4, "Natural Gas Combustion." Uncontrolled small natural gas boilers.

[2] Annual fuel use provided by Energy Fuels. Daily rate based on annnual rate divided by 365 days/year operation.

[3] Hourly emissions based on daily usage / 24 hours/day.

Source	Description	NOx		CO		VOC		SO2		PM10		PM2.5		H_2SO_4	
		(lb/hr)	(TPY)	(lb/hr)	(TPY)	(lb/hr)	(TPY)	(lb/hr)	(TPY)	(lb/hr)	(TPY)	(lb/hr)	(TPY)	(lb/hr)	(TPY)
UD-1	Uranium Dryer	0.12	0.54	0.10	0.45	0.01	0.03	0.00	0.00	0.01	0.04	0.01	0.04	--	--
EG	Emergency Generator	3.12	0.16	0.67	0.03	0.25	0.01	0.21	0.01	0.22	0.01	0.22	0.01	--	--
710-TK-001	Diluent Tank	--	--	--	--	0.00	0.00	--	--	--	--	--	--	--	--
710-TK-002	Organic Holding Tank No. 1	--	--	--	--	0.00	0.01	--	--	--	--	--	--	--	--
710-TK-003	Organic Holding Tank No. 2	--	--	--	--	0.00	0.01	--	--	--	--	--	--	--	--
SA Tank	Sulfuric Acid Tank	--	--	--	--	--	--	--	--	--	--	--	--	<0.01	<0.01
300-MS-01	1st Stage Extraction Mixer Settler	--	--	--	--	1.33	5.84	--	--	--	--	--	--	--	--
300-MS-02	2nd Stage Extraction Mixer Settler	--	--	--	--	1.33	5.84	--	--	--	--	--	--	--	--
300-MS-03	3rd Stage Extraction Mixer Settler	--	--	--	--	1.33	5.84	--	--	--	--	--	--	--	--
300-MS-04	4th Stage Extraction Mixer Settler	--	--	--	--	1.33	5.84	--	--	--	--	--	--	--	--
300-MS-05	SX Raffinate Settler	--	--	--	--	1.33	5.84	--	--	--	--	--	--	--	--
300-MS-06	Scrubber Mixer Settler	--	--	--	--	0.23	0.99	--	--	--	--	--	--	--	--
300-MS-07	1st Stage Stripping Mixer Settler	--	--	--	--	0.23	0.99	--	--	--	--	--	--	--	--
300-MS-08	2nd Stage Stripping Mixer Settler	--	--	--	--	0.23	0.99	--	--	--	--	--	--	--	--
300-MS-09	3rd Stage Stripping Mixer Settler	--	--	--	--	0.23	0.99	--	--	--	--	--	--	--	--
300-MS-10	4th Stage Stripping Mixer Settler	--	--	--	--	0.23	0.99	--	--	--	--	--	--	--	--
300-MS-11	Regeneration Mixer Settler	--	--	--	--	0.23	0.99	--	--	--	--	--	--	--	--
Holding	Holding Pond Evaporation	--	--	--	--	1.50	6.57	--	--	--	--	--	--	--	--
Collection	Collection Pond Evaporation	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Raffinate	Raffinate Pond Evaporation	--	--	--	--	0.001	0.01	--	--	--	--	--	--	--	--
DE Bag	DE Bag Breaker	--	--	--	--	--	--	--	--	2.66E-05	1.16E-04	1.33E-05	5.82E-05	--	--
WIND1	Wind Erosion of Heap Leach Pile	--	--	--	--	--	--	--	--	5.00	21.89	0.75	3.28	--	--
Total Point Sources		3.24	0.69	0.77	0.48	9.78	41.76	0.21	0.01	0.23	0.05	0.23	0.05	0.00	0.00
Total Fugitive Sources		--	--	--	--	--	--	--	--	5.00	21.89	0.75	3.28	--	--
Total		3.24	0.69	0.77	0.48	9.78	41.76	0.21	0.01	5.23	21.94	0.98	3.34	0.00	0.00

Emissions summary data from "Production Plant EI (5-7-13).xlsx" provided by Energy Fuels.

Sheep Mountain Mine
Surface Mining Activities

Appendix A - Table PN8

Mining Activity	Maximum Annual Throughput	Maximum 24-Hour Throughput	Maximum Annual Operation	Equipment Quantity	Maximum Daily Schedule per Unit	Maximum Daily Rate	Moisture Content	Silt Content	Wind Speed [2]	Emission Control Efficiency	PM_{10} Emission Factor[1]	Units	$PM_{2.5}$ Emission Factor [4]	Units	Annual PM_{10} Emissions	Max 24-hr PM_{10} Emissions	Annual $PM_{2.5}$ Emissions	Max 24-hr $PM_{2.5}$ Emissions	Max Hourly PM_{10} Emissions[6]	Max Hourly $PM_{2.5}$ Emissions[6]
	(tpy)	(tons/day)	(hrs/year)		(hrs/day)	(hrs/day)	(%)	(%)	(mph)	(%)					(tpy)	(lbs/day)	(tpy)	(lbs/day)	(lb/hr)	(lb/hr)
Dozing	--	--	10,400	2	20	40	5	6.9	--	0	1.428	lb/hr	0.750	lb/hr	7.4264	57.1264	3.8996	29.9973	1.4282	0.7499
Product Removal [5]	736,000	2,016	--	--	--	--	--	--	--	0	0.0009	lb/ton	1.80E-04	lb/ton	0.3312	1.8144	0.0662	0.3629	0.0907	0.0181
Overburden Removal [3]	15,639,886	42,850	--	--	--	--	5	--	--	0	0.0045	lb/ton	9.00E-04	lb/ton	35.1897	192.8250	7.0379	38.5650	9.6413	1.9283
Overburden Unloading [3]	15,639,886	42,850	--	--	--	--	5	--	12.0	0	0.00097	lb/ton	1.94E-04	lb/ton	7.5784	41.5267	1.5157	8.3053	2.0763	0.4153
Total Surface Mining Activites															50.5258	293.2925	12.5195	77.2305	13.2365	3.1116

Notes:

[1] Emission factor sources:

Dozing, AP-42 11.9-1 "Western Surface Coal Mining". Site material moisture, mean silt content taken from Table 11.9-3.

Emission factor: $[1.0(s)^{1.5}] / (M)^{1.4}$ lb/hr x scaling factor. Where s=material silt content (%), M=material moisture content (%), scaling factors = 0.75 for PM10 and 0.105 for PM2.5.

Annual emissions calculated as: Emission Factor (lb/hr) x hours/year / 2000 lb/ton.

Product removal, WDEQ-AQD Memorandum Re: Fugitive Dust Emission Factors, January 24, 1979. Uranium ore removal with front-end-loader. Applied 0.30 PM10/TSP ratio.

Annual emissions calculated as: Emission factor (lb/ton) x tons per year / 2000 lb/ton

Overburden removal, WDEQ-AQD Memorandum Re: Fugitive Dust Emission Factors, January 24, 1979. OB removal truck/shovel. Applied 0.30 PM10/TSP ratio.

Annual emissions calculated as: Emission factor (lb/ton) x tons per year / 2000 lb/ton

Overburden unloading, AP-42 13.2.4 "Aggregate Handling and Storage Piles". Site-specific material moisture, wind speed Casper average 2002-2006.

Emission factor: $k(0.0032) \times (U/5)^{1.3} / (M/2)^{1.4}$ lb/ton. Where k=particle size multiplier of 0.35 (PM10) or 0.053 (PM2.5), U=mean wind speed (mph), and M=material moisture content (%).

Annual emissions calculated as: Emission factor (lb/ton) x tons per year / 2000 lb/ton

[2] Mean wind speed at Casper, Wyoming, 2002-2006.

[3] Annual cubic yards overburden + interburden reported by Energy Fuels in data request reponse letter dated October 28, 2013.
Cubic yards converted to tons of material using an overburden density of 115 lb/ft3 provided by Energy Fuels.

[4] PM2.5 for Product Removal, Overburden Removal, and Overburden Unloading calculated using PM2.5/PM10 ratio of 0.20 from Western Regional Air Partnership guidance for agricultural tilling, from "Proposed Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors", Cowherd et al, Midwest Research Institute, 2006.

[5] See "Ore Transfers" sheet for product transfer to truck dump.

[6] Maximum hourly emission rates for all activities but dozing based on maximum daily emission rate / 20 hours/day work schedule.

Sheep Mountain Mine **Appendix A - Table PN9**

Ore Transfers

Ore Handling Activity	Annual Throughput[5]	24-Hour Throughput	Number of Transfers	Moisture Content	Mean Wind Speed[4]	Emission Control Efficiency[1]	PM_{10} Emission Factor[2]	Annual PM_{10} Emissions	Max 24-hr PM_{10} Emissions	Annual $PM_{2.5}$ Emissions	Max 24-hr $PM_{2.5}$ Emissions	Max Hourly PM_{10} Emissions[6]	Max Hourly $PM_{2.5}$ Emissions[6]
	(tpy)	(tons/day)		(%)	(mph)	(%)	(lb/ton)	(tpy)	(lbs/day)	(tpy)	(lbs/day)	(lb/hr)	(lb/hr)
Truck Dump	736,000	2,016	1	5	12.0	0	0.0051	1.8768	10.2838	0.3754	2.0568	0.5142	0.1028
Underground Coarse Ore Conveyor Transfer [3]	386,000	1,058	1	5	--	90	0.004	0.0772	0.4230	0.0154	0.0846	0.0212	0.0042
Overland Coarse Ore Conveyor Transfers	1,508,000	4,132	8	5	--	90	0.004	2.4128	13.2208	0.4826	2.6442	0.6610	0.1322
Radial Stacker to Leach Pad	1,508,000	4,132	1	5	12.0	0	9.69E-04	0.7307	4.0039	0.1461	0.8008	0.2002	0.0400
Total Ore Transfers								5.0975	27.9316	1.0195	5.5863	1.3966	0.2793

Notes:

[1] Water spray control on underground transfers = 90%. Complete enclosure on overland conveyor = 90%.

[2] Truck dump: WDEQ-AQD Memorandum Re: Fugitive Dust Emission Factors, January 24, 1979. Product dumping - Uranium factor. PM10/TSP ratio of 0.30 applied.
Annual emissions calculated as: Emission factor (lb/ton) x tons per year material / 2000 lb/ton
Conveyor transfers: AP-42 (EPA, 1982), Section 11.24-2, "Metallic Mineral Processing."
Annual emissions calculated as: Emission factor (lb/ton) x tons per year material / 2000 lb/ton x [100-control efficiency (%))/100].
Radial stacker: AP-42 Section 13.2.4, "Aggregate Handling and Storage Piles", Equation 1.
Emission factor: $k(0.0032) \times (U/5)^{1.3} / (M/2)^{1.4}$ lb/ton. Where k=particle size multiplier of 0.35 (PM10) or 0.053 (PM2.5), U=mean wind speed (mph), and M=material moisture content (%).
Annual emissions calculated as: Emission factor (lb/ton) x tons per year material / 2000 lb/ton x [100-control efficiency (%))/100].

[3] Underground conveyor transfer to stockpile.

[4] Mean wind speed at Casper, Wyoming, 2002-2006.

[5] Annual throughputs reported by Energy Fuels in data request reponse letter dated October 28, 2013.
Truck dump material throughput reflects total ore production rate of surface operations.
Underground Coarse Ore Conveyor Transfer material throughput reflects total underground ore production rate.
Overland Coarse Ore Transfers and Radial Stacker material throughput reflects sum of total surface and underground ore production rates.

[6] Maximum hourly emission rates for all activities but dozing based on maximum daily emission rate / 20 hours/day work schedule.

Sheep Mountain Mine
Primary Crusher and Screen
Surface Ore

Appendix A - Table PN10

Source	Maximum Annual Throughput[1]	Maximum Daily Throughput[1]	Water Spray Controls	PM_{10} Emission Factor[2]	Annual PM_{10} Emissions	Maximum 24-hr PM_{10} Emissions	Annual $PM_{2.5}$ Emissions	Maximum 24-hr $PM_{2.5}$ Emissions	Max Hourly PM_{10} Emissions[3]	Max Hourly $PM_{2.5}$ Emissions[3]
	(tpy)	(tons/day)	(%)	(lb/ton)	(tpy)	(lb/day)	(tpy)	(lb/day)	(lb/hr)	(lb/hr)
Crusher/Screen	736,000	3,000	90	0.009	0.3312	2.7000	0.0497	0.4050	0.1350	0.0203

Note:
[1] Annual throughput reported by Energy Fuels in data request reponse letter dated October 28, 2013.
1500 tpd throughput is maximum capacity of unit given by Proponent in "AQ Input List tw.doc".
[2] AP-42 (EPA, 1982), Section 11.24, "Metallic Minerals Processing."
Annual emissions calculated as: Emission factor (lb/ton) x annual throughput (tpy) x [(100-control efficiency %)/100] / 2000 lb/ton
24-Hour emissions calculated as: Emission factor (lb/ton) x daily throughput (tpd) x [(100-control efficiency %)/100]
MRI, 2006. Background document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors,
Midwest Research Institute for Western Regional Air Partnership, November 1, 2006.
[3] Maximum hourly emission rates for all activities but dozing based on maximum daily emission rate / 20 hours/day work schedule.

Sheep Mountain Mine
Primary Crusher and Screen
Underground Ore

Appendix A - Table PN11

Source	Maximum Annual Throughput[1]	Maximum Daily Throughput[1]	Water Spray Controls	PM_{10} Emission Factor[2]	Annual PM_{10} Emissions	Maximum 24-hr PM_{10} Emissions	Annual $PM_{2.5}$ Emissions	Maximum 24-hr $PM_{2.5}$ Emissions	Max Hourly PM_{10} Emissions[3]	Max Hourly $PM_{2.5}$ Emissions[3]
	(tpy)	(tons/day)	(%)	(lb/ton)	(tpy)	(lb/day)	(tpy)	(lb/day)	(lb/hr)	(lb/hr)
Crusher/Screen	368,000	1,500	90	0.009	0.1656	1.3500	0.0248	0.2025	0.0675	0.0101

Note:
[1] Maximum annual underground production reported by Energy Fuels in data request reponse letter dated October 28, 2013.
1500 tpd is maximum capacity of unit given by Proponent in "AQ Input List tw.doc".
[2] AP-42 (EPA, 1982), Section 11.24, "Metallic Minerals Processing."
Annual emissions calculated as: Emission factor (lb/ton) x annual throughput (tpy) x [(100-control efficiency %)/100] / 2000 lb/ton
24-Hour emissions calculated as: Emission factor (lb/ton) x daily throughput (tpd) x [(100-control efficiency %)/100]
PM2.5 fraction of PM10 of 0.15 taken from MRI, 2006,
MRI, 2006. Background document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors,
Midwest Research Institute for Western Regional Air Partnership, November 1, 2006.
[3] Maximum hourly emission rates for all activities but dozing based on maximum daily emission rate / 20 hours/day work schedule.

Sheep Mountain Mine **Appendix A - Table PN12**

Unpaved Roads

Vehicle Type	Average Vehicle Weight[1]	Vehicle Payload[1]	Annual Throughput	24-Hour Throughput	Silt Content[2]	Average Speed	Emission Control[5]	Annual Precip >0.01 in[7]	24-Hour Round Trips	Annual Round Trips	Average Round Trip Distance	Annual Vehicle Miles Traveled	24-Hour Vehicle Miles Traveled	PM_{10} Emission Factor[3]	PM2.5 Emission Factor[3]	Annual PM_{10} Emissions[4]	24-Hour PM_{10} Emissions[4]	Annual $PM_{2.5}$ Emissions[4]	24-Hour $PM_{2.5}$ Emissions[4]	Max Hourly PM_{10} Emissions[9]	Max Hourly $PM_{2.5}$ Emissions[9]
	(tons)	(tons)	(tpy)	(tons/day)	(%)	(mph)	(%)	(days)	(rt/day)	(rt/yr)	(miles)	(VMT)	(VMT)	(lb/VMT)	(lb/VMT)	(tpy)	(lb/day)	(tpy)	(lb/day)	(lb/hr)	(lb/hr)
Surface Ore Haul to Truck Dump	26	35	736,000	2,016	5.1	--	50	56	64	21,029	0.5	10,514	32.00	0.92	0.09	4.0838	29.3626	0.4084	2.9363	1.4681	0.1468
Surface Overburden Haul to Hanks Draw Spoils[10]	26	35	4,425,840	12,126	5.1	--	50	56	346	126,453	1.0	126,453	346.45	0.92	0.09	49.1143	317.8920	4.9114	31.7892	15.8946	1.5895
Surface Overburden Haul to South Spoils[10]	26	35	1,623,240	4,447	5.1	--	50	56	127	46,378	1.5	69,567	190.60	0.92	0.09	27.0201	174.8871	2.7020	17.4887	8.7444	0.8744
Water Trucks (2)	17	--	--	--	5.1	--	50	--	20	3,360	--	14,000	83.33	0.76	0.08	5.3053	63.1579	0.5305	6.3158	3.1579	0.3158
Haul Road Repair (Grading)	--	--	--	--	--	5	50	--	--	--	--	2,500	10.00	0.77	0.07	0.4781	3.8250	0.0433	0.6585	0.1913	0.0329
Light Vehicles	3	--	--	--	5.1	--	50	56	118	19,824	2.1	14,000	83.33	0.35	0.03	2.0577	28.9354	0.2058	2.8935	1.4468	0.1447
Bulk Delivery Trucks[6]	18	--	--	--	5.1	--	50	56	4	520	2.1	1,092	8.40	0.78	0.08	0.3594	6.5322	0.0359	0.6532	0.3266	0.0327
															Totals	88.4186	624.5922	8.8374	62.7352	31.2296	3.1368

Notes:

[1] Vehicle payload reported in "Revision to Permit to Mine 381C, Sheep Mountain Mine" dated January 2014. Average vehicle weight estimated.

[2] AP-42, Table 13.2.2-1, Unpaved Roads.

Equation 1a. $E = k(s/12)^a(W/3)^b$ lb/VMT. Where k=constant 1.5 for PM10 and 0.15 for PM2.5, a=0.9, b=0.45, s=surface material silt content (%), W=mean vehicle weight (tons).

[3] AP-42 (EPA, 2003), Section 13.2.2, "Unpaved Roads." (Ore, water, delivery, light trucks). See equation 1a above.

AP-42 (EPA 1998), Section 11.9, "Western Surface Coal Mining." Emission factor for grading: $0.051(S)^{2.0}$ lb/VMT x scaling factor. Where S=mean vehicle speed (mph).

Scaling factors=0.60 for PM10 and 0.031 for PM2.5.

[4] Calculated as Emissions in (lb/VMT) x Vehicle Miles Traveled (VMT).

[5] Dust control provided by frequent water application, control efficiency from MRI 2001. Technical Memorandum from G. Muleski, Midwest Research Institute, Kansas City, MO, to B. Kuykendal, U. S. EPA, Research Triangle Park, NC, Subject "Unpaved Roads," September 27, 2001.

[6] Bulk reagent delivery, weight based on Wyoming maximum GVW for tandem-axle highway trucks.

[7] Average annual days with precipitation greater than 0.01" observed at Jeffrey City, Wyoming from 1964-2005. Precipitation factor applied to surface ore haul, light vehicles, and bulk delivery.

[8] Round-trip distance off-site is based on the distance from south edge of ore stockpile to the point at which the road exits BLM lands.

[9] Maximum hourly emission rates for all activities but dozing based on maximum daily emission rate / 20 hours/day work schedule.

[10] Year 3 annual Hanks Draw Spoils haul total = 2,732,000 cy, and annual South Spoils haul total = 1,002,000 cy. Overburden density = 3240 lb/cy. Tons/yr = cy x (lb/cy) / (2000 lb/ton).

Sheep Mountain Mine

Wind Erosion of Open Acres

Appendix A - Table PN13

Activity	Area	PM_{10} Emission Factor[2]	$PM_{2.5}$ Emission Factor[3]	Annual PM_{10} Emissions	Max 24-Hr PM_{10} Emissions	Annual $PM_{2.5}$ Emissions	Max 24-Hr $PM_{2.5}$ Emissions
	(acres)	(ton/acre/yr)	(ton/acre/yr)	(tpy)	(lb/day)	(tpy)	(lb/day)
Open Acres[1]	216	0.114	0.0171	24.6	134.9	3.6936	20.2389

Notes:

[1] Total non-stockpile open acres subject to wind erosion for Congo Pit given in Table 2.3-1 of EIS.

[2] Emission factor from AP-42 Western Surface Coal Mining, Table 11.9-4 of 0.38 x PM10/TSP ratio of 0.30.

[3] PM2.5 to PM10 ratio of 0.15 used for wind-blown fugitive dust (MRI, 2006).
MRI, 2006. Background document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors, Midwest Research Institute for Western Regional Air Partnership, November 1, 2006.

Sheep Mountain Mine

Wind Erosion of Stockpiles

Appendix A - Table PN14

Stockpile	Area	Emission Factor [1]	Annual PM_{10} Emissions[2]	24-Hr PM_{10} Emissions[2]	Annual $PM_{2.5}$ Emissions[3]	24-Hr $PM_{2.5}$ Emissions[3]
	(m^2)	($lb/yr/m^2$)	(tpy)	(lb/day)	(tpy)	(lb/day)
Stockpiles[4] (Hanks Draw and South Spoils)	500,614	0.092067	23.0450	126.2740	3.4568	18.9411
Ore Stockpile[4]	123,434	0.092067	5.6821	31.1348	0.8523	4.6702
Topsoil Stockpiles[4]	112,911	0.092067	5.1977	28.4806	0.7797	4.2721
			33.9248	185.8894	5.0887	27.8834

Notes:

[1] Emission factor derived from unit emission rate calculated using AP-42 Section 13.2.5, Industrial Wind Erosion, combined with 2011-12 hourly on-site surface wind speed data.

[2] Emissions calculated using methodology from AP-42 Section 13.2.5, Industrial Wind Erosion, combined with 2011-12 hourly on-site surface wind speed data.
Emission factor (lb/yr/m2) x area (m2) / 2000 lb/ton = tons per year.

[3] $PM_{2.5}$ calculated based on PM2.5/PM10 ratio of 0.15 for fugitive dust (MRI, 2006).
MRI, 2006. Background document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors, Midwest Research Institute for Western Regional Air Partnership, November 1, 2006.

[4] Stockpile areas from EIS Table 2.3-1.

Sheep Mountain Mine

Mobile and Nonroad Source Diesel Combustion Emissions

Appendix A - Table PN15

Source	Typical Engine Model	Engine Horsepower (hp)	Number of Units	Fuel Consumption[3] (gal/yr)	NO_x Emission Factor (g/hp-hr)	CO Emission Factor (g/hp-hr)	PM Emission Factor (g/hp-hr)	SO_2 Emission Factor (g/hp-hr)	VOC Emission Factor (g/hp-hr)	CH_2O Emission Factor[4] (g/hp-hr)	Emission Factor Basis[5]	Equipment Availability and Utilization[1]	Load Factor[2]	Daily Operating Rate per Unit[6] (hr/day)	Max Hourly Operating Hours (hours)	Daily Operating Hours[6] (hr/day)	Annual Operating Hours[6] (hr/yr)
OPEN PIT MINING																	
MAJOR EQUIPMENT																	
330 LX Linkbelt Excavator		268	2	40,000	4.50	2.6	0.015	--	0.40	0.12	Tier 2	0.81	0.21	20	2	40	14560
16M CAT Motor Grader		297	1	22,500	4.50	2.6	0.015	--	0.40	0.12	Tier 2	0.81	0.59	20	1	20	7280
140 CAT Motor Grader		150	1	15,000	4.50	3.7	0.015	--	0.40	0.12	Tier 2	0.81	0.59	20	1	20	7280
D-8 CAT track Dozer		347	1	46.250	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	1	20	7280
D-9 CAT Track Dozer		460	1	61.250	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	1	20	7280
A30D Volvo Atriculated Truck	*Assume CAT D30D	435	2	76,000	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	2	40	14560
980 CAT Wheel Loader		393	1	23,750	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	1	20	7280
637 CAT Twin Engine Scraper		783	3	245,000	4.50	2.6	0.075	--	0.30	0.12	Tier 2	0.81	0.59	20	3	60	21840
CAT Single Engine Scraper		330	3	28,750	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	3	60	21840
623 CAT Self Loading Scraper		330	1	28,750	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	1	20	7280
Water truck 3000 gallons	*Assume half CAT 613	200	1	8.125	4.50	2.6	0.015	--	0.40	0.12	Tier 2	0.81	0.59	20	1	20	7280
Water Truck 8000 gallons	*Assume CAT 613	500	1	16.250	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	1	20	7280
MINE SUPPORT VEHICLES																	
Fuel/lube truck	Assume 3/4 ton diesel	400	1	37.5	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	1	20	7280
Mechanical Service Truck	Assume 3/4 ton diesel	400	1	37.5	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	1	20	7280
Rubber tire backhoe CAT 414e w/forklift attachme	*Assume 416c	62	1	20,750	5.20	3.7	0.015	--	0.40	0.12	Tier 2	0.81	0.21	20	1	20	7280
Pickup Trucks 4WD. 3/4-ton	*Assume 400 miles per 6 hrs. as per multiple 350 engines	315	8	300	0.0167	0.0567	0.015	--	0.004	negl.	MOBILE6	0.81	1.0	20	8	160	58240
				632,750													
UNDERGROUND MINING																	
MAJOR EQUIPMENT																	
Model Boomer SL1 Face Drill	*Assume CAT D4B, similar power/weight/engine	150	3	26,250	4.50	3.7	0.22	--	0.40	0.12	Tier 2/MSHA	0.81	0.40	20	3	60	15600
104 Face Drill	*Assume CAT D3. similar power/weight/engine	150	1	7.500	4.50	3.7	0.22	--	0.40	0.12	Tier 2/MSHA	0.81	0.40	20	1	20	5200
Model Boomer S10-DH Face Drill	*Assume CAT D4B, similar power/weight/engine	150	1	8,750	4.50	3.7	0.22	--	0.40	0.12	Tier 2/MSHA	0.81	0.40	20	1	20	5200
Model Boltec SL Bolter	*Assume CAT D4B. similar power/weight/engine	74	7	43.750	5.20	3.7	0.3	--	0.40	0.12	Tier 2/MSHA	0.81	0.21	20	7	140	36400
Model Boltec 235 Bolter	*Assume CAT D4B, similar power/weight/engine	74	2	17,500	5.20	3.7	0.3	--	0.40	0.12	Tier 2/MSHA	0.81	0.21	20	2	40	10400
Model ST7LP Scooptram	*Assume CAT AD45, Fluid specs not in handbook 38	210	4	105,000	6.90	8.5	0.4	--	1.00	0.12	Tier 1/MSHA	0.81	0.21	20	4	80	20800
Model ST7 Scooptram	*Assume CAT R1300G, Fluid specs not in handbook 38	210	2	25,000	6.90	8.5	0.4	--	1.00	0.12	Tier 1/MSHA	0.81	0.21	20	2	40	10400
MINE SUPPORT VEHICLES																	
Power Buggies	*Assume Whiteman Series WBH16AEWD 18 hp Gas Engine.	50	2	4,100	5.20	3.7	0.3	--	0.40	0.12	Tier 2/MSHA	0.81	0.21	20	2	40	10400
Bobcat Skidsteer	*Assume CAT D3B	50	2	15,000	5.20	3.7	0.3	--	0.40	0.12	Tier 2/MSHA	0.81	0.21	20	2	40	10400
Utility Truck-flatbed		50	1	37.5	5.20	3.7	0.3	--	0.40	0.12	Tier 2/MSHA	0.81	0.59	20	1	20	5200
Scissor Truck	Assume same as the Bolter	50	8	8,750	5.20	3.7	0.3	--	0.40	0.12	Tier 2/MSHA	0.81	0.21	20	8	160	41600
Man trips	Assume same as Powerbuggy	74	6	24,600	5.20	3.7	0.3	--	0.40	0.12	Tier 2/MSHA	0.81	0.21	20	6	120	31200
Pickup trucks. 4 WD. 3/4-ton	Assume same specs as the Conventional Mine	315	8	187.5	0.0167	0.0567	0.015	--	0.004	negl.	Mobile 6	0.81	1.0	20	8	160	41600
Fuel/lube truck		400	1	37.5	6.90	8.5	0.4	--	1.00	0.12	Tier 1/MSHA	0.81	0.59	20	1	20	5200
Forklift		400	1	37.5	6.90	8.5	0.4	--	1.00	0.12	Tier 1/MSHA	0.81	0.59	20	1	20	5200
Mechanical Service Truck		400	1	75.0	6.90	8.5	0.4	--	1.00	0.12	Tier 1/MSHA	0.81	0.21	20	1	20	5200
				286,575													

Source	NOx Maximum Hourly Emissions (lb/hr)	NOx Maximum 24-Hr Emissions (lb/day)	NOx Annual Average Emissions (tpy)	CO Maximum Hourly Emissions (lb/hr)	CO Maximum 24-Hr Emissions (lb/day)	CO Annual Average Emissions (tpy)	PM Maximum Hourly Emissions (lb/hr)	PM Maximum 24-Hr Emissions (lb/day)	PM Annual Average Emissions (tpy)	SO2 Maximum Hourly Emissions (lb/hr)	SO2 Maximum 24-Hr Emissions (lb/day)	SO2 Annual Average Emissions (tpy)	VOC Maximum Hourly Emissions (lb/hr)	VOC Maximum 24-Hr Emissions (lb/day)	VOC Annual Average Emissions (tpy)	CH_2O Maximum Hourly Emissions (lb/hr)	CH_2O Maximum 24-Hr Emissions (lb/day)	CH_2O Annual Average Emissions (tpy)
OPEN PIT MINING																		
MAJOR EQUIPMENT																		
330 LX Linkbelt Excavator	1.1167	18.0900	3.2924	0.6452	10.4520	1.9023	0.0037	0.0603	0.0110	0.0006	0.0233	0.0043	0.0993	1.6080	0.2927	0.0298	0.4824	0.0878
16M CAT Motor Grader	1.7384	28.1620	5.1255	1.0044	16.2714	2.9614	0.0058	0.0939	0.0171	0.0007	0.0131	0.0024	0.1545	2.5033	0.4556	0.0464	0.7510	0.1367
140 CAT Motor Grader	0.8780	14.2232	2.5886	0.7219	11.6946	2.1284	0.0029	0.0474	0.0086	0.0004	0.0088	0.0016	0.0780	1.2643	0.2301	0.0234	0.3793	0.0690
D-8 CAT track Dozer	2.0311	32.9030	5.9884	1.1735	19.0106	3.4599	0.0068	0.1097	0.0200	0.0014	0.0270	0.0049	0.1354	2.1935	0.3992	0.0542	0.8774	0.1597
D-9 CAT Track Dozer	2.6925	43.6179	7.9385	1.5556	25.2014	4.5867	0.0090	0.1454	0.0265	0.0018	0.0357	0.0065	0.1795	2.9079	0.5292	0.0718	1.1631	0.2117
A30D Volvo Atriculated Truck	5.0923	82.4946	15.0140	2.9422	47.6636	8.6748	0.0170	0.2750	0.0500	0.0011	0.0444	0.0081	0.3395	5.4996	1.0009	0.1358	2.1999	0.4004
980 CAT Wheel Loader	2.3003	37.2648	6.7822	1.3291	21.5308	3.9186	0.0077	0.1242	0.0226	0.0007	0.0139	0.0025	0.1534	2.4843	0.4521	0.0613	0.9937	0.1809
637 CAT Twin Engine Scraper	13.7491	222.7355	40.5379	7.9439	128.6916	23.4219	0.2292	3.7123	0.6756	0.0024	0.1430	0.0261	0.9166	14.8490	2.7025	0.3666	5.9396	1.0810
CAT Single Engine Scraper	5.7946	93.8732	17.0849	3.3480	54.2379	9.8713	0.0193	0.3129	0.0569	0.0003	0.0168	0.0031	0.3863	6.2582	1.1390	0.1545	2.5033	0.4556
623 CAT Self Loading Scraper	1.9315	31.2911	5.6950	1.1160	18.0793	3.2904	0.0064	0.1043	0.0190	0.0008	0.0168	0.0031	0.1288	2.0861	0.3797	0.0515	0.8344	0.1519
Water truck 3000 gallons	1.1706	18.9643	3.4515	0.6764	10.9571	1.9942	0.0039	0.0632	0.0115	0.0002	0.0047	0.0009	0.1041	1.6857	0.3068	0.0312	0.5057	0.0920
Water Truck 8000 gallons	2.9266	47.4107	8.6288	1.6909	27.3929	4.9855	0.0098	0.1580	0.0288	0.0005	0.0095	0.0017	0.1951	3.1607	0.5753	0.0780	1.2643	0.2301
MINE SUPPORT VEHICLES																		
Fuel/lube truck	2.3413	37.9286	6.9030	1.3527	21.9143	3.9884	0.0078	0.1264	0.0230	0.0000	0.0000	0.0000	0.1561	2.5286	0.4602	0.0624	1.0114	0.1841
Mechanical Service Truck	2.3413	37.9286	6.9030	1.3527	21.9143	3.9884	0.0078	0.1264	0.0230	0.0000	0.0000	0.0000	0.1561	2.5286	0.4602	0.0624	1.0114	0.1841
Rubber tire backhoe CAT 414e w/forklift attachme	0.1493	2.4180	0.4401	0.1062	1.7205	0.3131	0.0004	0.0070	0.0013	0.0006	0.0121	0.0022	0.0115	0.1860	0.0339	0.0034	0.0558	0.0102
Pickup Trucks 4WD. 3/4-ton	0.0928	1.5030	0.2735	0.3150	5.1030	0.9287	0.0833	1.3500	0.2457	0.0000	0.0002	0.0000	0.0222	0.3600	0.0655	negl.	negl.	negl.
UNDERGROUND MINING																		
MAJOR EQUIPMENT																		
Model Boomer SL1 Face Drill	1.7857	28.9286	3.7607	1.4683	23.7857	3.0921	0.0873	1.4143	0.1839	0.0004	0.0153	0.0028	0.1587	2.5714	0.3343	0.0476	0.7714	0.1003
104 Face Drill	0.5952	9.6429	1.2536	0.4894	7.9286	1.0307	0.0291	0.4714	0.0613	0.0003	0.0044	0.0008	0.0529	0.8571	0.1114	0.0159	0.2571	0.0334
Model Boomer S10-DH Face Drill	0.5952	9.6429	1.2536	0.4894	7.9286	1.0307	0.0291	0.4714	0.0613	0.0004	0.0051	0.0009	0.0529	0.8571	0.1114	0.0159	0.2571	0.0334
Model Boltec SL Bolter	1.2470	20.2020	2.6263	0.8873	14.3745	1.8687	0.0719	1.1655	0.1515	0.0003	0.0255	0.0047	0.0959	1.5540	0.2020	0.0288	0.4662	0.0606
Model Boltec 235 Bolter	0.3563	5.7720	0.7504	0.2535	4.1070	0.5339	0.0206	0.3330	0.0433	0.0004	0.0102	0.0019	0.0274	0.4440	0.0577	0.0082	0.1332	0.0173
Model ST7LP Scooptram	2.6833	43.4700	5.6511	3.3056	53.5500	6.9615	0.1556	2.5200	0.3276	0.0011	0.0613	0.0112	0.3889	6.3000	0.8190	0.0467	0.7560	0.0983
Model ST7 Scooptram	1.3417	21.7350	2.8256	1.6528	26.7750	3.4808	0.0778	1.2600	0.1638	0.0005	0.0146	0.0027	0.1944	3.1500	0.4095	0.0233	0.3780	0.0491
MINE SUPPORT VEHICLES																		
Power Buggies	0.2407	3.9000	0.5070	0.1713	2.7750	0.3608	0.0139	0.2250	0.0293	0.0001	0.0024	0.0004	0.0185	0.3000	0.0390	0.0056	0.0900	0.0117
Bobcat Skidsteer	0.2407	3.9000	0.5070	0.1713	2.7750	0.3608	0.0139	0.2250	0.0293	0.0003	0.0088	0.0016	0.0185	0.3000	0.0390	0.0056	0.0900	0.0117
Utility Truck-flatbed	0.3382	5.4786	0.7122	0.2406	3.8982	0.5068	0.0195	0.3161	0.0411	0.0000	0.0000	0.0000	0.0260	0.4214	0.0548	0.0078	0.1264	0.0164
Scissor Truck	0.9630	15.6000	2.0280	0.6852	11.1000	1.4430	0.0556	0.9000	0.1170	0.0000	0.0051	0.0009	0.0741	1.2000	0.1560	0.0222	0.3600	0.0468
Man trips	1.0689	17.3160	2.2511	0.7606	12.3210	1.6017	0.0617	0.9990	0.1299	0.0002	0.0144	0.0026	0.0822	1.3320	0.1732	0.0247	0.3996	0.0519
Pickup trucks. 4 WD. 3/4-ton	0.0928	1.5030	0.1954	0.3150	5.1030	0.6634	0.0833	1.3500	0.1755	0.0000	0.0001	0.0000	0.0222	0.3600	0.0468	negl.	negl.	negl.
Fuel/lube truck	3.5899	58.1571	7.5604	4.4224	71.6429	9.3136	0.2081	3.3714	0.4383	0.0000	0.0000	0.0000	0.5203	8.4286	1.0957	0.0624	1.0114	0.1315
Forklift	3.5899	58.1571	7.5604	4.4224	71.6429	9.3136	0.2081	3.3714	0.4383	0.0000	0.0000	0.0000	0.5203	8.4286	1.0957	0.0624	1.0114	0.1315
Mechanical Service Truck	1.2778	20.7000	2.6910	1.5741	25.5000	3.3150	0.0741	1.2000	0.1560	0.0000	0.0000	0.0000	0.1852	3.0000	0.3900	0.0222	0.3600	0.0468
Total Surface	46.3462	750.8085	136.6471	27.2738	441.8353	80.4140	0.4208	6.8164	1.2406	0.0115	0.3692	0.0674	3.2163	52.1038	9.4829	1.2329	19.9728	3.6350
Total Underground	20.0065	324.1051	42.1337	21.3091	345.2073	44.8769	1.2095	19.5936	2.5472	0.0038	0.1672	0.0305	2.4385	39.5043	5.1356	0.3993	6.4680	0.8408
Total Mine	66.3527	1074.9136	178.7808	48.5829	787.0426	125.2910	1.6302	26.4100	3.7878	0.0153	0.5365	0.0979	5.6548	91.6081	14.6185	1.6321	26.4408	4.4759

Notes:

[1] 90% availability. 90% utilization.
Availability means: availability of unit due to maintenance or other mechanical downtime. This is typically 85% for underground operations, 90% was used for this analysis.
Use of availability (utilization) means: percent of available unit operation time due non-mechanical reasons such as employee lunch and break time. 90% was conservatively used in this analysis.
Total availability = 90% availability x 90% utilization = 0.81

[2] Engine load factors from EPA/420-P-02-014. Load factors indicate the average proportion of rated power used. Rated power is the maximum power level that an engine is designed to produce at its rated speed.

[3] Equipment details, quantity, horsepower, and fuel consumption from Proponent, "2011 POO Equipment Consumption.xls".

[4] Formaldehyde emission factor from AP-42 Volume II.

[5] Undergound equipment emissions maximum allowable under MSHA, codified in 30 CFR Section 57.5067.

[6] Operating rates and annual hours based on surface mine operating schedule of two. 10-hour daily shifts. seven days per week. and underground mine operating schedule of two. 10-hour daily shifts. five days per week.

Sheep Mountain Mine

Mobile and Nonroad Source Diesel Combustion HAP Emissions

Appendix A - Table PN16

Source	Typical Engine Model	Engine Horsepower (hp)	Number of Units	Fuel Consumption[3] (gal/yr)	VOC Emission Factor (g/hp-hr)	Benzene in VOC by Weight[6] (%)	Toluene in VOC by Weight[6] (%)	Ethylbenzene in VOC by Weight[6] (%)	n-hexane in VOC by Weight[6] (%)	CH_2O Emission Factor[4] (g/hp-hr)	Emission Factor Basis[5]	Equipment Availability and Utilization [1]	Load Factor[2]	Daily Operating Rate per Unit[6] (hr/day)	Daily Operating Hours[7] (hr/day)	Annual Operating Hours[7] (hr/yr)	VOC Maximum 24-Hr Emissions (lb/day)	VOC Annual Average Emissions (tpy)	Benzene Maximum 24-Hr Emissions (lb/day)	Benzene Annual Average Emissions (tpy)	Toluene Maximum 24-Hr Emissions (lb/day)	Toluene Annual Average Emissions (tpy)	Ethylbenzene Maximum 24-Hr Emissions (lb/day)	Ethylbenzene Annual Average Emissions (tpy)	n-Hexane Maximum 24-Hr Emissions (lb/day)	n-Hexane Annual Average Emissions (tpy)	CH_2O Maximum 24-Hr Emissions (lb/day)	CH_2O Annual Average Emissions (tpy)
OPEN PIT MININING																												
MAJOR EQUIPMENT																												
330 LX Linkbelt Excavator		268	2	40,000	0.40	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.21	20	40	14560	1.6080	0.2927	0.0515	0.0094	0.0236	0.0043	0.0059	0.0011	0.0123	0.0022	0.4824	0.0878
16M CAT Motor Grader		297	1	22,500	0.40	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	20	7280	2.5033	0.4556	0.0802	0.0146	0.0368	0.0067	0.0092	0.0017	0.0192	0.0035	0.7510	0.1367
140 CAT Motor Grader		150	1	15,000	0.40	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	20	7280	1.2643	0.2301	0.0405	0.0074	0.0186	0.0034	0.0047	0.0008	0.0097	0.0018	0.3793	0.0690
D-8 CAT track Dozer		347	1	46,250	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	20	7280	2.1935	0.3992	0.0703	0.0128	0.0322	0.0059	0.0081	0.0015	0.0168	0.0031	0.8774	0.1597
D-9 CAT Track Dozer		460	1	61,250	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	20	7280	2.9079	0.5292	0.0932	0.0170	0.0427	0.0078	0.0107	0.0019	0.0223	0.0041	1.1631	0.2117
A30D Volvo Atriculated Truck	*Assume CAT D30D	435	2	76,000	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	40	14560	5.4996	1.0009	0.1762	0.0321	0.0808	0.0147	0.0202	0.0037	0.0422	0.0077	2.1999	0.4004
980 CAT Wheel Loader		393	1	23,750	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	20	7280	2.4843	0.4521	0.0796	0.0145	0.0365	0.0066	0.0091	0.0017	0.0190	0.0035	0.9937	0.1809
637 CAT Twin Engine Scraper		783	3	245,000	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	60	21840	14.8490	2.7025	0.4757	0.0866	0.2183	0.0397	0.0546	0.0099	0.1138	0.0207	5.9396	1.0810
CAT Single Engine Scraper		330	3	28,750	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	60	21840	6.2582	1.1390	0.2005	0.0365	0.0920	0.0167	0.0230	0.0042	0.0480	0.0087	2.5033	0.4556
623 CAT Self Loading Scraper		330	1	28,750	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	20	7280	2.0861	0.3797	0.0668	0.0122	0.0307	0.0056	0.0077	0.0014	0.0160	0.0029	0.8344	0.1519
Water truck 3000 gallons	*Assume half CAT 613	200	1	8,125	0.40	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	20	7280	1.6857	0.3068	0.0540	0.0098	0.0248	0.0045	0.0062	0.0011	0.0129	0.0024	0.5057	0.0920
Water Truck 8000 gallons	*Assume CAT 613	500	1	16,250	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	20	7280	3.1607	0.5753	0.1013	0.0184	0.0465	0.0085	0.0116	0.0021	0.0242	0.0044	1.2643	0.2301
MINE SUPPORT VEHICLES																												
Fuel/lube truck	Assume 3/4 ton diesel	400	1	37.5	0.30	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2	0.81	0.59	20	20	7280	2.5286	0.4602	0.0264	0.0048	0.0384	0.0070	0.0045	0.0008	0.0000	0.0000	1.0114	0.1841
Mechanical Service Truck	Assume 3/4 ton diesel	400	1	37.5	0.30	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2	0.81	0.59	20	20	7280	2.5286	0.4602	0.0264	0.0048	0.0384	0.0070	0.0045	0.0008	0.0000	0.0000	1.0114	0.1841
Rubber tire backhoe CAT 414e w/forklift attachme	*Assume 416c	62	1	20,750	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2	0.81	0.21	20	20	7280	0.1860	0.0339	0.0019	0.0004	0.0028	0.0005	0.0003	0.00006	0.0000	0.0000	0.0558	0.0102
Pickup Trucks 4WD, 3/4-ton	*Assume 400 miles per 6 hrs, as per multiple 350 engines	315	8	300	0.004	1.0450	1.5179	0.1793	0.0000	negl.	MOBILE6	0.81	1.0	20	160	58240	0.3600	0.0655	0.0038	0.0007	0.0055	0.0010	0.0006	0.00012	0.0000	0.0000	negl.	negl.
				632,750																								
UNDERGROUND MINING																												
MAJOR EQUIPMENT																												
Model Boomer SL1 Face Drill	*Assume CAT D4B, similar power/weight/engine	150	3	26,250	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.40	20	60	15600	2.5714	0.3343	0.0269	0.0035	0.0390	0.0051	0.0046	0.0006	0.0000	0.0000	0.7714	0.1003
104 Face Drill	*Assume CAT D3, similar power/weight/engine	150	1	7,500	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.40	20	20	5200	0.8571	0.1114	0.0090	0.0012	0.0130	0.0017	0.0015	0.0002	0.0000	0.0000	0.2571	0.0334
Model Boomer S10-DH Face Drill	*Assume CAT D4B, similar power/weight/engine	150	1	8,750	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.40	20	20	5200	0.8571	0.1114	0.0090	0.0012	0.0130	0.0017	0.0015	0.0002	0.0000	0.0000	0.2571	0.0334
Model Boltec SL Bolter	*Assume CAT D4B, similar power/weight/engine	74	7	43,750	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.21	20	140	36400	1.5540	0.2020	0.0162	0.0021	0.0236	0.0031	0.0028	0.0004	0.0000	0.0000	0.4662	0.0606
Model Boltec 235 Bolter	*Assume CAT D4B, similar power/weight/engine	74	2	17,500	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.21	20	40	10400	0.4440	0.0577	0.0046	0.0006	0.0067	0.0009	0.0008	0.0001	0.0000	0.0000	0.1332	0.0173
Model ST7LP Scooptram	*Assume CAT AD45, Fluid specs not in handbook 38	210	4	105,000	1.00	1.0450	1.5179	0.1793	0.0000	0.12	Tier 1/MSHA	0.81	0.21	20	80	20800	6.3000	0.8190	0.0658	0.0086	0.0956	0.0124	0.0113	0.0015	0.0000	0.0000	0.7560	0.0983
Model ST7 Scooptram	*Assume CAT R1300G, Fluid specs not in handbook 38	210	2	25,000	1.00	1.0450	1.5179	0.1793	0.0000	0.12	Tier 1/MSHA	0.81	0.21	20	40	10400	3.1500	0.4095	0.0329	0.0043	0.0478	0.0062	0.0056	0.0007	0.0000	0.0000	0.3780	0.0491
MINE SUPPORT VEHICLES																												
Power Buggies	*Assume Whiteman Series WBH16AEWD 18 hp Gas Engine.	50	2	4,100	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.21	20	40	10400	0.3000	0.0390	0.0031	0.0004	0.0046	0.0006	0.0005	0.0001	0.0000	0.0000	0.0900	0.0117
Bobcat Skidsteer	*Assume CAT D3B	50	2	15,000	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.21	20	40	10400	0.3000	0.0390	0.0031	0.0004	0.0046	0.0006	0.0005	0.0001	0.0000	0.0000	0.0900	0.0117
Utility Truck-flatbed		50	1	37.5	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.59	20	20	5200	0.4214	0.0548	0.0044	0.0006	0.0064	0.0008	0.0008	0.0001	0.0000	0.0000	0.1264	0.0164
Scissor Truck	Assume same as the Bolter	50	8	8,750	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.21	20	160	41600	1.2000	0.1560	0.0125	0.0016	0.0182	0.0024	0.0022	0.0003	0.0000	0.0000	0.3600	0.0468
Man trips	Assume same as Powerbuggy	74	6	24,600	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.21	20	120	31200	1.3320	0.1732	0.0139	0.0018	0.0202	0.0026	0.0024	0.0003	0.0000	0.0000	0.3996	0.0519
Pickup trucks, 4 WD, 3/4-ton	Assume same specs as the Conventional Mine	315	8	187.5	0.004	1.0450	1.5179	0.1793	0.0000	negl.	Mobile 6	0.81	1.0	20	160	41600	0.3600	0.0468	0.0038	0.0005	0.0055	0.0007	0.0006	0.0001	0.0000	0.0000	negl.	negl.
Fuel/lube truck		400	1	37.5	1.00	1.0450	1.5179	0.1793	0.0000	0.12	Tier 1/MSHA	0.81	0.59	20	20	5200	8.4286	1.0957	0.0881	0.0115	0.1279	0.0166	0.0151	0.0020	0.0000	0.0000	1.0114	0.1315
Forklift		400	1	37.5	1.00	1.0450	1.5179	0.1793	0.0000	0.12	Tier 1/MSHA	0.81	0.59	20	20	5200	8.4286	1.0957	0.0881	0.0115	0.1279	0.0166	0.0151	0.0020	0.0000	0.0000	1.0114	0.1315
Mechanical Service Truck		400	1	75.0	1.00	1.0450	1.5179	0.1793	0.0000	0.12	Tier 1/MSHA	0.81	0.21	20	20	5200	3.0000	0.3900	0.0314	0.0041	0.0455	0.0059	0.0054	0.0007	0.0000	0.0000	0.3600	0.0468
				286,575																								
																Total Surface	52.1038	9.4829	1.5482	0.2818	0.7686	0.1399	0.1811	0.0330	0.3565	0.0649	19.9728	3.6350
																Total Underground	39.5043	5.1356	0.4128	0.0537	0.5996	0.0780	0.0708	0.0092	0.0000	0.0000	6.4680	0.8408
																Total Mine	91.6081	14.6185	1.9610	0.3354	1.3682	0.2178	0.2519	0.0422	0.3565	0.0649	26.4408	4.4759

Notes:

[1] 90% availability, 90% utilization.
Availability means: availability of unit due to maintenance or other mechanical downtime. This is typically 85% for underground operations, 90% was used for this analysis.
Use of availability (utilization) means: percent of available unit operation time due non-mechanical reasons such as employee lunch and break time. 90% was conservatively used in this analysis.
Total availability = 90% availability x 90% utilization = 0.81

[2] Engine load factors from EPA/420-P-02-014. Load factors indicate the average proportion of rated power used. Rated power is the maximum power level that an engine is designed to produce at its rated speed.

[3] Equipment details, quantity, horsepower, and fuel consumption from Proponent, "2011 POO Equipment Consumption.xls".

[4] Formaldehyde emission factor from AP-42 Volume II.

[5] Undergound equipment emissions maximum allowable under MSHA, codified in 30 CFR Section 57.5067.

[6] HAP % by weight in total VOC emissions from U.S. EPA SPECIATE database. Large diesel equipment % from "Diesel exhaust emissions from Pre-2007 Model Year Heavy-duty Diesel Trucks" (Number 8774).
Mine support vehicles % from "Diesel Exhaust - Medium Duty Trucks (Number 4674).

[7] Operating rates and annual hours based on surface mine operating schedule of two, 10-hour daily shifts, seven days per week, and underground mine operating schedule of two, 10-hour daily shifts, five days per week.

Sheep Mountain Mine **Appendix A - Table PN17**
Diesel Combustion GHG Emissions

Emissions Source	Fuel	Fuel Rate		Fuel HHV		Part 98 CO_2 Emission Factor		Part 98 CH_4 Emission Factor		Part 98 N_2O Emission Factor		CO_2 Emissions (kg/yr)	CH_4 Emissions (kg/yr)	N_2O Emissions (kg/yr)	Part 98 CH_4 GWP	Part 98 N_2O GWP	CO_2e Emissions (mtpy)
Mine-Wide Diesel Combustion	Distillate Fuel Oil #2	1,077,975	gal/yr	0.138	mmBTU/gal Table C-1 default	73.96	kg/mmBtu Table C-1	0.003	kg/mmBtu Table C-2	0.0006	kg/mmBtu Table C-2	11,002,330	446.2817	89.2563	21.0000	310.0000	11,039.3717
Mine Intake Air Heaters	Natural Gas	900,000	scf/yr	0.001028	mmBTU/scf Table C-1 default	53.02	kg/mmBtu Table C-1	0.001	kg/mmBtu Table C-2	0.0001	kg/mmBtu Table C-2	49,054	0.9252	0.0925	21.0000	310.0000	49.1022
Facility Heaters	Natural Gas	3,950,000	scf/yr	0.001028	mmBTU/scf Table C-1 default	53.02	kg/mmBtu Table C-1	0.001	kg/mmBtu Table C-2	0.0001	kg/mmBtu Table C-2	215,293	4.0606	0.4061	21.0000	310.0000	215.5042
																Total CO_2e Emission Rate (metric tons/year)	11,303.9780

Notes:
Fuel HHV from 40 CFR Part 98 Table C-1.
Emission factors from 40 CFR Part 98 Table C-1 and Table C-2.
mtpy = Metric Tons per Year
GWP - Global Warming Potential (for CO_2e calculation of non-CO_2 emissions).
CO_2e emissions calculated as CO_2 + (CH_4 x CH_4 GWP) + (N_2O x N_2O GWP).
CO_2 calculations based on 40 CFR 98.33(a)(1) Eq. C-1.
CH_4, N_2O calculations based on 40 CFR 98.33(c)(1) Eq C-8.
Diesel fuel consumption rates from Energy Fuels letter dated October 28, 2013.
Natural gas consumption rates from Energy Fuels letter dated October 28, 2013.

Sheep Mountain Mine
Production Phase with Off-Site Processing
Air Emissions Summary

Appendix A - Table PF1

Source ID Number	Description	General Location	Point, Fugitive or Nonroad	Annual PM_{10} Emissions (tpy) [1]	24-Hour PM_{10} Emissions (lb/day)	Annual $PM_{2.5}$ Emissions (tpy) [1]	24-Hour $PM_{2.5}$ Emissions (lb/day)	Annual NO_x Emissions (tpy) [1]	24-Hour NO_x Emissions (lb/day)	Annual CO Emissions (tpy) [1]	24-Hour CO Emissions (lb/day)	Annual SO_2 Emissions (tpy) [1]	24-Hour SO_2 Emissions (lb/day)	Annual VOC Emissions (tpy) [1]	24-Hour VOC Emissions (lb/day)	Annual H2SO4 Emissions (tpy)	Annual H2SO4 Emissions (lb/day)	Annual CH_2O Emissions (tpy)	24-Hour CH_2O Emissions (lb/day)	Annual CO2e Emissions (metric tpy)	Annual Benzene Emissions (tpy)	Annual Toluene Emissions (tpy)	Annual Ethylbenzene Emissions (tpy)	Annual n-hexane Emissions (tpy)
1.0	**Mine Sources**																							
	Blasting - Particulate	Underground	F	0.0139	0.0802	0.0008	0.0046	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Blasting - Gaseous	Underground	F	--	--	--	--	6.3450	34.8100	22.1225	121.4600	0.6025	3.3100	--	--	--	--	--	--	--	--	--	--	--
	Natural Gas Heaters - Mine Intake	Underground	P	0.0034	0.0187	0.0034	0.0187	0.0450	0.2466	0.0378	0.2071	0.0003	0.0015	0.0025	0.0136	--	--	3.38E-05	1.85E-04	49.1022	9.45E-07	1.53E-06	--	8.10E-04
	Primary Crusher	Underground	P	0.1656	1.3500	0.0248	0.2025	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Coarse Ore Conveyor Transfers	Underground	P	0.0772	0.4230	0.0154	0.0846	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Underground Mobile Sources	Underground	N	2.5472	19.5936	2.5472	19.5936	42.1337	324.1051	44.8769	345.2073	0.0305	0.1672	5.1356	39.5043	--	--	0.8408	6.4680	3178.4673	0.0537	0.0780	0.0092	0.0000
2.0	**Surface Sources**																							
	Dozing	Pit	F	7.4264	28.5632	3.8996	14.9986	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Product Removal	Pit	F	0.3312	1.8144	0.0662	0.3629	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Overburden Removal	Pit	F	35.1897	192.8250	7.0379	38.5650	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Overburden Unloading	Spoils	F	7.5784	41.5267	1.5157	8.3053	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Truck Dump	Truck Dump	P	1.8768	10.2838	0.3754	2.0568	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Primary Crusher	Crusher	P	0.3312	2.7000	0.0497	0.4050	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Overland Coarse Ore Conveyor	Crusher to Pad	P	2.4128	13.2208	0.4826	2.6442	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Radial Stacker to Leach Pad	Leach Pad	F	0.7307	4.0039	0.1461	0.8008	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Surface Facilities Heating	Shop, Plant, Office	P	0.0150	0.0822	0.0150	0.0822	0.1975	1.0822	0.1659	0.9090	0.0012	0.0065	0.0109	0.0595	--	--	0.0001	0.0008	215.5042	4.15E-06	6.72E-06	--	0.0036
	Production Facility-Point Sources	Plant	P	0.0520	5.5306	0.0519	5.5302	0.6925	77.7132	0.4844	18.5827	0.0135	4.9622	41.7635	234.7306	0.0000	0.0000	--	--	--	--	--	--	--
	Production Facility-Fugitive Sources	Plant	F	21.8880	119.9342	3.2832	17.9901	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3.0	**Unpaved Roads**																							
	Surface Ore Haul to Truck Dump	Pit to Truck Dump	F	5.7173	29.3626	0.5717	2.9363	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Haul to Off-Site Mill	Ore Stckpl to Mill	F	24.0125	154.1537	2.4013	15.4154	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Surface Haul OB to Hanks Draw Spoils	Pit to Spoils	F	49.1143	317.8920	4.9114	31.7892																	
	Surface Haul OB to South Spoils	Pit to Spoils	F	27.0201	174.8871	2.7020	17.4887																	
	Water Trucks (2)	Haul Routes	F	5.3053	63.1579	0.5305	6.3158	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Haul Road Repair (Grading)	Haul Routes	F	0.4781	3.8250	0.0433	0.6585	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Light Vehicles	Unpaved Roads	F	2.0577	28.9354	0.2058	2.8935	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Bulk Delivery Trucks[6]	Haul Routes	F	0.3594	6.5322	0.0359	0.6532	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4.0	**Wind Erosion**																							
	Open Acres	Mine-Wide	F	24.6240	134.9260	3.6936	20.2389	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Stockpiles	Mine-Wide	F	34.8271	190.8332	5.2241	28.6250	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5.0	**Surface Mobile Sources**																							
	Surface Mobile/Nonroad Sources	Mine-Wide	N/M	1.2906	7.0914	1.2906	7.0914	151.6612	833.3031	89.0888	489.4989	0.0755	0.4136	10.4838	57.6035	--	--	4.0354	22.1727	7860.9044	0.1044	0.0554	0.0124	0.0232
	Total Point Source Emissions			4.9340	33.6092	1.0182	11.0243	0.9350	79.0419	0.6881	19.6989	0.0150	4.9702	41.7768	234.8036	0.0000	0.0000	1.82E-04	1.85E-04	264.6064	5.09E-06	8.25E-06	--	4.37E-03
	Total Fugitive Source Emissions			246.6742	1493.2529	36.2693	208.0419	6.3450	34.8100	22.1225	121.4600	0.6025	3.3100	--	--	--	--	--	--	--	--	--	--	--
	Total Nonroad/Mobile Source Emissions			3.8378	26.6850	3.8378	26.6850	193.7948	1157.4083	133.9657	834.7061	0.1060	0.5808	15.6194	97.1078	0.0000	0.0000	4.8763	28.6407	11039.3717	0.1580	0.1333	0.0216	0.0232
	Total Annual Emissions Production Phase			255.4459		41.1253		201.0749		156.7764		0.7235		57.3962		0.0000		4.8764		11303.9780	0.1580	0.1333	0.0216	0.0275

1. Annual emission rates may not be equivalent to daily emission rates x 365 days/year due to limitations on annual operating schedule, fuel input, or other factors. See individual calculation sheets for source-specific details.

Sheep Mountain Mine
Activity Data

Appendix A - Table PF2

Phase	Location	Activity	Parameter Description	Value
Production	Underground	UG Blasting - Particulate	Area blasted (ft2)	150
			Annual blasts (blasts/yr)	2080
			max daily blasts (blasts/day)	6
		UG Blasting - Gaseous	ANFO Use (annual tpy)	575
			ANFO Use (max daily tpd)	1.58
			High Explosives Use (annual tpy)	55
			High Explosives Use (max daily tpd)	0.15
		Surface Blasting - Particulate	Area blasted (ft2), annual blasts (blasts/yr), max daily blasts (blasts/day)	none
		Surface Blasting - Gaseous	ANFO Use (need annual tpy, max daily tpd)	none
			High Explosives Use (need annual tpy, max daily tpd)	none
		Natural Gas Heaters - Mine Intake	Natural gas use (scf/yr)	900,000
		Primary Crusher	Annual Throughput (tpy)	368,000
			Max Daily Throughput (tpd)	1500
		Coarse Ore Conveyor Transfers UG	Annual Throughput (tpy)	386000
			Max Daily Throughput (tpd)	1058
			Conveyor Transfers (number of transfers)	1
		Underground Mobile Sources	HP	See calculation
			Quantity	See calculation
			Annual operating hours	See calculation
Production	Surface	Dozing	Annual operating hours (hrs/year)	10400
			Maximum Daily Operating hours (hrs/day)	20
		Product Removal	Annual Throughput (tpy)	736000
			Max Daily Throughput (tpd)	2016
		Overburden Removal	Annual Throughput (tpy)	15639886
			Max Daily Throughput (tpd)	42850
		Overburden Unloading	Annual Throughput (tpy)	15639886
			Max Daily Throughput (tpd)	42850
		Truck Dump from Surface	Annual Throughput (tpy)	736000
			Max Daily Throughput (tpd)	2016
		Primary Crusher	Annual Throughput (tpy)	736000
			Max Daily Throughput (tpd)	3000
		Overland Coarse Ore Conveyor	Annual Throughput (tpy)	1508000
			Max Daily Throughput (tpd)	4132
			Conveyor Transfers (number of transfers)	8
		Radial Stacker to Leach Pad	Annual Throughput (tpy)	1508000
			Max Daily Throughput (tpd)	2066
		Surface Facilities Heating	Natural gas use (scf/yr)	3950000
			Or unit-specific data, if available (heat input mmbtu/hr or max fuel consumption, operating hours)	
Production	Unpaved Roads	Surface Ore Haul to Truck Dump	Annual Throughput (tpy)	736000
			Max Daily Throughput (tpd)	2016
			Round Trips per day	64

			Round Trip Distance (average miles)	0.5
		Water Trucks	--	See calculation
		Haul Road Repair	--	See calculation
		Bulk Delivery Trucks	--	See calculation
		Employee Traffic	--	See calculation
Production	Wind Erosion	Open Acres (acres)	--	230
		Alternate Spoils 1 and Spoils 2 (m2)	--	578,700
		Topsoil Stockpile (acres)	--	36.1
Production	Surface Combustion	Surface Mobile/Nonroad Sources	HP	See calculation
			Quantity	See calculation
			Annual operating hours	See calculation
		Mine-Wide Diesel Combustion	Mine-wide annual diesel fuel consumption (gal)	1077975
Production	On-Site Ore Processing	Uranium Dryer	Design capacity (mmbtu/hr)	1.25
		Emergency Generator	kW or hp rating	75 / 100.5
		Diluent Tank	Annual throughput (gal)	115,500
		Organic Holding Tank No. 1	Annual throughput (gal)	115,500
		Organic Holding Tank No. 2	Annual throughput (gal)	115,500
		Sulfuric Acid Tank	Annual throughput (gal)	3,120,000
		Holding Pond Evaporation Pond	Liquid entry rate (lb/hr)	25,000
		Collection Pond	Average surface area (50% full)	43,100
		Raffinate Pond	Average surface area (50% full)	29,200
		DE Bag Breaking	DE used (lb/day)	250
		Heap Leach Wind Erosion	Area (acres)	40
Production	Off-Site Ore Processing	Ore Truck Loading	Annual Throughput (tpy)	736000
			Max Daily Throughput (tpd)	2016
		Ore Truck Travel Off-Site	Round Trips per day	80
			Round Trip Distance - Total (average miles)	68
			Round Trip Distance - from load-out, on BLM Lands (average miles)	2.06
Data Source: Data provided to CLC by Energy Fuels, October 23, 2013 in "Sheep Mountain AQ Data Request 10-23-13_EFR.xlsx".				

Sheep Mountain Mine
Blasting - Particulate Emissions

Appendix A - Table PF3

Activity	Area Blasted[1]	Blasts per Year	Blasts per Day	PM_{10} Emission Factor[2]	$PM_{2.5}$ Emission Factor[2]	Annual PM_{10} Emissions	Max 24-Hr PM_{10} Emissions	Annual $PM_{2.5}$ Emissions	Max 24-Hr $PM_{2.5}$ Emissions
	(ft^2)			(lb/blast)	(lb/blast)	(tpy)	(lb/day)	(tpy)	(lb/day)
Underground	150	2,080	6.00	0.013	0.0008	0.0139	0.0802	0.0008	0.0046

Notes:
[1] Estimated.
[2] AP-42, 11.9, Western Surface Coal Mining, Table 11.9-1.
PM_{10} Emission Factor = $(0.000014)A^{1.5}$ * 0.52 (lb/blast)
$PM_{2.5}$ Emission Factor = $(0.000014)A^{1.5}$ * 0.03 (lb/blast)

Sheep Mountain Mine **Appendix A - Table PF4**

Blasting - Gaseous Emissions

Explosive	Pollutant	Annual Explosive Usage	Daily Explosive Usage[1]	Emission Factor[2]	Annual Emissions	Max 24-Hr Emissions
		(tpy)	(tons/day)	(lb/ton)	(tpy)	(lb/day)
ANFO	NO_x	575	1.58	17	4.8875	26.8600
	CO	575	1.58	67	19.2625	105.8600
	SO_2	575	1.58	2	0.5750	3.1600
High Explosive	NO_x	55	0.15	53	1.4575	7.9500
	CO	55	0.15	104	2.8600	15.6000
	SO_2	55	0.15	1	0.0275	0.1500
Total	NO_x				6.3450	34.8100
	CO				22.1225	121.4600
	SO_2				0.6025	3.3100

Note:

[1] Daily use calculated as annual use (tpy) / 365 days per year.

[2] AP-42 (EPA, 1980), Table 13.3-1, "Emission Factors for Detonation Explosives."

Emission factors selected for ammonium nitrate combined with fuel oil.

Emission factors selected for high explosives are those for gelatin dynamite with a range of 20-100% nitroglycerine.

Sheep Mountain Mine **Appendix A - Table PF5**

Natural Gas-Fired Mine Intake Air Heaters

Pollutant	Emission Factor[1]	Natural Gas	Annual Emissions[2]	Max.24-Hour Emissions
	($lb/10^6$ scf)	(10^6 scf/day)	(tpy)	(lb/day)
PM_{10}	7.6	0.00247	0.0034	0.0187
$PM_{2.5}$	7.6	0.00247	0.0034	0.0187
NO_x	100.0	0.00247	0.0450	0.2466
CO	84.0	0.00247	0.0378	0.2071
VOC	5.5	0.00247	0.0025	0.0136
SO_2	0.6	0.00247	0.0003	0.0015
Benzene	0.0021	0.00247	9.45E-07	5.18E-06
Toluene	0.0034	0.00247	1.53E-06	8.38E-06
Hexane	1.8	0.00247	8.10E-04	4.44E-03
CH_2O	0.075	0.00247	3.38E-05	1.85E-04

Notes:

[1] AP-42 (EPA, 1998), Section 1.4, "Natural Gas Combustion." Uncontrolled small natural gas boilers.

[2] Annual fuel use estimated based on similar underground operation.

Sheep Mountain Mine **Appendix A - Table PF6**

Natural Gas-Fired Heaters - Office, Shop and Plant Facilities

Pollutant	Emission Factor[1]	Natural Gas	Annual Emissions[2]	Max.24-Hour Emissions
	(lb/10^6 scf)	(10^6 scf/day)	(tpy)	(lb/day)
PM_{10}	7.6	0.0108	0.0150	0.0822
$PM_{2.5}$	7.6	0.0108	0.0150	0.0822
NO_x	100.0	0.0108	0.1975	1.0822
CO	84	0.0108	0.1659	0.9090
VOC	5.5	0.0108	0.0109	0.0595
SO_2	0.6	0.0108	0.0012	0.0065
Benzene	0.0021	0.0108	4.15E-06	2.27E-05
Toluene	0.0034	0.0108	6.72E-06	3.68E-05
Hexane	1.8	0.0108	3.56E-03	1.95E-02
CH_2O	0.075	0.0108	1.48E-04	8.12E-04

Notes:

[1] AP-42 (EPA, 1998), Section 1.4, "Natural Gas Combustion." Uncontrolled small natural gas boilers.

[2] Annual fuel use provided by Energy Fuels. Daily rate based on annnual rate divided by 365 days/year operation.

Source	Description	NOx		CO		VOC		SO2		PM10		PM2.5		H_2SO_4	
		(lb/hr)	(TPY)	(lb/hr)	(TPY)	(lb/hr)	(TPY)	(lb/hr)	(TPY)	(lb/hr)	(TPY)	(lb/hr)	(TPY)	(lb/hr)	(TPY)
UD-1	Uranium Dryer	0.12	0.54	0.10	0.45	0.01	0.03	0.00	0.00	0.01	0.04	0.01	0.04	--	--
EG	Emergency Generator	3.12	0.16	0.67	0.03	0.25	0.01	0.21	0.01	0.22	0.01	0.22	0.01	--	--
710-TK-001	Diluent Tank	--	--	--	--	0.00	0.00	--	--	--	--	--	--	--	--
710-TK-002	Organic Holding Tank No. 1	--	--	--	--	0.00	0.01	--	--	--	--	--	--	--	--
710-TK-003	Organic Holding Tank No. 2	--	--	--	--	0.00	0.01	--	--	--	--	--	--	--	--
SA Tank	Sulfuric Acid Tank	--	--	--	--	--	--	--	--	--	--	--	--	<0.01	<0.01
300-MS-01	1st Stage Extraction Mixer Settler	--	--	--	--	1.33	5.84	--	--	--	--	--	--	--	--
300-MS-02	2nd Stage Extraction Mixer Settler	--	--	--	--	1.33	5.84	--	--	--	--	--	--	--	--
300-MS-03	3rd Stage Extraction Mixer Settler	--	--	--	--	1.33	5.84	--	--	--	--	--	--	--	--
300-MS-04	4th Stage Extraction Mixer Settler	--	--	--	--	1.33	5.84	--	--	--	--	--	--	--	--
300-MS-05	SX Raffinate Settler	--	--	--	--	1.33	5.84	--	--	--	--	--	--	--	--
300-MS-06	Scrubber Mixer Settler	--	--	--	--	0.23	0.99	--	--	--	--	--	--	--	--
300-MS-07	1st Stage Stripping Mixer Settler	--	--	--	--	0.23	0.99	--	--	--	--	--	--	--	--
300-MS-08	2nd Stage Stripping Mixer Settler	--	--	--	--	0.23	0.99	--	--	--	--	--	--	--	--
300-MS-09	3rd Stage Stripping Mixer Settler	--	--	--	--	0.23	0.99	--	--	--	--	--	--	--	--
300-MS-10	4th Stage Stripping Mixer Settler	--	--	--	--	0.23	0.99	--	--	--	--	--	--	--	--
300-MS-11	Regeneration Mixer Settler	--	--	--	--	0.23	0.99	--	--	--	--	--	--	--	--
Holding	Holding Pond Evaporation	--	--	--	--	1.50	6.57	--	--	--	--	--	--	--	--
Collection	Collection Pond Evaporation	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Raffinate	Raffinate Pond Evaporation	--	--	--	--	0.001	0.01	--	--	--	--	--	--	--	--
DE Bag	DE Bag Breaker	--	--	--	--	--	--	--	--	2.66E-05	1.16E-04	1.33E-05	5.82E-05	--	--
WIND1	Wind Erosion of Heap Leach Pile	--	--	--	--	--	--	--	--	5.00	21.89	0.75	3.28	--	--
Total Point Sources		3.24	0.69	0.77	0.48	9.78	41.76	0.21	0.01	0.23	0.05	0.23	0.05	0.00	0.00
Total Fugitive Sources		--	--	--	--	--	--	--	--	5.00	21.89	0.75	3.28	--	--
Total		3.24	0.69	0.77	0.48	9.78	41.76	0.21	0.01	5.23	21.94	0.98	3.34	0.00	0.00

Emissions summary data from "Production Plant EI (5-7-13).xlsx" provided by Energy Fuels.

Sheep Mountain Mine
Surface Mining Activities

Appendix A - Table PF8

Mining Activity	Maximum Annual Throughput	Maximum 24-Hour Throughput	Maximum Annual Operation	Maximum 24-Hour Operation	Moisture Content	Silt Content	Wind Speed [2]	Emission Control Efficiency	PM_{10} Emission Factor[1]	Units	$PM_{2.5}$ Emission Factor [4]	Units	Annual PM_{10} Emissions	Max 24-hr PM_{10} Emissions	Annual $PM_{2.5}$ Emissions	Max 24-hr $PM_{2.5}$ Emissions
	(tpy)	(tons/day)	(hrs/year)	(hrs/day)	(%)	(%)	(mph)	(%)					(tpy)	(lbs/day)	(tpy)	(lbs/day)
Dozing	--	--	10,400	20	5	6.9	--	0	1.428	lb/hr	0.750	lb/hr	7.4264	28.5632	3.8996	14.9986
Product Removal [5]	736,000	2,016	--	--	--	--	--	0	0.0009	lb/ton	1.80E-04	lb/ton	0.3312	1.8144	0.0662	0.3629
Overburden Removal [3]	15,639,886	42,850	--	--	5	--	--	0	0.0045	lb/ton	9.00E-04	lb/ton	35.1897	192.8250	7.0379	38.5650
Overburden Unloading [3]	15,639,886	42,850	--	--	5	--	12.0	0	0.00097	lb/ton	1.94E-04	lb/ton	7.5784	41.5267	1.5157	8.3053
Total Surface Mining Activites													50.5258	264.7293	12.5195	62.2319

Notes:

[1] Emission factor sources:
Dozing, AP-42 11.9-1 "Western Surface Coal Mining". Site material moisture, mean silt content taken from Table 11.9-3.
Emission factor: $[1.0(s)^{1.5}] / (M)^{1.4}$ lb/hr x scaling factor. Where s=material silt content (%), M=material moisture content (%), scaling factors = 0.75 for PM10 and 0.105 for PM2.5.
Annual emissions calculated as: Emission Factor (lb/hr) x hours/year / 2000 lb/ton.
Product removal, WDEQ-AQD Memorandum Re: Fugitive Dust Emission Factors, January 24, 1979. Uranium ore removal with front-end-loader. Applied 0.30 PM10/TSP ratio.
Annual emissions calculated as: Emission factor (lb/ton) x tons per year / 2000 lb/ton
Overburden removal, WDEQ-AQD Memorandum Re: Fugitive Dust Emission Factors, January 24, 1979. OB removal truck/shovel. Applied 0.30 PM10/TSP ratio.
Annual emissions calculated as: Emission factor (lb/ton) x tons per year / 2000 lb/ton
Overburden unloading, AP-42 13.2.4 "Aggregate Handling and Storage Piles". Site-specific material moisture, wind speed Casper average 2002-2006.
Emission factor: $k(0.0032) \times (U/5)^{1.3} / (M/2)^{1.4}$ lb/ton. Where k=particle size multiplier of 0.35 (PM10) or 0.053 (PM2.5), U=mean wind speed (mph), and M=material moisture content (%).
Annual emissions calculated as: Emission factor (lb/ton) x tons per year / 2000 lb/ton

[2] Mean wind speed at Casper, Wyoming, 2002-2006.

[3] Annual cubic yards overburden + interburden reported by Energy Fuels in data request reponse letter dated October 28, 2013.
Cubic yards converted to tons of material using an overburden density of 115 lb/ft3 provided by Energy Fuels.

[4] PM2.5 for Product Removal, Overburden Removal, and Overburden Unloading calculated using PM2.5/PM10 ratio of 0.20 from Western Regional Air Partnership guidance for agricultural tilling, from "Proposed Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors", Cowherd et al, Midwest Research Institute, 2006.

[5] See "Ore Transfers" sheet for product transfer to truck dump.

Sheep Mountain Mine **Appendix A - Table PF9**
Ore Transfers

Ore Handling Activity	Annual Throughput[5]	24-Hour Throughput	Number of Transfers	Moisture Content	Mean Wind Speed[4]	Emission Control Efficiency[1]	PM_{10} Emission Factor[2]	Annual PM_{10} Emissions	Max 24-hr PM_{10} Emissions	Annual $PM_{2.5}$ Emissions	Max 24-hr $PM_{2.5}$ Emissions
	(tpy)	(tons/day)		(%)	(mph)	(%)	(lb/ton)	(tpy)	(lbs/day)	(tpy)	(lbs/day)
Truck Dump	736,000	2,016	1	5	12.0	0	0.0051	1.8768	10.2838	0.3754	2.0568
Underground Coarse Ore Conveyor Transfer [3]	386,000	1,058	1	5	--	90	0.004	0.0772	0.4230	0.0154	0.0846
Overland Coarse Ore Conveyor Transfers	1,508,000	4,132	8	5	--	90	0.004	2.4128	13.2208	0.4826	2.6442
Radial Stacker to Leach Pad	1,508,000	4,132	1	5	12.0	0	9.69E-04	0.7307	4.0039	0.1461	0.8008
Total Ore Transfers								5.0975	27.9316	1.0195	5.5863

Notes:
[1] Water spray control on underground transfers = 90%. Complete enclosure on overland conveyor = 90%.
[2] Truck dump: WDEQ-AQD Memorandum Re: Fugitive Dust Emission Factors, January 24, 1979. Product dumping - Uranium factor. PM10/TSP ratio of 0.30 applied.
Annual emissions calculated as: Emission factor (lb/ton) x tons per year material / 2000 lb/ton
Conveyor transfers: AP-42 (EPA, 1982), Section 11.24-2, "Metallic Mineral Processing."
Annual emissions calculated as: Emission factor (lb/ton) x tons per year material / 2000 lb/ton x [100-control efficiency (%))/100].
Radial stacker: AP-42 Section 13.2.4, "Aggregate Handling and Storage Piles", Equation 1.
Emission factor: $k(0.0032) \times (U/5)^{1.3} / (M/2)^{1.4}$ lb/ton. Where k=particle size multiplier of 0.35 (PM10) or 0.053 (PM2.5), U=mean wind speed (mph), and M=material moisture content (%).
Annual emissions calculated as: Emission factor (lb/ton) x tons per year material / 2000 lb/ton x [100-control efficiency (%))/100].
[3] Underground conveyor transfer to stockpile.
[4] Mean wind speed at Casper, Wyoming, 2002-2006.
[5] Annual throughputs reported by Energy Fuels in data request reponse letter dated October 28, 2013.
Truck dump material throughput reflects total ore production rate of surface operations.
Underground Coarse Ore Conveyor Transfer material throughput reflects total underground ore production rate.
Overland Coarse Ore Transfers and Radial Stacker material throughput reflects sum of total surface and underground ore production rates.

Sheep Mountain Mine **Appendix A - Table PF10**

Primary Crusher and Screen

Surface Ore

Source	Maximum Annual Throughput[1]	Maximum Daily Throughput[1]	Water Spray Controls	PM_{10} Emission Factor[2]	Annual PM_{10} Emissions	Maximum 24-hr PM_{10} Emissions	Annual $PM_{2.5}$ Emissions	Maximum 24-hr $PM_{2.5}$ Emissions
	(tpy)	(tons/day)	(%)	(lb/ton)	(tpy)	(lb/day)	(tpy)	(lb/day)
Crusher/Screen	736,000	3,000	90	0.009	0.3312	2.7000	0.0497	0.4050

Note:

[1] Annual throughput reported by Energy Fuels in data request reponse letter dated October 28, 2013.
1500 tpd throughput is maximum capacity of unit given by Proponent in "AQ Input List tw.doc".

[2] AP-42 (EPA, 1982), Section 11.24, "Metallic Minerals Processing."

Annual emissions calculated as: Emission factor (lb/ton) x annual throughput (tpy) x [(100-control efficiency %)/100] / 2000 lb/ton

24-Hour emissions calculated as: Emission factor (lb/ton) x daily throughput (tpd) x [(100-control efficiency %)/100]

MRI, 2006. Background document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors,
Midwest Research Institute for Western Regional Air Partnership, November 1, 2006.

Sheep Mountain Mine **Appendix A - Table PF11**

Primary Crusher and Screen
Underground Ore

Source	Maximum Annual Throughput[1]	Maximum Daily Throughput[1]	Water Spray Controls	PM_{10} Emission Factor[2]	Annual PM_{10} Emissions	Maximum 24-hr PM_{10} Emissions	Annual $PM_{2.5}$ Emissions	Maximum 24-hr $PM_{2.5}$ Emissions
	(tpy)	(tons/day)	(%)	(lb/ton)	(tpy)	(lb/day)	(tpy)	(lb/day)
Crusher/Screen	368,000	1,500	90	0.009	0.1656	1.3500	0.0248	0.2025

Note:
[1] Maximum annual underground production reported by Energy Fuels in data request reponse letter dated October 28, 2013.
1500 tpd is maximum capacity of unit given by Proponent in "AQ Input List tw.doc".
[2] AP-42 (EPA, 1982), Section 11.24, "Metallic Minerals Processing."
Annual emissions calculated as: Emission factor (lb/ton) x annual throughput (tpy) x [(100-control efficiency %)/100] / 2000 lb/ton
24-Hour emissions calculated as: Emission factor (lb/ton) x daily throughput (tpd) x [(100-control efficiency %)/100]
PM2.5 fraction of PM10 of 0.15 taken from MRI, 2006,
MRI, 2006. Background document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors,
Midwest Research Institute for Western Regional Air Partnership, November 1, 2006.

Sheep Mountain Mine

Off-Site Haulage Scenario

Appendix A - Table PF12

Vehicle Type	Average Vehicle Weight[1]	Vehicle Payload[1]	Annual Throughput	24-Hour Throughput	Silt Content[2]	Average Speed	Emission Control[5]	Annual Precip >0.01 in[7]	24-Hour Round Trips	Annual Round Trips	Average Round Trip Distance[8]	Annual Vehicle Miles Traveled	24-Hour Vehicle Miles Traveled	PM_{10} Emission Factor[3]	PM2.5 Emission Factor[3]	Annual PM_{10} Emissions[4]	24-Hour PM_{10} Emissions[4]	Annual $PM_{2.5}$ Emissions[4]	24-Hour $PM_{2.5}$ Emissions[4]	Max Hourly PM_{10} Emissions[9]	Max Hourly $PM_{2.5}$ Emissions[9]
	(tons)	(tons)	(tpy)	(tons/day)	(%)	(mph)	(%)	(days)	(rt/day)	(rt/yr)	(miles)	(VMT)	(VMT)	(lb/VMT)	(lb/VMT)	(tpy)	(lb/day)	(tpy)	(lb/day)	(lb/hr)	(lb/hr)
Surface Ore Haul to Truck Dump	26	25	736,000	2,016	5.1	--	50	56	64	29,440	0.5	14,720	32.00	0.92	0.09	5.7173	29.3626	0.5717	2.9363	1.4681	0.1468
Haul to Off-Site Mill	26	25	736,000	2,016	5.1	--	50	56	80	29,440	2.1	61,824	168.00	0.92	0.09	24.0125	154.1537	2.4013	15.4154	7.7077	0.7708
Surface Overburden Haul to Hanks Draw Spoils[10]	26	35	4,425,840	12,126	5.1	--	50	56	346	126,453	1.0	126,453	346.45	0.92	0.09	49.1143	317.8920	4.9114	31.7892	15.8946	1.5895
Surface Overburden Haul to South Spoils[10]	26	35	1,623,240	4,447	5.1	--	50	56	127	46,378	1.5	69,567	190.60	0.92	0.09	27.0201	174.8871	2.7020	17.4887	8.7444	0.8744
Water Trucks (2)	17		--	--	5.1	--	50	--	20	3,360		14,000	83.33	0.76	0.08	5.3053	63.1579	0.5305	6.3158	3.1579	0.3158
Haul Road Repair (Grading)	--		--	--	--	5	50	--	--	--	--	2,500	10.00	0.77	0.07	0.4781	3.8250	0.0433	0.6585	0.1913	0.0329
Light Vehicles	3	--	--	--	5.1	--	50	56	118	19,824	2.1	14,000	83.33	0.35	0.03	2.0577	28.9354	0.2058	2.8935	1.4468	0.1447
Bulk Delivery Trucks[6]	18				5.1	--	50	56	4	520	2.1	1,092	8.40	0.78	0.08	0.3594	6.5322	0.0359	0.6532	0.3266	0.0327
															Totals	114.0646	778.7459	11.4020	78.1506	38.9373	3.9075

Notes:

[1] Vehicle weight reported by Proponent in "AQ Input List tw.doc". Payload reported by Energy Fuels in data request reponse letter dated October 28, 2013.

[2] AP-42, Table 13.2.2-1, Unpaved Roads.

Equation 1a. $E = k(s/12)^a(W/3)^b$ lb/VMT. Where k=constant 1.5 for PM10 and 0.15 for PM2.5, a=0.9, b=0.45, s=surface material silt content (%), W=mean vehicle weight (tons).

[3] AP-42 (EPA, 2003), Section 13.2.2, "Unpaved Roads." (On- and off-site ore, water, delivery, light trucks). See equation 1a above.

AP-42 (EPA 1998), Section 11.9, "Western Surface Coal Mining." Emission factor for grading: $0.051(S)^{2.0}$ lb/VMT x scaling factor. Where S=mean vehicle speed (mph).

Scaling factors=0.60 for PM10 and 0.031 for PM2.5.

[4] Calculated as Emissions in (lb/VMT) x Vehicle Miles Traveled (VMT).

[5] Dust control provided by frequent water application.

[6] Bulk reagent delivery, weight based on Wyoming maximum GVW for tandem-axle highway trucks.

[7] Average annual days with precipitation greater than 0.01" observed at Jeffrey City, Wyoming from 1964-2005. Precipitation factor applied to surface ore haul, light vehicles, and bulk delivery.

[8] Round-trip distance off-site is based on the distance from south edge of ore stockpile to the point at which the road exits BLM lands.

[9] Maximum hourly emission rates for all activities but dozing based on maximum daily emission rate / 20 hours/day work schedule.

[10] Year 3 annual Hanks Draw Spoils haul total = 2,732,000 cy, and annual South Spoils haul total = 1,002,000 cy. Overburden density = 3240 lb/cy. Tons/yr = cy x (lb/cy) / (2000 lb/ton).

Sheep Mountain Mine

Wind Erosion of Open Acres

Appendix A - Table PF13

Activity	Area	PM_{10} Emission Factor[2]	$PM_{2.5}$ Emission Factor[3]	Annual PM_{10} Emissions	Max 24-Hr PM_{10} Emissions	Annual $PM_{2.5}$ Emissions	Max 24-Hr $PM_{2.5}$ Emissions
	(acres)	(ton/acre/yr)	(ton/acre/yr)	(tpy)	(lb/day)	(tpy)	(lb/day)
Open Acres[1]	216	0.114	0.0171	24.6	134.9	3.6936	20.2389

Notes:

[1] Total non-stockpile open acres subject to wind erosion for Congo Pit given in Table 2.3-1 of EIS.

[2] Emission factor from AP-42 Western Surface Coal Mining, Table 11.9-4 of 0.38 x PM10/TSP ratio of 0.30.

[3] PM2.5 to PM10 ratio of 0.15 used for wind-blown fugitive dust (MRI, 2006).
MRI, 2006. Background document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors, Midwest Research Institute for Western Regional Air Partnership, November 1, 2006.

Sheep Mountain Mine **Appendix A - Table PF14**

Wind Erosion of Stockpiles

Stockpile	Area	Emission Factor [1]	Annual PM_{10} Emissions[2]	24-Hr PM_{10} Emissions[2]	Annual $PM_{2.5}$ Emissions[3]	24-Hr $PM_{2.5}$ Emissions[3]
	(m^2)	(lb/yr/m^2)	(tpy)	(lb/day)	(tpy)	(lb/day)
Stockpiles[4] (Hanks Draw and Spoils 2)	500,614	0.092067	23.0450	126.2740	3.4568	18.9411
Ore Stockpile[4]	123,434	0.092067	5.6821	31.1348	0.8523	4.6702
Off-Site Processing Facility Stockpile[5]	19,600	0.092067	0.9023	4.9439	0.1353	0.7416
Topsoil Stockpiles[4]	112,911	0.092067	5.1977	28.4806	0.7797	4.2721
			34.8271	190.8332	5.2241	28.6250

Notes:

[1] Emission factor derived from unit emission rate calculated using AP-42 Section 13.2.5, Industrial Wind Erosion, combined with 2011-12 hourly on-site surface wind speed data.

[2] Emissions calculated using methodology from AP-42 Section 13.2.5, Industrial Wind Erosion, combined with 2011-12 hourly on-site surface wind speed data.
Emission factor (lb/yr/m2) x area (m2) / 2000 lb/ton = tons per year.

[3] $PM_{2.5}$ calculated based on PM2.5/PM10 ratio of 0.15 for fugitive dust (MRI, 2006).
MRI, 2006. Background document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors, Midwest Research Institute for Western Regional Air Partnership, November 1, 2006.

[4] Stockpile areas from EIS Table 2.3-1.

[5] Off-site processing stockpile assumes a 4.84 acre stockpile is present at the Sweetwater Mill.

Sheep Mountain Mine
Mobile and Nonroad Source Diesel Combustion Emissions
Surface and Underground Vehicles Including Off-Site Haul

Appendix A - Table PF15

Source	Typical Engine Model	Engine Horsepower (hp)	Number of Units	Fuel Consumption[3] (gal/yr)	NO_x Emission Factor (g/hp-hr)	CO Emission Factor (g/hp-hr)	PM Emission Factor (g/hp-hr)	SO_2 Emission Factor (g/hp-hr)	VOC Emission Factor (g/hp-hr)	CH_2O Emission Factor[4] (g/hp-hr)	Emission Factor Basis[5]	Equipment Availability and Utilization[1]	Load Factor[2]	Daily Operating Rate per Unit[6] (hr/day)	Max Hourly Operating Hours (hours)	Daily Operating Hours[6] (hr/day)	Annual Operating Hours[6] (hr/yr)
OPEN PIT MININING																	
MAJOR EQUIPMENT																	
330 LX Linkbelt Excavator		268	2	40,000	4.50	2.6	0.015	--	0.40	0.12	Tier 2	0.81	0.21	20	2	40	14560
16M CAT Motor Grader		297	1	22,500	4.50	2.6	0.015	--	0.40	0.12	Tier 2	0.81	0.59	20	1	20	7280
140 CAT Motor Grader		150	1	15,000	4.50	3.7	0.015	--	0.40	0.12	Tier 2	0.81	0.59	20	1	20	7280
D-8 CAT track Dozer		347	1	46.250	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	1	20	7280
D-9 CAT Track Dozer		460	1	61,250	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	1	20	7280
A30D Volvo Atriculated Truck	*Assume CAT D30D	435	2	76,000	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	2	40	14560
980 CAT Wheel Loader		393	1	23.750	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	1	20	7280
637 CAT Twin Engine Scraper		783	3	245,000	4.50	2.6	0.075	--	0.30	0.12	Tier 2	0.81	0.59	20	3	60	21840
CAT Single Engine Scraper		330	3	28.750	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	3	60	21840
623 CAT Self Loading Scraper		330	1	28,750	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	1	20	7280
Water truck 3000 gallons	*Assume half CAT 613	200	1	8,125	4.50	2.6	0.015	--	0.40	0.12	Tier 2	0.81	0.59	20	1	20	7280
Water Truck 8000 gallons	*Assume CAT 613	500	1	16.250	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	1	20	7280
MINE SUPPORT VEHICLES																	
Fuel/lube truck	Assume 3/4 ton diesel	400	1	37.5	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	1	20	7280
Mechanical Service Truck	Assume 3/4 ton diesel	400	1	37.5	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	1	20	7280
Rubber tire backhoe CAT 414e w/forklift attachme	*Assume 416c	62	1	20.750	5.20	3.7	0.015	--	0.40	0.12	Tier 2	0.81	0.21	20	1	20	7280
Ore haul truck to Sweetwater Mill	*Assume CAT D30D	435	2	76,000	4.50	2.6	0.015	--	0.30	0.12	Tier 2	0.81	0.59	20	2	40	14560
Pickup Trucks 4WD. 3/4-ton	*Assume 400 miles per 6 hrs. as per multiple 350 engines	315	8	300	0.0167	0.0567	0.015	--	0.004	negl.	MOBILE6	0.81	1.0	20	8	160	58240
				708,750													
UNDERGROUND MINING																	
MAJOR EQUIPMENT																	
Model Boomer SL1 Face Drill	*Assume CAT D4B, similar power/weight/engine	150	3	26,250	4.50	3.7	0.22	--	0.40	0.12	Tier 2/MSHA	0.81	0.40	20	3	60	15600
104 Face Drill	*Assume CAT D3, similar power/weight/engine	150	1	7,500	4.50	3.7	0.22	--	0.40	0.12	Tier 2/MSHA	0.81	0.40	20	1	20	5200
Model Boomer S10-DH Face Drill	*Assume CAT D4B, similar power/weight/engine	150	1	8,750	4.50	3.7	0.22	--	0.40	0.12	Tier 2/MSHA	0.81	0.40	20	1	20	5200
Model Boltec SL Bolter	*Assume CAT D4B, similar power/weight/engine	74	7	43,750	5.20	3.7	0.3	--	0.40	0.12	Tier 2/MSHA	0.81	0.21	20	7	140	36400
Model Boltec 235 Bolter	*Assume CAT D4B, similar power/weight/engine	74	2	17.500	5.20	3.7	0.3	--	0.40	0.12	Tier 2/MSHA	0.81	0.21	20	2	40	10400
Model ST7LP Scooptram	*Assume CAT AD45, Fluid specs not in handbook 38	210	4	105,000	6.90	8.5	0.4	--	1.00	0.12	Tier 1/MSHA	0.81	0.21	20	4	80	20800
Model ST7 Scooptram	*Assume CAT R1300G, Fluid specs not in handbook 38	210	2	25,000	6.90	8.5	0.4	--	1.00	0.12	Tier 1/MSHA	0.81	0.21	20	2	40	10400
MINE SUPPORT VEHICLES																	
Power Buggies	*Assume Whiteman Series WBH16AEWD 18 hp Gas Engine.	50	2	4.100	5.20	3.7	0.3	--	0.40	0.12	Tier 2/MSHA	0.81	0.21	20	2	40	10400
Bobcat Skidsteer	*Assume CAT D3B	50	2	15,000	5.20	3.7	0.3	--	0.40	0.12	Tier 2/MSHA	0.81	0.21	20	2	40	10400
Utility Truck-flatbed		50	1	37.5	5.20	3.7	0.3	--	0.40	0.12	Tier 2/MSHA	0.81	0.59	20	1	20	5200
Scissor Truck	Assume same as the Bolter	50	8	8,750	5.20	3.7	0.3	--	0.40	0.12	Tier 2/MSHA	0.81	0.21	20	8	160	41600
Man trips	Assume same as Powerbuggy	74	6	24,600	5.20	3.7	0.3	--	0.40	0.12	Tier 2/MSHA	0.81	0.21	20	6	120	31200
Pickup trucks. 4 WD. 3/4-ton	Assume same specs as the Conventional Mine	315	8	187.5	0.0167	0.0567	0.015	--	0.004	negl.	Mobile 6	0.81	1.0	20	8	160	41600
Fuel/lube truck		400	1	37.5	6.90	8.5	0.4	--	1.00	0.12	Tier 1/MSHA	0.81	0.59	20	1	20	5200
Forklift		400	1	37.5	6.90	8.5	0.4	--	1.00	0.12	Tier 1/MSHA	0.81	0.59	20	1	20	5200
Mechanical Service Truck		400	1	75.0	6.90	8.5	0.4	--	1.00	0.12	Tier 1/MSHA	0.81	0.21	20	1	20	5200
				286.575													

Source	NOx Maximum Hourly Emissions (lb/hr)	NOx Maximum 24-Hr Emissions (lb/day)	NOx Annual Average Emissions (tpy)	CO Maximum Hourly Emissions (lb/hr)	CO Maximum 24-Hr Emissions (lb/day)	CO Annual Average Emissions (tpy)	PM Maximum Hourly Emissions (lb/hr)	PM Maximum 24-Hr Emissions (lb/day)	PM Annual Average Emissions (tpy)	SO2 Maximum Hourly Emissions (lb/hr)	SO2 Maximum 24-Hr Emissions (lb/day)	SO2 Annual Average Emissions (tpy)	VOC Maximum Hourly Emissions (lb/hr)	VOC Maximum 24-Hr Emissions (lb/day)	VOC Annual Average Emissions (tpy)	CH_2O Maximum Hourly Emissions (lb/hr)	CH_2O Maximum 24-Hr Emissions (lb/day)	CH_2O Annual Average Emissions (tpy)
OPEN PIT MININING																		
MAJOR EQUIPMENT																		
330 LX Linkbelt Excavator	1.1167	18.0900	3.2924	0.6452	10.4520	1.9023	0.0037	0.0603	0.0110	0.0006	0.0233	0.0043	0.0993	1.6080	0.2927	0.0298	0.4824	0.0878
16M CAT Motor Grader	1.7384	28.1620	5.1255	1.0044	16.2714	2.9614	0.0058	0.0939	0.0171	0.0007	0.0131	0.0024	0.1545	2.5033	0.4556	0.0464	0.7510	0.1367
140 CAT Motor Grader	0.8780	14.2232	2.5886	0.7219	11.6946	2.1284	0.0029	0.0474	0.0086	0.0004	0.0088	0.0016	0.0780	1.2643	0.2301	0.0234	0.3793	0.0690
D-8 CAT track Dozer	2.0311	32.9030	5.9884	1.1735	19.0106	3.4599	0.0068	0.1097	0.0200	0.0014	0.0270	0.0049	0.1354	2.1935	0.3992	0.0542	0.8774	0.1597
D-9 CAT Track Dozer	2.6925	43.6179	7.9385	1.5556	25.2014	4.5867	0.0090	0.1454	0.0265	0.0018	0.0357	0.0065	0.1795	2.9079	0.5292	0.0718	1.1631	0.2117
A30D Volvo Atriculated Truck	5.0923	82.4946	15.0140	2.9422	47.6636	8.6748	0.0170	0.2750	0.0500	0.0011	0.0444	0.0081	0.3395	5.4996	1.0009	0.1358	2.1999	0.4004
980 CAT Wheel Loader	2.3003	37.2648	6.7822	1.3291	21.5308	3.9186	0.0077	0.1242	0.0226	0.0007	0.0139	0.0025	0.1534	2.4843	0.4521	0.0613	0.9937	0.1809
637 CAT Twin Engine Scraper	13.7491	222.7355	40.5379	7.9439	128.6916	23.4219	0.2292	3.7123	0.6756	0.0024	0.1430	0.0261	0.9166	14.8490	2.7025	0.3666	5.9396	1.0810
CAT Single Engine Scraper	5.7946	93.8732	17.0849	3.3480	54.2379	9.8713	0.0193	0.3129	0.0569	0.0003	0.0168	0.0031	0.3863	6.2582	1.1390	0.1545	2.5033	0.4556
623 CAT Self Loading Scraper	1.9315	31.2911	5.6950	1.1160	18.0793	3.2904	0.0064	0.1043	0.0190	0.0008	0.0168	0.0031	0.1288	2.0861	0.3797	0.0515	0.8344	0.1519
Water truck 3000 gallons	1.1706	18.9643	3.4515	0.6764	10.9571	1.9942	0.0039	0.0632	0.0115	0.0002	0.0047	0.0009	0.1041	1.6857	0.3068	0.0312	0.5057	0.0920
Water Truck 8000 gallons	2.9266	47.4107	8.6288	1.6909	27.3929	4.9855	0.0098	0.1580	0.0288	0.0005	0.0095	0.0017	0.1951	3.1607	0.5753	0.0780	1.2643	0.2301
MINE SUPPORT VEHICLES																		
Fuel/lube truck	2.3413	37.9286	6.9030	1.3527	21.9143	3.9884	0.0078	0.1264	0.0230	0.0000	0.0000	0.0000	0.1561	2.5286	0.4602	0.0624	1.0114	0.1841
Mechanical Service Truck	2.3413	37.9286	6.9030	1.3527	21.9143	3.9884	0.0078	0.1264	0.0230	0.0000	0.0000	0.0000	0.1561	2.5286	0.4602	0.0624	1.0114	0.1841
Rubber tire backhoe CAT 414e w/forklift attachme	0.1493	2.4180	0.4401	0.1062	1.7205	0.3131	0.0004	0.0070	0.0013	0.0006	0.0121	0.0022	0.0115	0.1860	0.0339	0.0034	0.0558	0.0102
Ore haul truck to Sweetwater Mill	5.0923	82.4946	15.0140	2.9422	47.6636	8.6748	0.0170	0.2750	0.0500	0.0011	0.0444	0.0081	0.3395	5.4996	1.0009	0.1358	2.1999	0.4004
Pickup Trucks 4WD. 3/4-ton	0.0928	1.5030	0.2735	0.3150	5.1030	0.9287	0.0833	1.3500	0.2457	0.0000	0.0002	0.0000	0.0222	0.3600	0.0655	negl.	negl.	negl.
UNDERGROUND MINING																		
MAJOR EQUIPMENT																		
Model Boomer SL1 Face Drill	1.7857	28.9286	3.7607	1.4683	23.7857	3.0921	0.0873	1.4143	0.1839	0.0004	0.0153	0.0028	0.1587	2.5714	0.3343	0.0476	0.7714	0.1003
104 Face Drill	0.5952	9.6429	1.2536	0.4894	7.9286	1.0307	0.0291	0.4714	0.0613	0.0003	0.0044	0.0008	0.0529	0.8571	0.1114	0.0159	0.2571	0.0334
Model Boomer S10-DH Face Drill	0.5952	9.6429	1.2536	0.4894	7.9286	1.0307	0.0291	0.4714	0.0613	0.0004	0.0051	0.0009	0.0529	0.8571	0.1114	0.0159	0.2571	0.0334
Model Boltec SL Bolter	1.2470	20.2020	2.6263	0.8873	14.3745	1.8687	0.0719	1.1655	0.1515	0.0003	0.0255	0.0047	0.0959	1.5540	0.2020	0.0288	0.4662	0.0606
Model Boltec 235 Bolter	0.3563	5.7720	0.7504	0.2535	4.1070	0.5339	0.0206	0.3330	0.0433	0.0004	0.0102	0.0019	0.0274	0.4440	0.0577	0.0082	0.1332	0.0173
Model ST7LP Scooptram	2.6833	43.4700	5.6511	3.3056	53.5500	6.9615	0.1556	2.5200	0.3276	0.0011	0.0613	0.0112	0.3889	6.3000	0.8190	0.0467	0.7560	0.0983
Model ST7 Scooptram	1.3417	21.7350	2.8256	1.6528	26.7750	3.4808	0.0778	1.2600	0.1638	0.0005	0.0146	0.0027	0.1944	3.1500	0.4095	0.0233	0.3780	0.0491
MINE SUPPORT VEHICLES																		
Power Buggies	0.2407	3.9000	0.5070	0.1713	2.7750	0.3608	0.0139	0.2250	0.0293	0.0001	0.0024	0.0004	0.0185	0.3000	0.0390	0.0056	0.0900	0.0117
Bobcat Skidsteer	0.2407	3.9000	0.5070	0.1713	2.7750	0.3608	0.0139	0.2250	0.0293	0.0003	0.0088	0.0016	0.0185	0.3000	0.0390	0.0056	0.0900	0.0117
Utility Truck-flatbed	0.3382	5.4786	0.7122	0.2406	3.8982	0.5068	0.0195	0.3161	0.0411	0.0000	0.0000	0.0000	0.0260	0.4214	0.0548	0.0078	0.1264	0.0164
Scissor Truck	0.9630	15.6000	2.0280	0.6852	11.1000	1.4430	0.0556	0.9000	0.1170	0.0000	0.0051	0.0009	0.0741	1.2000	0.1560	0.0222	0.3600	0.0468
Man trips	1.0689	17.3160	2.2511	0.7606	12.3210	1.6017	0.0617	0.9990	0.1299	0.0002	0.0144	0.0026	0.0822	1.3320	0.1732	0.0247	0.3996	0.0519
Pickup trucks. 4 WD. 3/4-ton	0.0928	1.5030	0.1954	0.3150	5.1030	0.6634	0.0833	1.3500	0.1755	0.0000	0.0001	0.0000	0.0222	0.3600	0.0468	negl.	negl.	negl.
Fuel/lube truck	3.5899	58.1571	7.5604	4.4224	71.6429	9.3136	0.2081	3.3714	0.4383	0.0000	0.0000	0.0000	0.5203	8.4286	1.0957	0.0624	1.0114	0.1315
Forklift	3.5899	58.1571	7.5604	4.4224	71.6429	9.3136	0.2081	3.3714	0.4383	0.0000	0.0000	0.0000	0.5203	8.4286	1.0957	0.0624	1.0114	0.1315
Mechanical Service Truck	1.2778	20.7000	2.6910	1.5741	25.5000	3.3150	0.0741	1.2000	0.1560	0.0000	0.0000	0.0000	0.1852	3.0000	0.3900	0.0222	0.3600	0.0468
Total Surface	51.4385	833.3031	151.6612	30.2160	489.4989	89.0888	0.4377	7.0914	1.2906	0.0126	0.4136	0.0755	3.5558	57.6035	10.4838	1.3687	22.1727	4.0354
Total Underground	20.0065	324.1051	42.1337	21.3091	345.2073	44.8769	1.2095	19.5936	2.5472	0.0038	0.1672	0.0305	2.4385	39.5043	5.1356	0.3993	6.4680	0.8408
Total Mine	71.4450	1157.4083	193.7948	51.5251	834.7061	133.9657	1.6472	26.6850	3.8378	0.0164	0.5808	0.1060	5.9943	97.1078	15.6194	1.7679	28.6407	4.8763

Notes:

[1] 90% availability. 90% utilization.
Availability means: availability of unit due to maintenance or other mechanical downtime. This is typically 85% for underground operations, 90% was used for this analysis.
Use of availability (utilization) means: percent of available unit operation time due non-mechanical reasons such as employee lunch and break time. 90% was conservatively used in this analysis.
Total availability = 90% availability x 90% utilization = 0.81

[2] Engine load factors from EPA/420-P-02-014. Load factors indicate the average proportion of rated power used. Rated power is the maximum power level that an engine is designed to produce at its rated speed.

[3] Equipment details. quantity. horsepower. and fuel consumption from Proponent. "2011 POO Equipment Consumption.xls".

[4] Formaldehyde emission factor from AP-42 Volume II.

[5] Undergound equipment emissions maximum allowable under MSHA, codified in 30 CFR Section 57.5067.

[6] Operating rates and annual hours based on surface mine operating schedule of two. 10-hour daily shifts. seven days per week. and underground mine operating schedule of two. 10-hour daily shifts. five days per week.

Sheep Mountain Mine
Mobile and Nonroad Source Diesel Combustion Emissions
Surface and Underground Vehicles Including Off-Site Haul

Source	Typical Engine Model	Engine Horsepower (hp)	Number of Units	Fuel Consumption[3] (gal/yr)	VOC Emission Factor (g/hp-hr)	Benzene in VOC by Weight[6] (%)	Toluene in VOC by Weight[6] (%)	Ethylbenzene in VOC by Weight[6] (%)	n-hexane in VOC by Weight[6] (%)	CH_2O Emission Factor[4] (g/hp-hr)	Emission Factor Basis[5]	Equipment Availability and Utilization [1]	Load Factor[2]	Daily Operating Schedule (hr/day)	Annual Operating Schedule (hr/yr)	VOC Maximum 24-Hr Emissions (lb/day)	VOC Annual Average Emissions (tpy)	Benzene Maximum 24-Hr Emissions (lb/day)	Benzene Annual Average Emissions (tpy)	Toluene Maximum 24-Hr Emissions (lb/day)	Toluene Annual Average Emissions (tpy)	Ethylbenzene Maximum 24-Hr Emissions (lb/day)	Ethylbenzene Annual Average Emissions (tpy)	n-Hexane Maximum 24-Hr Emissions (lb/day)	n-Hexane Annual Average Emissions (tpy)	CH_2O Maximum 24-Hr Emissions (lb/day)	CH_2O Annual Average Emissions (tpy)
OPEN PIT MININING																											
MAJOR EQUIPMENT																											
330 LX Linkbelt Excavator		268	2	40,000	0.40	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.21	20	5200	0.8040	0.1045	0.0258	0.0033	0.0118	0.0015	0.0030	0.0004	0.0062	0.0008	0.2412	0.0314
16M CAT Motor Grader		297	1	22,500	0.40	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	10	2600	1.2516	0.1627	0.0401	0.0052	0.0184	0.0024	0.0046	0.0006	0.0096	0.0012	0.3755	0.0488
140 CAT Motor Grader		150	1	15,000	0.40	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	10	2600	0.6321	0.0822	0.0203	0.0026	0.0093	0.0012	0.0023	0.0003	0.0048	0.0006	0.1896	0.0247
D-8 CAT track Dozer		347	1	46,250	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	10	2600	1.0968	0.1426	0.0351	0.0046	0.0161	0.0021	0.0040	0.0005	0.0084	0.0011	0.4387	0.0570
D-9 CAT Track Dozer		460	1	61,250	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	10	2600	1.4539	0.1890	0.0466	0.0061	0.0214	0.0028	0.0053	0.0007	0.0111	0.0014	0.5816	0.0756
A30D Volvo Atriculated Truck	*Assume CAT D30D	435	2	76,000	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	20	5200	2.7498	0.3575	0.0881	0.0115	0.0404	0.0053	0.0101	0.0013	0.0211	0.0027	1.0999	0.1430
980 CAT Wheel Loader		393	1	23,750	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	10	2600	1.2422	0.1615	0.0398	0.0052	0.0183	0.0024	0.0046	0.0006	0.0095	0.0012	0.4969	0.0646
637 CAT Twin Engine Scraper		783	3	245,000	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	30	7800	7.4245	0.9652	0.2378	0.0309	0.1091	0.0142	0.0273	0.0035	0.0569	0.0074	2.9698	0.3861
CAT Single Engine Scraper		330	3	28,750	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	30	7800	3.1291	0.4068	0.1002	0.0130	0.0460	0.0060	0.0115	0.0015	0.0240	0.0031	1.2516	0.1627
623 CAT Self Loading Scraper		330	1	28,750	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	10	2600	1.0430	0.1356	0.0334	0.0043	0.0153	0.0020	0.0038	0.0005	0.0080	0.0010	0.4172	0.0542
Water truck 3000 gallons	*Assume half CAT 613	200	1	8,125	0.40	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	10	2600	0.8429	0.1096	0.0270	0.0035	0.0124	0.0016	0.0031	0.0004	0.0065	0.0008	0.2529	0.0329
Water Truck 8000 gallons	*Assume CAT 613	500	1	16,250	0.30	3.2034	1.4700	0.3678	0.7666	0.12	Tier 2	0.81	0.59	10	2600	1.5804	0.2054	0.0506	0.0066	0.0232	0.0030	0.0058	0.0008	0.0121	0.0016	0.6321	0.0822
MINE SUPPORT VEHICLES																											
Fuel/lube truck	Assume 3/4 ton diesel	400	1	37.5	0.30	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2	0.81	0.59	10	2600	1.2643	0.1644	0.0132	0.0017	0.0192	0.0025	0.0023	0.0003	0.0000	0.0000	0.5057	0.0657
Mechanical Service Truck	Assume 3/4 ton diesel	400	1	37.5	0.30	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2	0.81	0.59	10	2600	1.2643	0.1644	0.0132	0.0017	0.0192	0.0025	0.0023	0.0003	0.0000	0.0000	0.5057	0.0657
Rubber tire backhoe CAT 414e w/forklift attachme	*Assume 416c	62	1	20,750	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2	0.81	0.21	10	2600	0.0930	0.0121	0.0010	0.0001	0.0014	0.0002	0.0002	0.00002	0.0000	0.0000	0.0279	0.0036
Ore haul truck to Sweetwater Mill	*Assume CAT D30D	435	2	76,000	0.30	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2	0.81	0.59	20	5200	2.7498	0.3575	0.0287	0.0037	0.0417	0.0054	0.0049	0.00064	0.0000	0.0000	1.0999	0.1430
Pickup Trucks 4WD, 3/4-ton	*Assume 400 miles per 6 hrs, as per multiple 350 engines	315	8	300	0.004	1.0450	1.5179	0.1793	0.0000	negl.	MOBILE6	0.81	1.0	80	20800	0.1800	0.0234	0.0019	0.0002	0.0027	0.0004	0.0003	0.00004	0.0000	0.0000	negl.	negl.
				708,750																							
UNDERGROUND MINING																											
MAJOR EQUIPMENT																											
Model Boomer SL1 Face Drill	*Assume CAT D4B, similar power/weight/engine	150	3	26,250	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.40	60	15600	2.5714	0.3343	0.0269	0.0035	0.0390	0.0051	0.0046	0.0006	0.0000	0.0000	0.7714	0.1003
104 Face Drill	*Assume CAT D3, similar power/weight/engine	150	1	7,500	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.40	20	5200	0.8571	0.1114	0.0090	0.0012	0.0130	0.0017	0.0015	0.0002	0.0000	0.0000	0.2571	0.0334
Model Boomer S10-DH Face Drill	*Assume CAT D4B, similar power/weight/engine	150	1	8,750	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.40	20	5200	0.8571	0.1114	0.0090	0.0012	0.0130	0.0017	0.0015	0.0002	0.0000	0.0000	0.2571	0.0334
Model Boltec SL Bolter	*Assume CAT D4B, similar power/weight/engine	74	7	43,750	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.21	140	36400	1.5540	0.2020	0.0162	0.0021	0.0236	0.0031	0.0028	0.0004	0.0000	0.0000	0.4662	0.0606
Model Boltec 235 Bolter	*Assume CAT D4B, similar power/weight/engine	74	2	17,500	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.21	40	10400	0.4440	0.0577	0.0046	0.0006	0.0067	0.0009	0.0008	0.0001	0.0000	0.0000	0.1332	0.0173
Model ST7LP Scooptram	*Assume CAT AD45, Fluid specs not in handbook 38	210	4	105,000	1.00	1.0450	1.5179	0.1793	0.0000	0.12	Tier 1/MSHA	0.81	0.21	80	20800	6.3000	0.8190	0.0658	0.0086	0.0956	0.0124	0.0113	0.0015	0.0000	0.0000	0.7560	0.0983
Model ST7 Scooptram	*Assume CAT R1300G, Fluid specs not in handbook 38	210	2	25,000	1.00	1.0450	1.5179	0.1793	0.0000	0.12	Tier 1/MSHA	0.81	0.21	40	10400	3.1500	0.4095	0.0329	0.0043	0.0478	0.0062	0.0056	0.0007	0.0000	0.0000	0.3780	0.0491
MINE SUPPORT VEHICLES																											
Power Buggies	*Assume Whiteman Series WBH16AEWD 18 hp Gas Engine.	50	2	4,100	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.21	40	10400	0.3000	0.0390	0.0031	0.0004	0.0046	0.0006	0.0005	0.0001	0.0000	0.0000	0.0900	0.0117
Bobcat Skidsteer	*Assume CAT D3B	50	2	15,000	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.21	40	10400	0.3000	0.0390	0.0031	0.0004	0.0046	0.0006	0.0005	0.0001	0.0000	0.0000	0.0900	0.0117
Utility Truck-flatbed		50	1	37.5	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.59	20	5200	0.4214	0.0548	0.0044	0.0006	0.0064	0.0008	0.0008	0.0001	0.0000	0.0000	0.1264	0.0164
Scissor Truck	Assume same as the Bolter	50	8	8,750	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.21	160	41600	1.2000	0.1560	0.0125	0.0016	0.0182	0.0024	0.0022	0.0003	0.0000	0.0000	0.3600	0.0468
Man trips	Assume same as Powerbuggy	74	6	24,600	0.40	1.0450	1.5179	0.1793	0.0000	0.12	Tier 2/MSHA	0.81	0.21	120	31200	1.3320	0.1732	0.0139	0.0018	0.0202	0.0026	0.0024	0.0003	0.0000	0.0000	0.3996	0.0519
Pickup trucks, 4 WD, 3/4-ton	Assume same specs as the Conventional Mine	315	8	187.5	0.004	1.0450	1.5179	0.1793	0.0000	negl.	Mobile 6	0.81	1.0	160	41600	0.3600	0.0468	0.0038	0.0005	0.0055	0.0007	0.0006	0.0001	0.0000	0.0000	negl.	negl.
Fuel/lube truck		400	1	37.5	1.00	1.0450	1.5179	0.1793	0.0000	0.12	Tier 1/MSHA	0.81	0.59	20	5200	8.4286	1.0957	0.0881	0.0115	0.1279	0.0166	0.0151	0.0020	0.0000	0.0000	1.0114	0.1315
Forklift		400	1	37.5	1.00	1.0450	1.5179	0.1793	0.0000	0.12	Tier 1/MSHA	0.81	0.59	20	5200	8.4286	1.0957	0.0881	0.0115	0.1279	0.0166	0.0151	0.0020	0.0000	0.0000	1.0114	0.1315
Mechanical Service Truck		400	1	75.0	1.00	1.0450	1.5179	0.1793	0.0000	0.12	Tier 1/MSHA	0.81	0.21	20	5200	3.0000	0.3900	0.0314	0.0041	0.0455	0.0059	0.0054	0.0007	0.0000	0.0000	0.3600	0.0468
				286,575																							
															Total Surface	28.8017	3.7442	0.8028	0.1044	0.4260	0.0554	0.0955	0.0124	0.1782	0.0232	11.0863	1.4412
															Total Underground	39.5043	5.1356	0.4128	0.0537	0.5996	0.0780	0.0708	0.0092	0.0000	0.0000	6.4680	0.8408
															Total Mine	68.3060	8.8798	1.2156	0.1580	1.0257	0.1333	0.1663	0.0216	0.1782	0.0232	17.5543	2.2821

Notes:
[1] 90% availability, 90% utilization.
Availability means: availability of unit due to maintenance or other mechanical downtime. This is typically 85% for underground operations, 90% was used for this analysis.
Use of availability (utilization) means: percent of available unit operation time due non-mechanical reasons such as employee lunch and break time. 90% was conservatively used in this analysis.
Total availability = 90% availability x 90% utilization = 0.81
[2] Engine load factors from EPA/420-P-02-014. Load factors indicate the average proportion of rated power used. Rated power is the maximum power level that an engine is designed to produce at its rated speed.
[3] Equipment details, quantity, horsepower, and fuel consumption from Proponent, "2011 POO Equipment Consumption.xls".
[4] Formaldehyde emission factor from AP-42 Volume II.
[5] Undergound equipment emissions maximum allowable under MSHA, codified in 30 CFR Section 57.5067.
[6] HAP % by weight in total VOC emissions from U.S. EPA SPECIATE database. Large diesel equipment % from "Diesel exhaust emissions from Pre-2007 Model Year Heavy-duty Diesel Trucks" (Number 8774).
Mine support vehicles % from "Diesel Exhaust - Medium Duty Trucks (Number 4674).

Sheep Mountain Mine
Diesel Combustion GHG Emissions

Appendix A - Table PF17

Emissions Source	Fuel	Fuel Rate	Fuel HHV	Part 98 CO_2 Emission Factor	Part 98 CH_4 Emission Factor	Part 98 N_2O Emission Factor	CO_2 Emissions (kg/yr)	CH_4 Emissions (kg/yr)	N_2O Emissions (kg/yr)	Part 98 CH_4 GWP	Part 98 N_2O GWP	CO_2e Emissions (mtpy)
Mine-Wide Diesel Combustion	Distillate Fuel Oil #2	1,077,975 gal/yr	0.138 mmBTU/gal Table C-1 default	73.96 kg/mmBtu Table C-1	0.003 kg/mmBtu Table C-2	0.0006 kg/mmBtu Table C-2	11,002,330	446.2817	89.2563	21.0000	310.0000	11,039.3717
Mine Intake Air Heaters	Natural Gas	900,000 scf/yr	0.001028 mmBTU/scf Table C-1 default	53.02 kg/mmBtu Table C-1	0.001 kg/mmBtu Table C-2	0.0001 kg/mmBtu Table C-2	49,054	0.9252	0.0925	21.0000	310.0000	49.1022
Facility Heaters	Natural Gas	3,950,000 scf/yr	0.001028 mmBTU/scf Table C-1 default	53.02 kg/mmBtu Table C-1	0.001 kg/mmBtu Table C-2	0.0001 kg/mmBtu Table C-2	215,293	4.0606	0.4061	21.0000	310.0000	215.5042
											Total CO_2e Emission Rate (metric tons/year)	11,303.9780

Notes:

Fuel HHV from 40 CFR Part 98 Table C-1.
Emission factors from 40 CFR Part 98 Table C-1 and Table C-2.
mtpy = Metric Tons per Year
GWP - Global Warming Potential (for CO_2e calculation of non-CO_2 emissions).
CO_2e emissions calculated as CO_2 + (CH_4 x CH_4 GWP) + (N_2O x N_2O GWP).
CO_2 calculations based on 40 CFR 98.33(a)(1) Eq. C-1.
CH_4, N_2O calculations based on 40 CFR 98.33(c)(1) Eq C-8.
Diesel fuel consumption rates from Energy Fuels letter dated October 28, 2013.
Natural gas consumption rates from Energy Fuels letter dated October 28, 2013.

APPENDIX B

RADIOLOGICAL IMPACTS ANALYSIS TECHNICAL DOCUMENT

Estimated Radiation Doses
To Members of the Public
from the Proposed Sheep Mountain Mine

Prepared for:

U.S. Department of the Interior
Bureau of Land Management
Lander Field Office
Lander, Wyoming

Prepared by:

Two Lines, Inc.
896 Overview Rd.
Grand Junction, Colorado

August, 2014

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF MAPS

LIST OF ABBREVIATIONS AND ACRONYMS

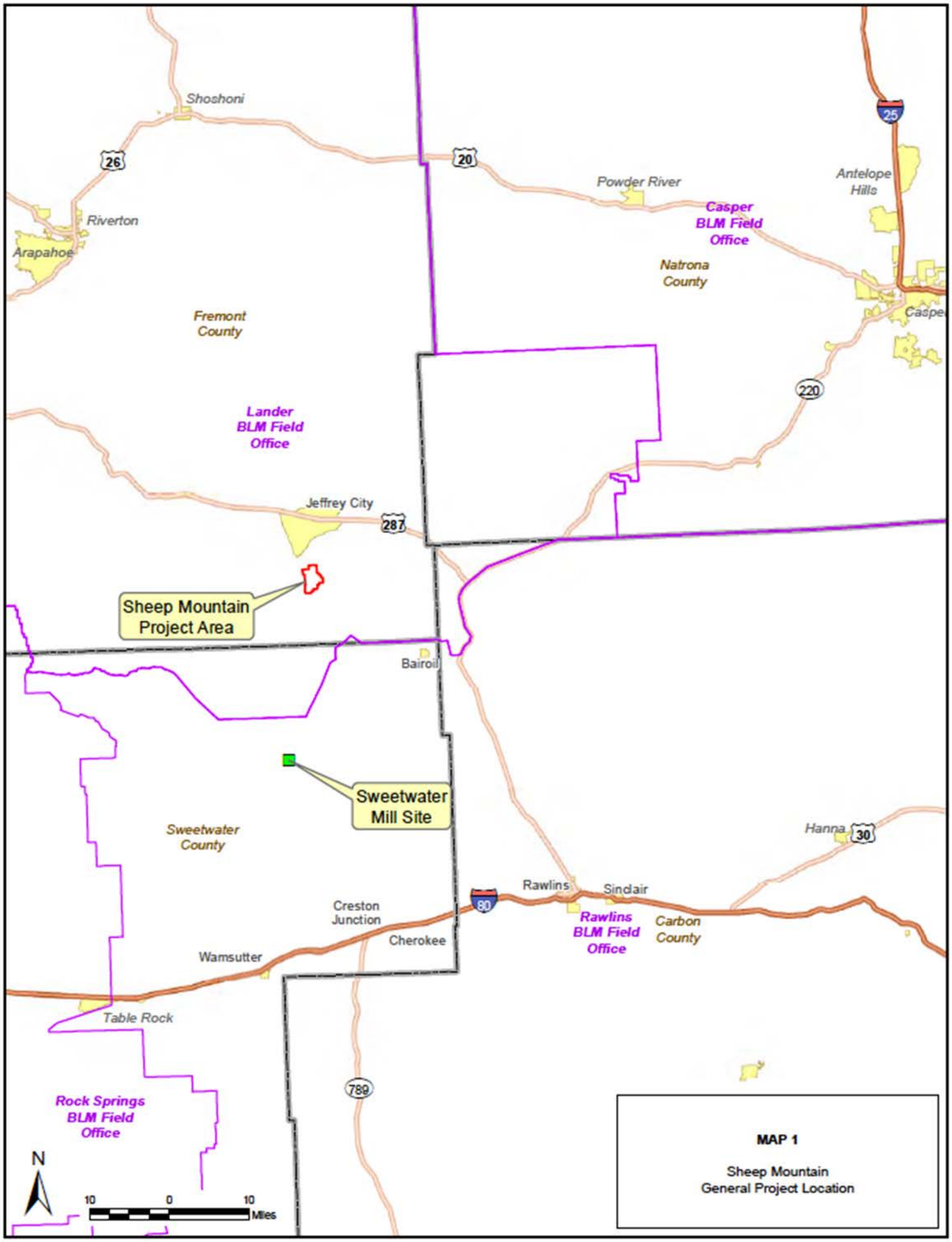
222Rn	radon-222
226Ra	radium-226
238U	uranium-238
ANL	Argonne National Laboratory
AQTSD	Air Quality Technical Support Document
CPP	Central Processing Plant
DOE	U.S. Department of Energy
EIS	Environmental Impact Statement
Energy Fuels	Energy Fuels Resources (USA) Inc.
EPA	U.S. Environmental Protection Agency
ISR	in situ recovery
Kennecott	Kennecott Uranium Company
MILDOS	MILDOS-AREA version 3.10
NRC	Nuclear Regulatory Commission
TEDE	total effective dose equivalents
TLI	Two Lines, Inc.

1.0 INTRODUCTION

Energy Fuels Resources (USA) Inc. (Energy Fuels) is proposing to develop and operate the Sheep Mountain mine located approximately 8 road miles South of Jeffrey City, Wyoming in Fremont County, Township 28 North, Range 92 West, Sections 4, 5, 9, 16, 17, 20, 21, 27, 29, 30, 32 and 33, as shown on Map 1. This area lies approximately 62 road miles southeast of Riverton, approximately 67 miles north of Rawlins, and approximately 105 road miles west of Casper and is located on Jeffrey City and Crooks Peak U.S. Geological Survey 7.5-minute topographic quadrangles. The Project Area includes approximately 3,625 surface acres (approximately 5.7 square miles) of mixed ownership including 2,313 acres of federal surface, 768 acres under state ownership, and 544 acres of fee lands. Approximately 2,836 acres of federal mineral estate is included in the Project Area.

The Project will include an open pit mine (the Congo Pit) and an underground mine with two adits. A heap leach uranium processing facility will be built to the south of the mines. Potential doses to members of the public from the heap leach facility were modeled previously and will be included in Energy Fuels' license application to the Nuclear Regulatory Commission (NRC).

In support of the Environmental Impact Statement (EIS) for the Sheep Mountain Project, Two Lines, Inc. (TLI) was asked to model potential radiation doses to members of the public that would result from releases from the Project. This report describes the modeling approach and results.


Shoshoni
26
20
Riverton
Arapahoe
Powder River
Antelope Hills
25
Casper BLM Field Office
Natrona County
Casper
Fremont County
220
Lander BLM Field Office
Jeffrey City
287
Sheep Mountain Project Area
Bairoil
Sweetwater Mill Site
Sweetwater County
Hanna
30
Rawlins
Sinclair
Creston Junction
80
Rawlins BLM Field Office
Carbon County
Cherokee
Wamsutter
Table Rock
789
Rock Springs BLM Field Office
N
10
0
10
Miles
MAP 1
Sheep Mountain General Project Location

2.0 PROJECT DESCRIPTION

Energy Fuels proposes to explore for, and develop uranium reserves to extract approximately 1.0 million to 2.0 million pounds of uranium from the ore per year during active operations (estimated at 20 years). Mining would be completed using conventional methods including both open-pit and underground methods. There are three principal phases in the Proposed Action: Construction, Operations, and Reclamation. The Proposed Action would require up to 929 acres of disturbance of which 356.5 acres would be new disturbance and 572.5 acres was previously disturbed.

Construction includes the building of facilities and installation of equipment that would be needed prior to Operations. Operations would include the mining and milling of uranium ore (Map 2). Conventional open pit (Congo Pit) and modified room and pillar underground (Sheep Underground) mining methods would be employed to remove mineralized uranium ore. Ore from both the Congo Pit and underground mine would be stockpiled at the entry to the underground mine on the Ore Stockpile for later transport to:

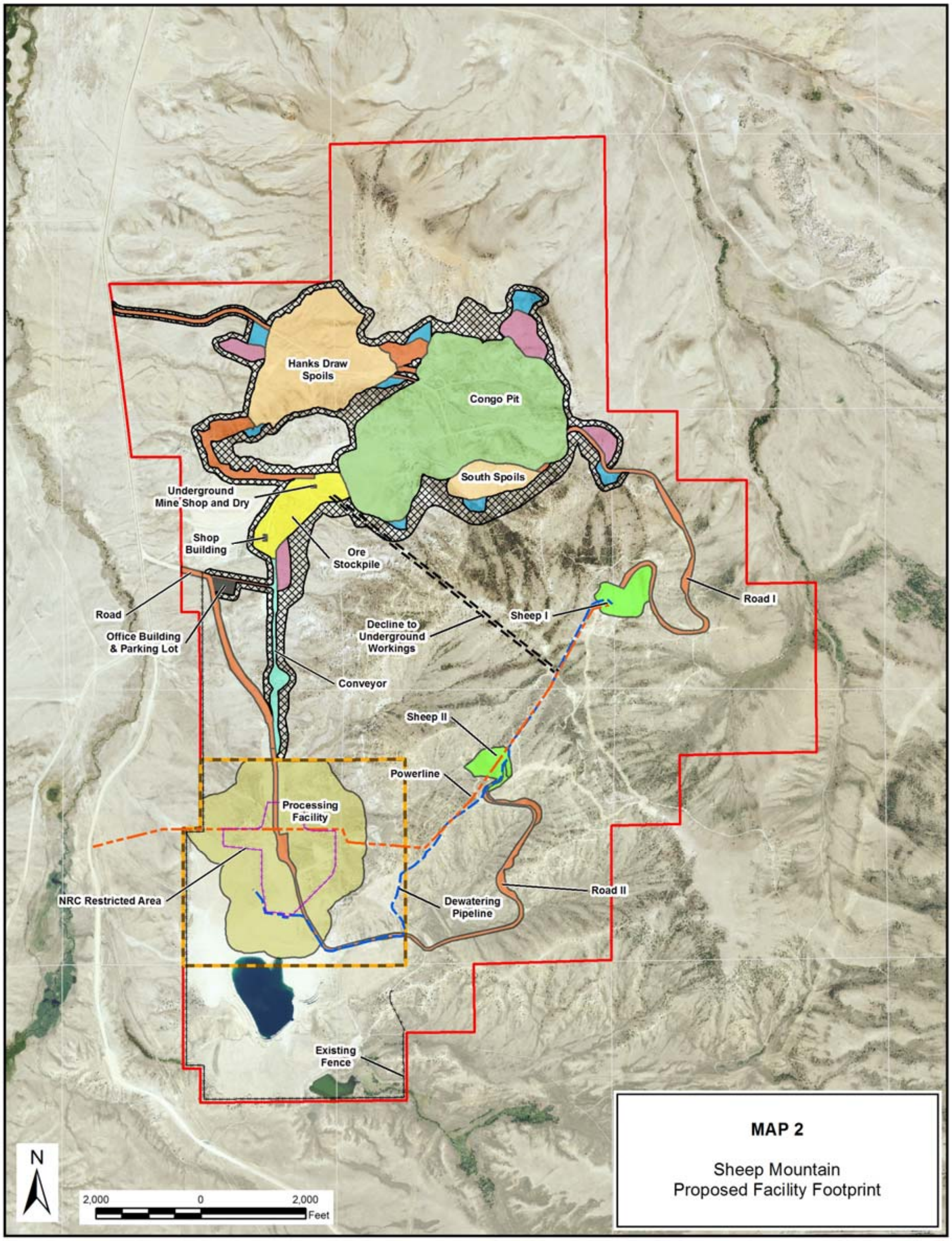
- An On-Site Ore Processing Facility, which would be licensed by the NRC as a uranium processing mill. Ore would be transported to this Facility via conveyor, which would be within the Project Area. The Facility would include a Heap Leach Pad for dissolution of the uranium from the ore; a series of Treatment Ponds (Holding Pond, Collection Pond, and Raffinate Pond) for the solution from the Pad; an Extraction Plant for removing the ore from solution, and a Precipitation and Packaging Plant.
- An Off-Site Ore Processing Facility. Ore would be transported to this location via truck to the Sweetwater Mill. The Sweetwater Uranium Mill is owned and operated by Kennecott Uranium Company (Kennecott), a division of Rio Tinto Americas, Inc. The mill is located entirely on private lands owned by Kennecott.

The option to pursue off-site processing is a sub-part of the Proposed Action because it is advanced by Energy Fuels. The Sweetwater Uranium Mill (owned and operated by Kennecott Uranium Company - Kennecott, a division of Rio Tinto) is located entirely on private lands owned by Kennecott and permitted with the NRC as an operating license under Source Material License SUA-1350 which allows for production of 4,100,000 pounds of yellowcake per year. Therefore, Kennecott could receive ore and begin operations under the stipulations of their permit at any time. For the purpose of analysis within this EIS, it is assumed that operations at the Sweetwater Mill would occur under the existing license without significant revisions, and impacts associated with the operations of the mill would be similar to those of the operation of the Heap Leach facility at Sheep Mountain and/or the Piñon Ridge Mill in Colorado in relation to applicable resources such as air and human health and safety. The impacts associated with hauling ore to the Sweetwater Mill from the Sheep Mountain site and operating the Sweetwater Mill are disclosed in this EIS because they are connected actions. However, the BLM would not be involved in permitting or authorizing hauling of ore to the Sweetwater Mill along county roads or processing at the Sweetwater Mill.

Reclamation would include decommissioning of facilities, backfilling, and re-vegetating of the mined areas, and covering of the heap leach pad to prepare for long-term care and maintenance by the State of Wyoming or the U.S. Department of Energy (DOE).

As mentioned above, potential doses to members of the public from the NRC-regulated heap leach facility would be part of Energy Fuels' license application to the NRC. The purpose of this report is to describe potential doses to members of the public from mining-related activities including the Congo Pit, stockpiling of ore, storage of spoils materials and releases from the underground mine adits.

Potential doses were modeled using MILDOS-AREA version 3.10 (MILDOS), released in 2012. The users manual for MILDOS was published in 1989 by Argonne National Laboratory (ANL, 1989) and has not been updated since that time. A new version of MILDOS-AREA is undergoing beta testing at this time, but has not been released for use.


Hanks Draw Spoils
Congo Pit
South Spoils
Underground Mine Shop and Dry
Shop Building
Ore Stockpile
Road
Office Building & Parking Lot
Decline to Underground Workings
Sheep I
Road I
Conveyor
Sheep II
Powerline
Processing Facility
NRC Restricted Area
Dewatering Pipeline
Road II
Existing Fence
N
2,000
0
2,000
Feet
MAP 2
Sheep Mountain
Proposed Facility Footprint

3.0 POTENTIAL RADIOACTIVE EFFLUENTS

Uranium-238 (^{238}U) in the ore body ultimately decays to radium-226 (^{226}Ra) and then radon-222 (^{222}Rn). MILDOS was designed to model releases of uranium decay products from uranium production facilities including conventional mills. It was later amended to include modules for *in* situ recovery facilities and may be used to model releases from heap leach facilities, as well. For the purposes of this Project, doses to members of the public were modeled to arise from radioactive material released from the following site features:

- **Congo Pit**: Radon from the pit will be released when the encountered ore is disturbed. Radioparticulates from the pit were not modeled on the assumption that water spray would limit releases from the rim of the pit, especially as it gets deeper.
- **Ore stockpile**: Radon as well as radioparticulates of the uranium decay chain will be released over time by wind action on the stored material.
- **Hanks Draw and South Spoils**: Releases of uranium decay chain radioparticulates and radon from stored waste rock or spoils areas.
- **Sheep I and II underground mine adits**: Radon will be released from the adits of the underground mine.
- **Handling of materials**. During handling and transport of materials, both radioparticulates and radon will be released.

Each of the sources were modeled to estimate impacts at receptors of interest. Modeling assumptions and results are presented below.

4.0 MODELING

The computer code MILDOS-AREA was used to estimate potential radiation doses from releases as mentioned above. MILDOS (ANL, 1989) was originally developed to estimate doses from conventional uranium milling operations, including large area releases such as ore storage pads and tailings beaches. Inputs to the dose are limited to uranium decay chain radionuclides. MILDOS was subsequently updated in 1998 to address potential impacts of uranium *in situ* leaching operations (ANL, 1998). In situ leach specific types of source terms, such as production wells and restoration wells are included in the updated version. Modeling parameters and assumptions are addressed below.

MILDOS calculates effective dose as well as organ doses from inhalation, ingestion, direct exposure from deposition of radioparticulates on ground surfaces, and submersion in contaminated air. For each source, there are calculations both with and without radon to allow comparison to 10 CFR 20.1301 (including radon) and 40 CFR 190 (doses excluding radon) dose limits.

Meteorology

Meteorological conditions greatly influence dispersion of radionuclides from estimated releases during the year. The Sheep Mountain Project has an on-site meteorological station. Data for the period August 2010 through September 2013 were used (Table 1 and Figure 1). The data set included wind speed, wind direction, and stability class. These data were converted to stability array joint frequency distribution (STAR file) required for input to MILDOS. These calculations were performed using the STARMD program which is based on the Sigma-Theta method in EPA 454/R-99-005 (EPA, 1987). STAR data represent percentages of time for each wind direction (16 compass points) in particular wind speed and stability classes. As shown in Table 1, winds are from the southeast, south-southeast and south account for nearly 60 percent of the time.

Table 1 - Wind Direction Frequency Distribution

Direction From	Percentage of Total Hours	Direction From	Percentage of Total Hours
N	6.30	S	10.93
NNE	2.58	SSW	5.91
NE	1.98	SW	4.59
ENE	1.58	WSW	3.80
E	0.89	W	3.35
ESE	1.27	WNW	1.28
SE	19.48	NW	2.20
SSE	28.66	NNW	5.19
Total..........100.00			

Wind Rose of Sheep Mountain Meteorological Station (IML,2013)

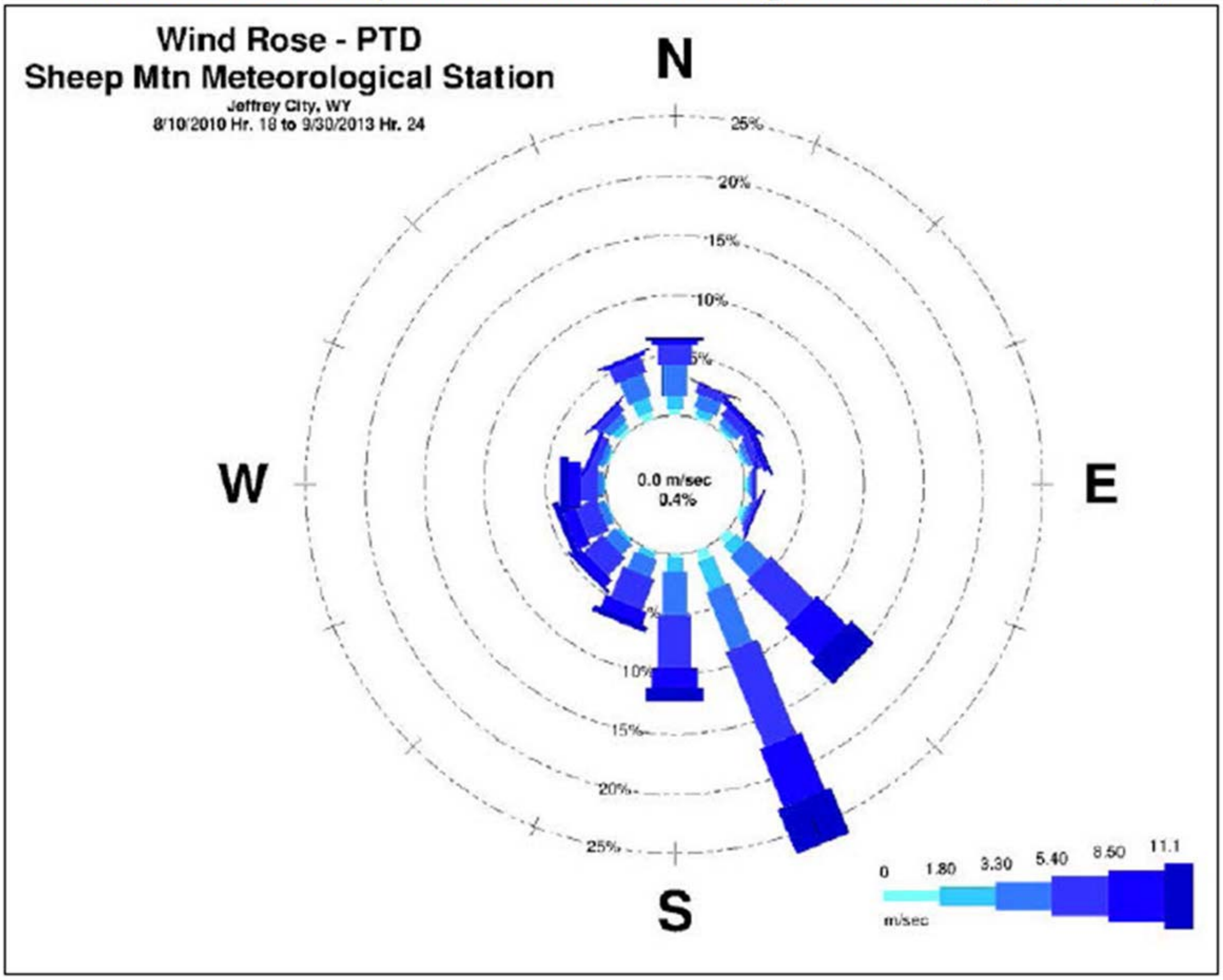


Figure 1. Windrose for Sheep Mountain Meteorological Station

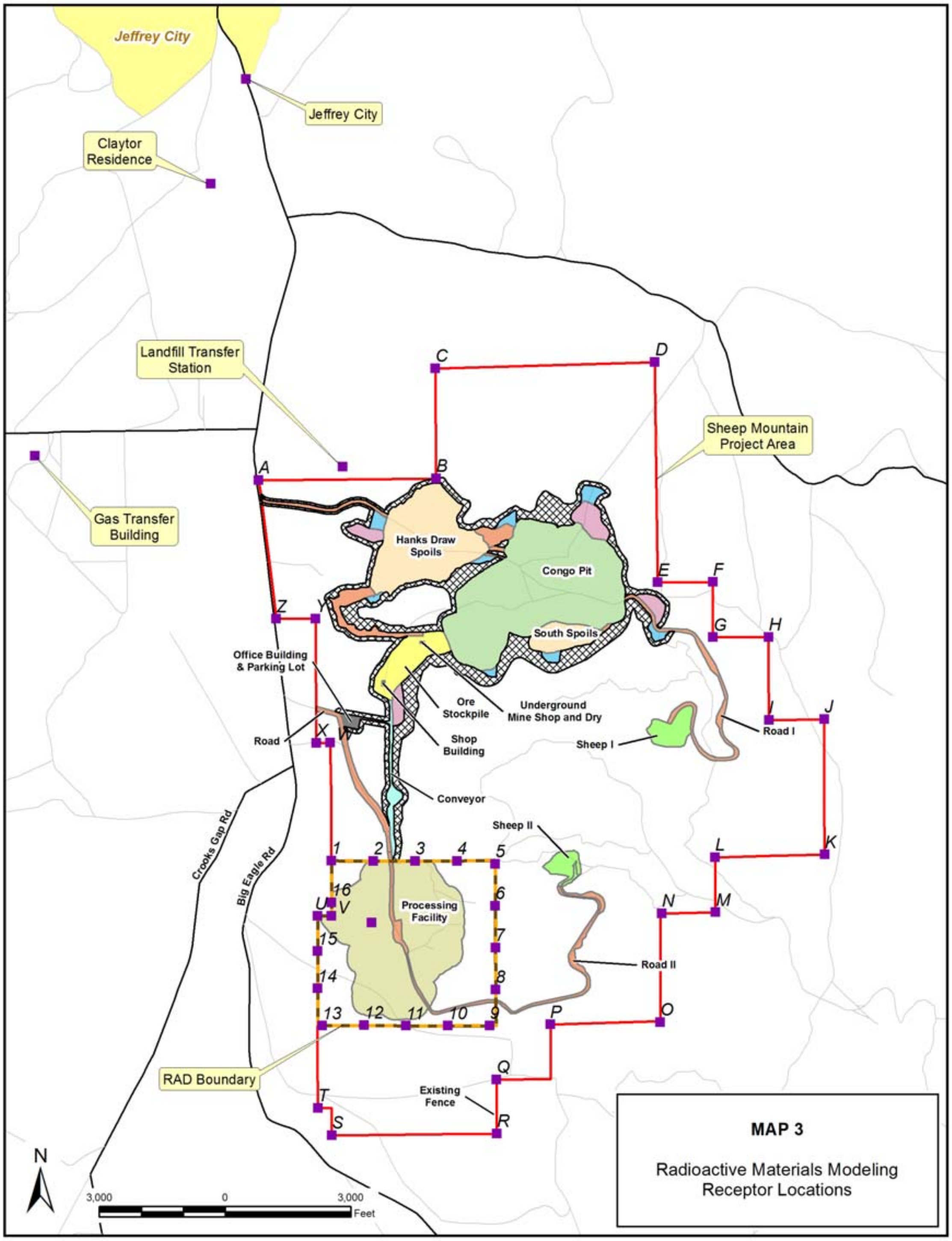
Receptor Locations

For MILDOS purposes, receptors are situated relative to a central location. The locations of receptors are shown on Map 3.

There are few permanent receptors in the vicinity of the Sheep Mountain project. The nearest permanent residence, the Claytor ranch, is 5.5 km to the north-northwest of the plant. The nearest town is Jeffrey City, which is approximately 6 km to the northwest of the proposed central processing facility.

Table 2 - Location of Modeled Receptors (Relative to the Ore Processing Facility)

Name	X (km)	Y (km)	Z (m)	Name	X (km)	Y (km)	Z (m)
Project Area Boundary Receptor Locations							
A	-0.85	3.22	-72	N	2.17	0.14	277
B	0.44	3.26	85	O	2.18	-0.65	175
C	0.41	4.06	141	P	1.38	-0.69	112
D	2.01	4.15	-4	Q	0.99	-1.10	40
E	2.07	2.55	77	R	1.01	-1.50	10
F	2.48	2.56	62	S	-0.19	-1.54	23
G	2.49	2.16	88	T	-0.30	-1.35	-18
H	2.89	2.17	53	U	-0.34	0.05	-33
I	2.91	1.57	111	V	-0.24	0.05	-27
J	3.31	1.58	84	W	-0.28	1.32	-44
K	3.34	0.60	171	X	-0.38	1.31	-50
L	2.54	0.56	207	Y	-0.41	2.22	-18
M	2.56	0.16	297	Z	-0.70	2.21	-58
NRC Boundary Receptor Locations							
1	-0.25	0.46	-36	9	0.94	-0.71	70
2	0.06	0.46	-18	10	0.63	-0.72	47
3	0.36	0.47	0	11	0.33	-0.73	-51
4	0.67	0.48	36	12	0.02	-0.73	-6
5	0.94	0.46	149	13	-0.28	-0.75	-12
6	0.95	0.16	71	14	-0.32	-0.48	-7
7	0.96	-0.15	106	15	-0.33	-0.20	-18
8	0.97	-0.45	76	16	-0.24	0.15	-30
Inhabited Receptor Locations							
Claytor Ranch	1.26	5.36	-111	Landfill Transfer station	-0.24	3.33	-41
Gas Transfer building	2.49	3.35	-61	Jeffrey City	1.02	6.13	-114


Jeffrey City
Jeffrey City
Claytor Residence
Landfill Transfer Station
Gas Transfer Building
Sheep Mountain Project Area
Hanks Draw Spoils
Congo Pit
South Spoils
Office Building & Parking Lot
Ore Stockpile
Underground Mine Shop and Dry
Shop Building
Road
Conveyor
Sheep I
Road I
Sheep II
Processing Facility
Road II
Crooks Gap Rd
Big Eagle Rd
RAD Boundary
Existing Fence
N
3,000
0
3,000
Feet
MAP 3
Radioactive Materials Modeling Receptor Locations

Input Parameters for MILDOS Model

Parameters that apply to the entire Project are shown in Table 3.

Table 3 - Important Input Parameters

All sources	Ore grade	0.122% (342 pCi/g U)
	General emanation rate (after Leach et al. 1982)	2160 pCi/ m^2 sec per % ore
	Particle release rate	6.62E-06 g/m^2 sec
Ore stockpile	Area	30.5 ac (1.23E+05 m^2)
	U decay chain concentration	342 pCi/g
	Particulate release rate	6.62E-06 g/m^2 sec
	Enrichment factor, N	2.5
Spoils piles	U decay chain concentration	40 pCi/g
	Area (Hanks Draw + South spoils)	124 ac (5.00E+05 m^2)
	Enrichment factor, N	2.5
Congo Pit	Area	216 ac (8.75E+05 m^2)
	Radon emanation rate	264 pCi / m^2 sec
Sheep I and II adits	Radon release (after Mudd, 2008)	1190 pCi/y
Handling	Particulate releases - Truck dumping	1.88 ton/yr
	Particulate releases - Crusher	0.33 ton/yr
	Particulate releases - Conveyor	2.41 ton/yr
	Radon emission factor	0.1

The particulate release rate was taken from the stockpiles values presented in Table 1 of the Air Quality Technical Support Document (AQTSD) and converted to the size of the ore stockpile. This value was used to calculate the releases from storage of materials. The activity enrichment factor, N, is set at 2.5 to reflect the extent to which suspended airborne particles have a higher uranium concentration than in bulk ore (NRC, 1987, page 3.59-8).

For modeling of spoils storage, it was conservatively assumed that the uranium decay chain concentrations of the spoils materials was 40 pCi/g, or approximately 1/8 that of the ore itself.

To model handling of overburden and placement on spoil piles, the values presented in the AQTSD Table 1 were used. Overburden was assumed to have only 5 pCi/g of uranium, while ore has a concentration of 342 pCi/g. For handling of ore via truck dumping, crushing, and transport by conveyor, the particulate release rates from the AQTSD Table 1 were used.

The general emanation rate for radon gas from ore deposits was taken from Leach et al. (1982) who studied a relatively high grade pit mine in Australia. They observed that the ratio of radon emanation rate to ore grade was fairly stable. Unless the ore was weathered, the emanation rate held steady at 80 Bq/m^2 sec per % ore, which is equivalent to 2,160 pCi/ m^2 sec per % ore. For the Sheep Mountain ore, this computes to 264 pCi/ m^2 sec for ore.

Radon releases from the Sheep I and Sheep II adits were derived using data presented by Mudd (2008). Mudd studied radon releases from uranium mining and milling projects in

Australia and cites releases from the Jabiluka and Olympic Dam mines which averaged 121 GBq/day, equivalent to 1190 pCi/yr.

For handling of materials, the radon emission fraction was set as 0.1 because of the relatively short residence time of materials in these processes (NRC 1987, page 3.59-15). The general equation to estimate a radioparticulate release rate for handling of ore is:

$$S = EF * C * E * 9.08E - 07 \text{ Ci/yr}$$

Where:

S	= source term, amount released
EF	= Emissions, tons/yr
C	= Concentration, pCI/g
E	= Enrichment ratio, 2.5 unitless

For truck dumping, this accounts for 1.46E-3 Ci released per year from the ore pad dumping point source. The enrichment factor of 2.5 accounts for the fact radionuclide concentrations in suspended airborne materials is considerably higher than in bulk ore.

Radon releases from crushing ore are calculated using:

$$S = EF * C * 0.1 * 9.08E - 07 \frac{Ci}{yr}$$

Where:

S	= amount of Rn released
EF	= Emissions, tons/yr
C	= Concentration, pCI/g
0.1	= fraction of radon in ore released during crushing

For crushing, this amounts to 22.9 Ci/yr of Rn released as a point source.

Modeling

MILDOS allows a variety of types of source terms, including:

- Point sources: used for releases from stacks, material handling, and various stationary sources.
- Area sources: used for sources such as ore pads or tailings beaches. Implicitly assumes a square footprint.
- Quadrilateral area sources: allow modeling of sources such as ore pads and tailings beaches having a non-square footprint.
- New well field sources: models radon release from installation of new wells at an *in situ* recovery (ISR) site.
- Production well field sources: models releases of radon from venting or purge water releases from wells, piping, or ion exchange columns during uranium production at an ISR site.

- Drying and packaging sources: allows for modeling of releases of radioparticulates from non-vacuum dryers.
- Restoration well field sources: m models releases of radon from venting or purge water releases from wells, piping, or ion exchange columns during restoration of a wellfield at an ISR site.

For purposes of this modeling exercise, sources were considered to be either point sources or quadrilateral sources. The model was run for each of the following situations for a time step of one year:

- **Ore stockpile:** The ore stockpile was modeled as a quadrilateral source that mimics the size and location shown on Map 2.
- **Spoils pile:** The Hanks Draw spoils pile was modeled as two quadrilaterals shaped to mimic the single pile shown on Map 2. The South Spoils pile was modeled as a single quadrilateral.
- **Congo Pit:** Radon releases from the Congo Pit were modeled as a three quadrilateral sources that collectively overlay the proposed pit. Radon emanation was conservatively calculated assuming that the entire shape was composed of ore, with the general emanation rate shown in Table 4.
- **Sheep I and Sheep II adits:** Releases from the adits were calculated using the release rates presented by Mudd (2008).
- **Handling:** As mentioned above, handling of materials used the particulate and radon release rates described above for each source, considered to be a point. Releases were assumed to occur at the centroid of the source with the exception of the conveyor. The total conveyor releases for both radioparticulates and radon were modeled as six separate sources stretching from the ore stockpile/crusher to the NRC boundary.

Inhalation, direct exposure from material deposited on the surface (ground) and submersion in contaminated air (cloud) were calculated for all receptors. Food pathways were included for vegetables and cattle grown in the area. It was assumed that all cattle feed was from pasture grass, not hay or other feed. The milk pathway was turned off for all receptors because there is no commercial dairy in the vicinity. Doses were calculated for an 8,760-hr year, a conservative assumption meaning that, unless otherwise noted, exposure at a receptor location occurs for 100 percent of the time.

5.0 MODEL RESULTS

This section presents the results of the MILDOS modeling.

Radon Release Rates

Potential annual radon release rates calculated by MILDOS from input parameters during the Project from the various sources are listed in Table 4. The activity of ^{238}U decay products is equivalent to the ^{238}U activity because they are considered to be in secular equilibrium with the parent radionuclide.

Table 4 - Calculated Radioactivity Releases by Source

	Source	**Ci/yr**
Activity	**Radioparticulates (^{238}U and decay products in equilibrium)**	
Storage	Ore stockpile	2.23E-02
	Hanks Draw spoils	7.50E-03
	South spoils	7.70E-04
Handling	Overburden unloading	8.14E-05
	Truck dumping	1.46E-03
	Crusher	2.56E-04
	Conveyor	1.87E-03
	Radon	
Storage	Ore stockpile	1.04E+03
	Hanks Draw spoils	3.45E+02
	South spoils	3.53E+01
	Congo Pit	6.03E+03
	Sheep I and II adits	1.19E+03
Handling	Overburden unloading	7.10E-00
	Truck dumping	2.29E+01
	Crusher	2.29E+01
	Conveyor	4.68E+01

Dose to Individual Receptor Locations

Estimated maximum annual total effective dose equivalents (TEDE) and 40 CFR 190 doses (without radon) at individual boundary receptor locations are shown below in Tables 5 and 6. The maximum TEDE to any Project Area boundary location occurs at location B and is estimated at 19.7 mrem, which is far below that 100 mrem/yr limit expressed in 10 CFR 20.1301. At the same location, the bone dose exceeds the 25 mrem/yr limit of 40 CFR 190 for any organ. The dose strictly from radon and radon decay products at location B is the difference between the TEDE (dose including particulates and radon) and the 40 CFR 190 effective dose (dose without radon) or 17.3 mrem/yr. Location B is very near to the Hanks Draw spoils pile, so it makes sense that it would be the highest dose location.

Table 4
Total Effective Dose Equivalent (TEDE) and 40 CFR 190 Doses (without radon) to an Adult at Sheep Mountain Project Area Boundary Locations

Location	TEDE (mrem/yr)	40 CFR 190 Dose (mrem/yr)		
		Eff	Bone	Lung
A	6.47E+00	6.59E-01	7.69E+00	1.86E+00
B	**1.97E+01**	**2.41E+00**	**2.93E+01**	**6.39E+00**
C	1.52E+01	7.28E-01	8.75E+00	1.96E+00
D	3.25E+00	1.19E-01	1.41E+00	3.30E-01
E	3.60E+00	1.45E-01	1.71E+00	4.03E-01
F	2.38E+00	1.01E-01	1.19E+00	2.82E-01
G	2.33E+00	8.78E-02	1.03E+00	2.49E-01
H	1.62E+00	6.76E-02	7.90E-01	1.92E-01
I	1.62E+00	4.67E-02	5.38E-01	1.35E-01
J	1.14E+00	3.73E-02	4.29E-01	1.08E-01
K	1.86E+00	1.99E-02	2.24E-01	5.94E-02
L	6.20E+00	3.74E-02	4.28E-01	1.09E-01
M	4.81E+00	3.52E-02	4.02E-01	1.03E-01
N	6.06E+00	5.20E-02	5.92E-01	1.51E-01
O	4.03E+00	4.24E-02	4.76E-01	1.26E-01
P	3.19E+00	7.17E-02	7.93E-01	2.19E-01
Q	2.52E+00	6.68E-02	7.33E-01	2.08E-01
R	2.20E+00	5.43E-02	5.94E-01	1.69E-01
S	1.44E+00	4.76E-02	5.16E-01	1.51E-01
T	1.41E+00	5.30E-02	5.65E-01	1.72E-01
U	2.03E+00	1.09E-01	1.18E+00	3.51E-01
V	2.22E+00	1.29E-01	1.37E+00	4.23E-01
W	4.63E+00	3.83E-01	4.45E+00	1.07E+00
X	3.80E+00	2.83E-01	3.30E+00	7.96E-01
Y	1.27E+01	2.03E+00	2.31E+01	6.02E+00
Z	4.80E+00	4.83E-01	5.56E+00	1.40E+00

Doses at the so-called NRC Restricted Area boundary are shown in Table 6. The maximum TEDE for any NRC boundary location is 12.9 mrem/yr at NRC5. The maximum organ dose occurs in the bone of an adult at the NRC3 location. Both the TEDE and organ doses are below the public dose limits of 100 mrem/yr and 25 mrem/yr dose limits from 10 CFR 20.1301 and 40 CFR 190, respectively.

Table 7 lists doses to locations actually inhabited or utilized. The Gas Transfer building has the highest estimated TEDE of 19.8 mrem/yr. The Claytor Ranch location would be subject to 7.76 mrem/yr and Jeffrey City 6.99 mrem/yr TEDE. No 40CFR190 dose exceeds the 25 mrem/yr limit.

It is important to note that the calculated doses are conservative (overestimates) for several reasons. The primary reason is that MILDOS assumes 100 percent occupancy at the modeled location. That means to receive 19.7 mrem, as modeled for location B, a person would be required to be at that location for 8,760 hours during the year. This is a very unlikely scenario. Likewise, a worker at the Gas Transfer building who spent 40 hours/week or 2,000 hours per year would receive 19.8*2000/8760 hours/year or 4.5 mrem/yr. In reality, workers are at the gas transfer building only sporadically and for far less than 40 hours/week.

Table 5
Total Effective Dose Equivalent (TEDE) and 40 CFR 190 (without radon) dose to Adult at NRC Boundary Locations

Name	TEDE (mrem/yr)	40 CFR 190 Dose (mrem/yr)		
		Effective	Bone	Lung
NRC1	3.82E+00	1.77E-01	1.98E+00	5.14E-01
NRC2	6.01E+00	4.94E-01	5.29E+00	1.48E+00
NRC3	8.43E+00	**6.41E-01**	**6.79E+00**	**1.94E+00**
NRC4	9.69E+00	2.95E-01	3.28E+00	8.64E-01
NRC5	**1.29E+01**	2.06E-01	2.32E+00	5.99E-01
NRC6	1.07E+01	1.65E-01	1.86E+00	4.79E-01
NRC7	8.15E+00	1.40E-01	1.56E+00	4.07E-01
NRC8	6.53E+00	1.18E-01	1.31E+00	3.46E-01
NRC9	5.41E+00	1.03E-01	1.14E+00	3.02E-01
NRC10	1.82E+00	2.92E-02	3.32E-01	8.39E-02
NRC11	3.32E+00	1.22E-01	1.35E+00	3.58E-01
NRC12	3.33E+00	1.10E-01	1.21E+00	3.26E-01
NRC13	2.71E+00	9.02E-02	9.87E-01	2.68E-01
NRC14	2.93E+00	9.15E-02	1.01E+00	2.70E-01
NRC15	3.11E+00	1.27E-01	1.39E+00	3.78E-01
NRC16	3.54E+00	1.68E-01	1.83E+00	4.93E-01

Table 6
Total Effective Dose Equivalent (TEDE) and Dose without Radon (40 CFR 190) to Adult at Each Inhabited Location

Name	TEDE (mrem/yr)	40 CFR 190 Dose (mrem/yr)		
		Effective	Bone	Lung
Claytor Ranch	7.76E+00	3.19E-01	3.74E+00	8.77E-01
Landfill Transfer	2.15E+00	7.75E-02	8.59E-01	2.26E-01
Gas Transfer	1.98E+01	1.41E+00	1.67E+01	3.86E+00
Jeffrey City	6.99E+00	2.37E-01	2.77E+00	6.54E-01

Dose to Members of the Public Under Various Scenarios

The above doses are to locations and represent a maximum potential dose due to the 100 percent occupancy assumption. In reality, various members of the public may potentially be exposed under a variety of different situations. Several common exposure scenarios include a courier or delivery person, a worker at the landfill transfer station, a visitor at the mine site, and a person camping nearby. Potential doses to each of these scenarios were calculated and the results are shown in Table 8.

Table 7
Potential Classes of Exposure to Members of the Public

Class	Annual Hours Exposed	MILDOS Dose Rate (modeled location)	Estimated Annual Dose
Delivery person	2.5 hr/wk * 50 wks/yr = 125 hr/yr	4.63 mrem/yr (location W)	(125 hr/yr * 4.63 mrem/yr) / 8760 hr/yr = 6.6E-02 mrem/yr
Tour group	8 hr/yr	12.2 mrem/yr (average of locations B & W)	(8 hr/yr * 12.2 mrem/yr) / 8760 hr/yr = 1.1E-02 mrem/yr
Landfill worker	8 hr/wk * 50 wk/yr = 400 hr/yr	2.15 mrem/yr (landfill transfer station)	(400 hr/yr * 2.15 mrem/yr) / 8760 hr/yr = 9.8E-02 mrem/yr
Camper	1 wk/yr = 168 hr/yr	19.7 mrem/yr (Location B)	(168 hr/yr * 19.7 mrem/yr) / 8760 hr/yr = 3.8E-01 mrem/yr

Delivery Person or Courier

It is reasonable to assume that a courier or delivery person might spend as much as 125 hours per year at the Project office building (Map 2). The nearest modeled dose location to that building is location W (Map 4) which has an estimated dose rate of 4.63 mrem/yr. Prorating that rate for the 125 hour exposure equates to an annual dose of 6.6E-02 mrem.

Tour Group Member

Tours of the Project would likely spend some time being briefed at the office building (Map 2) and then be transported to various locations around the Project Area. A likely maximum exposure time of 8 hours seems reasonable. To account for various dose rates at multiple locations, the average of the highest dose rate location and the location nearest the office building was used. The projected tour group member might receive as much as 1.1E-02 mrem during a visit.

Landfill Worker

The landfill transfer station is not occupied by a full-time worker. A worker at that location one day per week would be exposed for 400 hours/year. At the modeled dose rate of 2.1 mrem/yr the annual dose equates to 9.8E-02 mrem.

Camper

It is conceivable, though not likely, that someone might decide to camp near the Project. To be conservative, assume that the campsite is situated near location B, just adjacent to the Hanks Draw Spoils Pile. A camper spending an entire week, 168 hours, at that location would be subjected to a dose rate of 19.7 mrem/yr, which would prorate to 3.8E-01 mrem for the week.

Dose from Mine Adits

As mentioned above, radon releases from the underground mine are from the Sheep I and Sheep II adits. These releases were modeled as point sources with the following results. The maximum dose from the mine adits alone are to location 1 on the NRC Restricted Area boundary and location L on the Project Area boundary (Map 4). Those doses are 5.58 mrem/yr and 3.80 mrem/yr, respectively.

The 40 CFR 61.22 limits dose to a member of the public from an underground mine to 10 mrem/yr. Both these locations are well below that standard.

Contribution from Processing Facility

As shown on Map 2, Energy Fuels intends to operate a heap leach processing facility to the south of the mine complex. A license application will be submitted to the NRC. As part of the application, potential doses from the heap leach facility (mill) were modeled using MILDOS. That facility will also potentially contribute dose to members of the public. Table 9 provides modeled doses to common locations.

Table 8
Modeled TEDE Doses from Mining and Processing

Name	TEDE (mrem/yr)		
	Mine	Mill	Total
Claytor ranch	7.76E+00	9.27E-01	8.69E+00
Landfill Transfer	2.15E+00	7.15E-01	2.87E+00
Jeffrey City	6.99E+00	1.69E-01	7.16E+00
Maximum NRC – mine max (NRC5/NLA-NE)	1.29E+01	2.23E+00	1.51E+01
Maximum NRC - processing max (NRC3/NLA-N1)	8.43E+01	1.8E+01	2.64E+01

The Claytor Ranch location was estimated to received a total of approximately 8.7 mrem/yr from the combined mine and mill operations. The majority of that would result from mining operations which is reasonable given the proximity of the mine compared to the mill. The same is true of Jeffrey City, which would receive a total of 7.2 mrem/yr. Common boundary locations modeled for the mine and the mill are also shown. The maximum dose rate location mining, which was in common with the mill is location NRC5, designated NLA-NE for the mill modeling project. For that location the maximum dose rate was 12.9 mrem/yr, most of which likely results from the Sheep II underground mine adit. Contributions from the mill accounted for 2.23 mrem/yr. The maximum dose rate location modeled for the mill facility is the NRC3 location, designated NLA-N1 in the mill modeling project. The total dose rate at that location is estimated to be 26.4 mrem/yr, nearly 70 percent of which results from the milling process, not mining activities.

Uncertainties in Dose Estimates

MILDOS is not designed to calculate uncertainty associated with estimates of doses. Use of the Gaussian Plume Dispersion coefficients and the uncertainty in the dose conversion factors themselves introduce an unknown amount of uncertainty into estimated doses at receptor locations.

Doses calculated by the code represent an entire year of occupancy at the specified receptor location. For any actual resident, this represents a large overestimate of the actual dose that would be received. Residents in the vicinity would leave their place of residence for work or recreation and the model does not account for those absences. To account for those absences, which would reduce the estimated potential dose, a separate dose assessment using MILDOS-calculated values and prorating for time away from the modeled location would be required. This approach is similar to the scenario approach used above to estimate dose to an individual member of the public.

In addition, conservative assumptions were made in the modeling exercise. For example, radon releases from the Congo Pit were assumed to come from an area equivalent to the entire footprint of the pit with ore grade material. In reality, radon from ore will only be generated from the uncovered ore in the pit, not the entire footprint at once.

6.0 SUMMARY

The maximum TEDE at a receptor point on the Sheep Mountain Project Area Boundary was less than 20 mrem/yr at location B, which is just adjacent to the Hanks Draw Spoils area. The maximum TEDE at any NRC boundary location is estimated to be 12.9 mrem at location NRC5. Neither of these exceed the 10 CFR 20.1301 limit for dose to a member of the public of 100 mrem/yr. At location B, the maximum bone dose is estimated to be 29.3 mrem/yr, which does exceed the 40 CFR190 bone dose of 25 mrem/yr. It is important to remember that these dose rates are to locations, not actual members of the public and are calculated under the assumption of 100 percent occupancy at that location.

The TEDE dose rate at inhabited locations does not exceed 8 mrem/yr for any of the four modeled locations. The dose excluding radon (as per 40CFR190) does not exceed 4 mrem for any of the four. The same caveats regarding occupancy apply to the inhabited locations.

The maximum estimated TEDE from radon releases from the two underground mine adits, labeled Sheep I and Sheep II on Map 2, was 5.58 mrem/yr to location NRC1. This is below the 40 CFR 61.22 dose limit to a member of the public from an underground mine of 10 mrem/yr.

To get a more accurate assessment of actual potential dose to a member of the public, the length of exposure must be accounted for. Doses were estimated for four different classes of members of the public: courier, tour group, landfill worker, and camper. The estimated dose to each of those classes under certain scenarios was less than 1 mrem/yr in all cases.

In summary, while two static locations exceeded the potential bone dose from particulate releases, the TEDE limit was not exceeded at any location, nor by any member of the public under several exposure scenarios. The calculated doses to static locations is conservative due to the assumption of 100 percent occupancy at each location.

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