SECTION 4: EMISSION CALCULATIONS

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1. CONTROLLED POTENTIAL TO EMIT

Energy Fuels Resources Corporation Pinon Ridge Mill Facility
Montrose County, CO

Controlled Potential to Emit Summary (tons per year) **Plant Capacity:** **1,000 tons of ore processed per day**

Source ID	Emission Source	PM	PM_{10}	$PM_{2.5}$	NO_x	SO_2	CO	VOC	Total HAPs	Sulfuric Acid	Ammonia
FUGITIVE SOURCES											
UPMAIN	Unpaved Main Road	79.90	23.58	2.36	-----	-----	-----	-----	-----	-----	-----
PMAIN	Paved Main Road	0.72	0.14	0.02	-----	-----	-----	-----	-----	-----	-----
MONRD	Unpaved Monitoring Road	14.46	5.79	0.58	-----	-----	-----	-----	-----	-----	-----
SECRD	Unpaved Security Road	27.97	11.20	1.12	-----	-----	-----	-----	-----	-----	-----
UNLOAD1	Ore Unloading from Trucks	0.91	0.37	0.06	-----	-----	-----	-----	-----	-----	-----
UNLOAD2	Unloading from dumping platform to ore pad	0.91	0.37	0.06	-----	-----	-----	-----	-----	-----	-----
ORERD	Ore Pad Travel	7.72	2.28	0.23	-----	-----	-----	-----	-----	-----	-----
WIND1	Wind erosion of ore stockpiles	7.75	3.87	0.58	-----	-----	-----	-----	1.67E-03	-----	-----
110-FRAG	Oversized ore fragmenting	5.20E-03	2.34E-03	4.33E-04	-----	-----	-----	-----	-----	-----	-----
WIND2	Tailings Cell Wind Erosion	9.12	4.56	0.68	-----	-----	-----	-----	-----	-----	-----
WIND3	Evaporation Pond Wind Erosion	7.60	3.80	0.57	-----	-----	-----	-----	-----	-----	-----
EVAP1	Tailing Cell Evaporation	-----	-----	-----	-----	-----	-----	7.53	0.68	11.63	-----
EVAP2	Evaporation Pond Evaporation	-----	-----	-----	-----	-----	-----	13.58	-----	2.57	-----
420-MSS-01	Uranium Mixer Settler Tank A1	-----	-----	-----	-----	-----	-----	1.62	-----	-----	-----
420-MSS-02	Uranium Mixer Settler Tank A2	-----	-----	-----	-----	-----	-----	1.62	-----	-----	-----
420-MSS-03	Uranium Mixer Settler Tank A3	-----	-----	-----	-----	-----	-----	1.62	-----	-----	-----
420-MSS-04	Uranium Mixer Settler Tank A4	-----	-----	-----	-----	-----	-----	1.62	-----	-----	-----
430-MSS-01	Uranium Mixer Settler Tank B1	-----	-----	-----	-----	-----	-----	1.62	-----	-----	-----
430-MSS-02	Uranium Mixer Settler Tank B2	-----	-----	-----	-----	-----	-----	1.62	-----	-----	-----
430-MSS-03	Uranium Mixer Settler Tank B3	-----	-----	-----	-----	-----	-----	1.62	-----	-----	-----
430-MSS-04	Uranium Mixer Settler Tank B4	-----	-----	-----	-----	-----	-----	1.62	-----	-----	-----
440-MSS-01	Uranium Scrubber Mixer Settler	-----	-----	-----	-----	-----	-----	0.87	-----	-----	-----
440-MSS-02	Uranium Stripper Mixer Settler #1	-----	-----	-----	-----	-----	-----	0.87	-----	-----	-----
440-MSS-03	Uranium Stripper Mixer Settler #2	-----	-----	-----	-----	-----	-----	0.87	-----	-----	-----
440-TKH-01	Uranium SX Loaded Organic Tank	-----	-----	-----	-----	-----	-----	0.009	-----	-----	-----
440-TKH-02	Uramium SX Barren Organic Tank	-----	-----	-----	-----	-----	-----	0.009	-----	-----	-----
620-MSS-01	Vanadium Mixer Settler Tank A1	-----	-----	-----	-----	-----	-----	1.70	-----	-----	-----
620-MSS-02	Vanadium Mixer Settler Tank A2	-----	-----	-----	-----	-----	-----	1.70	-----	-----	-----
620-MSS-03	Vanadium Mixer Settler Tank A3	-----	-----	-----	-----	-----	-----	1.70	-----	-----	-----
620-MSS-04	Vanadium Mixer Settler Tank A4	-----	-----	-----	-----	-----	-----	1.70	-----	-----	-----
620-MSS-05	Vanadium Mixer Settler Tank A5	-----	-----	-----	-----	-----	-----	1.70	-----	-----	-----
630-MSS-01	Vanadium Mixer Settler Tank B1	-----	-----	-----	-----	-----	-----	1.70	-----	-----	-----
630-MSS-02	Vanadium Mixer Settler Tank B2	-----	-----	-----	-----	-----	-----	1.70	-----	-----	-----
630-MSS-03	Vanadium Mixer Settler Tank B3	-----	-----	-----	-----	-----	-----	1.70	-----	-----	-----
630-MSS-04	Vanadium Mixer Settler Tank B4	-----	-----	-----	-----	-----	-----	1.70	-----	-----	-----
630-MSS-05	Vanadium Mixer Settler Tank B5	-----	-----	-----	-----	-----	-----	1.70	-----	-----	-----
640-MSS-01	Vanadium Scrubber Mixer Settler	-----	-----	-----	-----	-----	-----	0.93	-----	-----	-----
640-MSS-02	Vanadium Stripper Mixer Settler #1	-----	-----	-----	-----	-----	-----	0.93	-----	-----	-----
640-MSS-03	Vanadium Stripper Mixer Settler #2	-----	-----	-----	-----	-----	-----	0.93	-----	-----	-----
640-MSS-04	Vanadium Stripper Mixer Settler #3	-----	-----	-----	-----	-----	-----	0.93	-----	-----	-----
640-TKH-01	Vanadium SX Loaded Organic Tank	-----	-----	-----	-----	-----	-----	0.009	-----	-----	-----
640-TKH-02	Vanadium SX Barren Organic Tank	-----	-----	-----	-----	-----	-----	0.009	-----	-----	-----
810-TKH-01	Sulfuric Acid Tank #1	-----	-----	-----	-----	-----	-----	-----	-----	0.002	-----
810-TKH-02	Sulfuric Acid Tank #2	-----	-----	-----	-----	-----	-----	-----	-----	0.002	-----
810-TKH-03	Sulfuric Acid Tank #3	-----	-----	-----	-----	-----	-----	-----	-----	0.002	-----
820-CVS-01	Ammonium Sulfate transfer conveyor	4.59E-04	1.51E-04	4.27E-05	-----	-----	-----	-----	-----	-----	-----
820-CVS-02	Ammonium Sulfate feed conveyor	4.59E-04	1.51E-04	4.27E-05	-----	-----	-----	-----	-----	-----	-----
850-HPF-01	Flocculant Hopper	5.58E-06	1.83E-06	5.18E-07	-----	-----	-----	-----	-----	-----	-----

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Energy Fuels Resources Corporation Pinon Ridge Mill Facility
Montrose County, CO

Controlled Potential to Emit Summary (tons per year) **Plant Capacity:** **1,000 tons of ore processed per day**

Source ID	Emission Source	PM	PM_{10}	$PM_{2.5}$	NO_x	SO_2	CO	VOC	Total HAPs	Sulfuric Acid	Ammonia
850-CVS-01	Flocculant Feed Conveyor	5.58E-06	1.83E-06	5.18E-07	-----	-----	-----	-----	-----	-----	-----
950-TKH-04	Gasoline Tank	-----	-----	-----	-----	-----	-----	0.38	-----	-----	-----
NON-FUGITIVE SOURCES											
110-STK-01	Feed System Dust Collector	0.04	0.01	2.21E-03	-----	-----	-----	-----	-----	-----	-----
120-DCS-01	SAG Mill Dust Scrubber	0.02	0.01	1.20E-03	-----	-----	-----	-----	3.34E-05	-----	-----
220-GHS-01	Leach Train Vent Gas Scrubber	-----	-----	-----	-----	-----	-----	-----	1.53E-09	7.76	-----
410-BBB-01	DE Bag Breaker	4.65E-04	4.65E-04	2.33E-04	-----	-----	-----	-----	-----	-----	-----
730-GHS-01	Packed Bed Wet Vent Scrubber	4.37E-03	4.37E-03	4.37E-03	-----	-----	-----	-----	4.33E-10	-----	5.15
730-GHS-02	Wet Venturi Scrubber	0.21	0.21	0.21	-----	-----	-----	-----	-----	-----	-----
910-PPL-01	Fire Water Diesel Pump	3.65E-03	3.65E-03	3.65E-03	0.11	0.02	0.01	3.88E-03	2.65E-04	-----	-----
920-STK-01	Combined Boiler Stack	0.82	0.82	0.82	3.91	1.76	8.79	0.58	1.98E-01	-----	-----
1000-SG-01	Standby Generator	9.35	7.68	7.46	3.22	5.97E-04	0.74	0.09	1.37E-03	-----	-----
Fugitive Source Total (ton per year)		**157.06**	**55.96**	**6.25**	**0.00**	**0.00**	**0.00**	**57.88**	**0.68**	**14.21**	**0.00**
Non-Fugitive Source Total (ton per year)		**10.45**	**8.75**	**8.50**	**7.24**	**1.78**	**9.54**	**0.67**	**0.20**	**7.76**	**5.15**
Facility Total (Fugitive and Non-Fugitive) (ton per year)		**167.50**	**64.71**	**14.75**	**7.24**	**1.78**	**9.54**	**58.54**	**0.88**	**21.96**	**5.15**

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2. UNCONTROLLED POTENTIAL TO EMIT

Energy Fuels Resources Corporation Pinon Ridge Mill Facility
Montrose County, CO

Uncontrolled Potential to Emit Summary (tons per year) **Plant Capacity:** **1,000 tons of ore processed per day**
Non-Fugitive Sources only

Source ID	Emission Source	PM	PM_{10}	$PM_{2.5}$	NO_x	SO_2	CO	VOC	Total HAPs	Sulfuric Acid	Ammonia
110-STK-01	Feed System Dust Collector	3.65	1.46	0.22	-----	-----	-----	-----	-----	-----	-----
120-DCS-01	SAG Mill Dust Scrubber	2.23	0.87	0.12	-----	-----	-----	-----	3.34E-03	-----	-----
220-GHS-01	Leach Train Vent Gas Scrubber	-----	-----	-----	-----	-----	-----	-----	0.00E+00	7.76	-----
410-BBB-01	DE Bag Breaker	4.65E-04	4.65E-04	2.33E-04	-----	-----	-----	-----	-----	-----	-----
730-GHS-01	Packed Bed Wet Vent Scrubber	0.00	0.00	0.00	-----	-----	-----	-----	0.00E+00	-----	5.15
730-GHS-02	Wet Venturi Scrubber	21.16	21.16	21.16	-----	-----	-----	-----	-----	-----	-----
910-PPL-01	Fire Water Diesel Pump	3.65E-03	3.65E-03	3.65E-03	0.11	0.02	0.01	3.88E-03	2.65E-04	-----	-----
920-STK-01	Combined Boiler Stack	0.82	0.82	0.82	15.24	1.76	8.79	0.58	1.98E-01	-----	-----
1000-SG-01	Standby Generator	9.35	7.68	7.46	3.22	5.97E-04	0.74	0.09	1.37E-03	-----	-----
Facility Non-Fugitive Source Total (ton per year)		**37.22**	**32.00**	**29.79**	**18.57**	**1.78**	**9.54**	**0.67**	**0.20**	**7.76**	**5.15**

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3. GIVEN PARAMETERS

Energy Fuels Resources Corporation Pinon Ridge Mill Facility
Montrose County, CO

General Operating Parameters			
Operating scenario	1,000	tons per day	
Operating days per year	365	days per year	
Mill operating hours	16	hours per day	
Leach system operating hours	24	hours per day	

Delivery Truck Information			
Ore delivery truck empty weight	18.5	tons	Referenced from email from Bob Monok dated April 21, 2009
Ore delivery trucks nominal capacity	24	tons	Referenced from email from Bob Monok dated April 21, 2009
Water delivery truck empty weight	13	tons	Average empty weight of 5 axle trucks from Table 3 of SFTA Report
Water delivery truck capacity	5,000	gallons	
Non-potable water needed per day	150,000	gallons	
Potable water trucks per day	1	trucks per day	On a six day per week schedule
Tankers and Semis for consumables	16	trucks per day	On a Monday - Friday schedule
FedEx delivery trucks	3	trucks per day	On a Monday - Friday schedule
FedEx truck weight	8	tons	US DOT Vehicle Inventory and Use Survey (Class 4/5 medium duty truck)
Delivery hours per day	10	hours per day	Daylight hours
Delivery days per year	365	days per year	

Worker Vehicle Information			
Number of vehicles to administration	27	cars/day	Day shift
Number of vehicles to mill area	30	cars/day	Day shift
Number of vehicles to mill area	15	cars/day	Swing, graveyard, and weekend shifts
Number of administration workers	27	people	
Number of mill workers	93	people	
Weight of worker vehicles	2.4	tons	EMFAC 2007 light duty truck average weight class

Product Delivery Trucks			
Uranium Trucks per year	30	trucks/year	
Vanadium Trucks per year	100	trucks/year	
Empty weight of product trucks	18.5	tons	Same as ore truck
Capacity of product trucks	26	tons	

Security / Monitoring Truck			
Weight of truck	2.4	tons	
Security round trips per day	6	trips/day	Referenced from email from Zach Rogers dated June 9, 2009
Monitoring one way trips per day	6.4	trips/day	Referenced from email from Zach Rogers dated June 9, 2009
Security hours per day	24	hours/day	
Monitoring hours per day	10	hours/day	

Length of Road Segments			
Paved Main Haul Road	150	feet	
To Administration Building	1800	feet	
To North Ore Pad	5630	feet	
To North Delivery Platform	5,570	feet	
To South Delivery Platform	6,410	feet	
To South Ore Pad	6230	feet	
To Mill Area/Reagent Unloading	7300	feet	
To Product Shipping Area	8180	feet	
Secondary Monitoring Road	7245	feet	
Secondary Security Loop	14951	feet	

Dumping Platform			
Length of dumping platform	350	feet	
Width of dumping platform	120	feet	
Height of dumping platform	8	feet	
Width of load after dumping	17.5	feet	
Amount of ore stored in dumping platform	20	loads	
	480	tons	

Ore Pad			
Concrete short term storage area	1	acre	
Gravel long term storage area	5	acre	
Stockpile height	18	feet	
Typical size of stockpile	0.34	acre	
	10,000	tons	
Stockpiles in Ore pad	10	piles	
Operating weight of Cat 988	54.6	tons	
Rated Payload of Cat 988	12.5	tons	
Capacity of Front End Loader (Cat 988)	9	cubic yards	

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Energy Fuels Resources Corporation Pinon Ridge Mill Facility
Montrose County, CO

Oversized Ore			
Amount of total ore	1	%	
How often crushed	1	day per week	

SAG Mill			
Maximum ore delivery to mill from feed system	100	tons per hour	

Pre-Leach Area			
Pre-Leach Tank Diameter	21	feet	
Pre-Leach Tank Height	24	feet	
Pre-Leach Tank Nominal Capacity	60,000	gallons	
Number of Pre-Leach Tanks	2	tanks	

Leach Area			
Leach Tank Diameter	21	feet	
Leach Tank Height	24	feet	
Leach Tank Nominal Capacity	60,000	gallons	
Number of Leach Tanks	8	tanks	

Tailings Disposal			
Number of tailings cells	3	cells	
Size of each tailing cell	30	acres	
Maximum number of active cells	2	cells	
Depth of each tailing cell	70	feet	
Liquid entering tailings	118	tons/hour	300-PF-002
Tailings liquid returning to mill	101.1	tons/hour	300-PF-002

Evaporation Ponds			
Number of evaporation pond sets	2	sets	
Number of ponds in each set	10	ponds	
Size of each pond set	40	acres	
Depth of each pond	6	feet	

Area 700 Emissions Data			
Ammonia dischaged from rotary kiln	117	lb/hr	Email from John Litz on July 7, 2009.
Particulate from rotary kiln	10	ppm	Scrubber design specification
Particulate from furnace, wheel and packaging	200	ppm	Scrubber design specification

Sulfuric Acid Tanks (vertical)			
Number of tanks	3	tanks	
Diameter of tank	28	feet	
Height of tank	28	feet	
Capacity of each tank	128,963	gallons	

Ammonia Tanks			
Number of tanks	2	tanks	
Capacity of each tank	12,000	gallons	

Kerosene Tank			
Number of tanks	1	tank	
Diameter of tank	18	feet	
Height of tank	20	feet	
Capacity of each tank	38,069	gallons	

Organics Tank			
Number of tanks	1	tank	
Diameter of tank	10	feet	
Height of tank	10	feet	
Capacity of each tank	5,875	gallons	

Diatomaceous Earth			
Amount needed per day	958	lb/day	
Size of bags	100	lbs	
Bags of DE used per day	10	bags/day	

Diesel Tanks			
Number of main tanks	1	tanks	
Diameter of main tank	8.5	feet	
Length of main tank	36.5	feet	
Capacity of Main tank	12,000	gallons	
Number of Day tanks	2	tanks	
Capacity of generator day tank	3,600	gallons	

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Montrose County, CO

Propane Tank (horizontal)			
Number of tanks	1	tank	
Diameter of tank	10.9	feet	
Length of tank	45	feet	
Capacity of each tank	18,000	gallons	

Gasoline Tank			
Number of tanks	1	tank	
Diameter of tank	5.8	feet	
Length of tank	12.5	feet	
Capacity of each tank	2,000	gallons	

Steam Boilers			
Number of Boilers	3	boilers	
Max number of operational boilers	2	boilers	
Capacity of each boiler	10,350	lb steam/hr	

Firewater Pump			
Rated horsepower	207	horsepower	
Annual hours of operation	100	hours/year	

Backup Generator			
Rated Power	2,000	kW	
Max Fuel Consumption	147.3	gal/hr	
Annual hours of operation	100	hours/year	

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4. EMISSION SUMMARY

Energy Fuels Resources Corporation Pinon Ridge Mill Facility

HAUL ROADS			
UPMAIN	Unpaved Main Road	AP-42 Section 13.2.2 Unpaved Haul Roads, Final Section, November 2006.	Treated with magnesium chloride three to four times per year. During dry and windy conditions, a water truck would be available. Road is gravel.
PMAIN	Paved Main Road	AP-42 Section 13.2.1 Paved Haul Roads, Final Section, November 2006.	No controls for paved portion.
MONRD	Unpaved Monitoring Road	AP-42 Section 13.2.2 Unpaved Haul Roads, Final Section, November 2006.	Only treated with magnesium chloride if necessary.
SECRD	Unpaved Security Road	AP-42 Section 13.2.2 Unpaved Haul Roads, Final Section, November 2006.	Only treated with magnesium chloride if necessary.
STOCKPILE AREAS			
UNLOAD1	Ore Unloading from Trucks	AP-42 Section 11.24 Metallic Minerals Processing, Final Section, August 1982.	Water sprays or misters will spray across dump point during unloading.
UNLOAD2	Unloading from dumping platform to ore pad	AP-42 Section 11.24 Metallic Minerals Processing, Final Section, August 1982.	Water spray in ore pad area. Spray may not be directly on dumping process.
ORERD	Ore Pad Travel	AP-42 Section 13.2.2 Unpaved Haul Roads, Final Section, November 2006.	Transfer routes would be water sprayed as needed, or possible chemical suppression or raffinate solution.
WIND1	Wind erosion of ore stockpiles	AP-42 Section 11.9 Western Surface Coal Mining, Final Section, August 1982.	Ore pad stockpiles would be water sprayed or sprayed with a chemical dust suppressant.
AREA 110 - FEED HOPPER AND CONVEYOR SYSTEM			
110-SNG-01	Unloading to Grizzly Screen	AP-42 Section 11.24 Metallic Minerals Processing, Final Section, August 1982.	Water sprays and misters located inside the feed hopper building to reduce dumping emissions. Plastic curtain on open side of building. Located inside a building. Connected to baghouse (110-STK-01).
110-FRAG	Oversized ore fragmenting	AP-42 Section 11.24 Metallic Minerals Processing, Final Section, August 1982.	No controls given in operating plan.
110-FDA-01	Ore transfer - Apron Feeder to Conveyor	AP-42 Section 11.24 Metallic Minerals Processing, Final Section, August 1982.	Below grade. Connected to baghouse (110-STK-01).
110-CVB-01	SAG Mill Feed Conveyor	Emissions negligible since below grade in an enclosed concrete tunnel.	Below grade inside a concrete tunnel.
110-STK-01	Feed System Dust Collector	Emissions based on 99% Efficiency of Feed System emissions.	Receives emissions from grizzly area in feed hopper building and apron feeder dump point at the conveyor belt.
AREA 120 - SAG MILL			
UNLOAD3	Unloading to Vibrating Feeder	AP-42 Section 11.24 Metallic Minerals Processing, Final Section, August 1982.	Rubber curtains present at feed point. Connected to scrubber 120-DCS-01.
120-FDV-01	Vibrating Feeder	AP-42 Section 11.19.2 Crushed Stone Processing and Pulverized Mineral Processing, Final Section, August 2004.	Process water and slurry from oversize screen added. Connected to scrubber 120-DCS-01.
120-MLS-01	SAG Mill	Wet grinding process, emissions are negligible per AP-42, Section 11.24	Connected to scrubber 120-DCS-01.
120-SNV-01	SAG Mill Classifying Screen #1	Ore is a slurry at this point, so emissions are negligible	Wet process.
120-SNV-02	SAG Mill Classifying Screen #2	Ore is a slurry at this point, so emissions are negligible	Wet process.
120-SNT-01	Trommel Screen	Ore is a slurry at this point, so emissions are negligible	Wet process.
120-DCS-01	SAG Mill Dust Scrubber	Emissions based on 99% control efficiency applied to SAG Mill Process area.	Receives emissions from the SAG Mill process area including the vibratory feeder and dischage end of mill.

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AREA 130 - PULP STORAGE TANKS			
130-TKH-01	Pulp Storage Tank #1	Emissions negligible since the tank contains a slurry	Wet process.
130-TKH-02	Pulp Storage Tank #2	Emissions negligible since the tank contains a slurry	Wet process.
AREA 210 - PRE-LEACH			
210-TKL-01	Pre-Leach Tank #1	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CE)	Tank is totally enclosed. Vented to wet Venturi scrubber (220-GHS-01).
210-TKL-02	Pre-Leach Tank #2	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CE)	Tank is totally enclosed. Vented to wet Venturi scrubber (220-GHS-01).
210-TKM-01	Pre-Leach Thickener Feed Box	Open tank. Solution reaches equilibrium prior to entering this tank, so no acidic emissions are generated.	No controls since emissions are not generated.
210-THK-01	Pre-Leach Thickener	Open tank. Solution reaches equilibrium prior to entering this tank, so no acidic emissions are generated.	No controls since emissions are not generated.
210-CLS-01	Pre-Leach Clarifier	Open tank. Solution reaches equilibrium prior to entering this tank, so no acidic emissions are generated.	No controls since emissions are not generated.
AREA 220 - LEACH			
220-GHS-01	Leach Train Vent Gas Scrubber	Emissions based on 99% control efficiency applied to pre-leach and leach tanks.	Receives vent gases from pre-leach and leach systems
220-TKL-01	Leach Tank #1	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CE)	Tank enclosed. Vented to wet Venturi scrubber (220-GHS-01).
220-TKL-02	Leach Tank #2	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CE)	Tank enclosed. Vented to wet Venturi scrubber (220-GHS-01).
220-TKL-03	Leach Tank #3	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CE)	Tank enclosed. Vented to wet Venturi scrubber (220-GHS-01).
220-TKL-04	Leach Tank #4	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CE)	Tank enclosed. Vented to wet Venturi scrubber (220-GHS-01).
220-TKL-05	Leach Tank #5	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CE)	Tank enclosed. Vented to wet Venturi scrubber (220-GHS-01).
220-TKL-06	Leach Tank #6	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CE)	Tank enclosed. Vented to wet Venturi scrubber (220-GHS-01).
220-TKL-07	Leach Tank #7	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CE)	Tank enclosed. Vented to wet Venturi scrubber (220-GHS-01).
220-TKL-08	Leach Tank #8	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CE)	Tank enclosed. Vented to wet Venturi scrubber (220-GHS-01).
AREA 310 - CCD THICKENERS			
310-THK-01 - 08	CCD Thickeners #1 - #8	Wet process and only flocculant added. No reportable emissions.	No controls since emissions are not generated.
AREA 320 - TAILINGS DISPOSAL			
WIND2	Tailings Cell Wind Erosion	AP-42 Section 11.9 Western Surface Coal Mining, Final Section, August 1982.	During summer months, the tailings beach can dry out and cause fugitive dust emissions. Water or raffinate spray will be used as a control.
EVAP1	Tailing Cell Evaporation	Mass of liquid organic values from "Pinon Ridge Project (Rev. 2) Tailing Stream Analysis", Brett Berg, March 12, 2008.	No controls.

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AREA 330 - EVAPORATION PONDS			
WIND3	Evaporation Pond Wind Erosion	AP-42 Section 11.9 Western Surface Coal Mining, Final Section, August 1982.	During summer months, the evaporation ponds can dry out and cause fugitive dust emissions. Water or raffinate spray will be used as a control.
EVAP2	Evaporation Pond Evaporation	Mass of liquid organic values from "Pinon Ridge Project (Rev. 2) Tailing Stream Analysis", Brett Berg, March 12, 2008.	No controls.
AREA 410 - URANIUM SX FEED SYSTEM			
410-TKH-01	Clarifier Overflow Pipe	Receives overflow from preleach clarifier, which is a solution in equilibrium and thus no emissions are expected.	No controls since emissions are not generated.
410-FLL-01-02	Polishing Filters #1 and #2	Receives clarifier pipe solution and DE solution, neither of which will create emissions.	No controls since emissions are not generated.
410-TKM-03	Diatomaceous Earth Preparation Tank	Receives dry DE and mixes to create a solution. Bag breaker system integral to the preparation tank.	Water is added to dry DE within the tank. Dust collector with bag breaker integral to tank.
410-BBB-01	DE Bag Breaker	AP-42, Section 8.12, Sodium Carbonate, Final Section, July 1993	Filter system integral to bag breaker device with 99% control efficiency.
AREA 420 AND 430 - URANIUM EXTRACTION TRAINS A AND B			
420-TKH-01	Uranium SX Feed Tank	Provides storage for the solution from the polishing filter tanks before it goes into the uranium extraction circuit. No emissions.	No controls since emissions are not generated.
420-MSS-01	Uranium Mixer Settler Tank A1	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
420-MSS-02	Uranium Mixer Settler Tank A2	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
420-MSS-03	Uranium Mixer Settler Tank A3	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
420-MSS-04	Uranium Mixer Settler Tank A4	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
430-MSS-01	Uranium Mixer Settler Tank B1	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
430-MSS-02	Uranium Mixer Settler Tank B2	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
430-MSS-03	Uranium Mixer Settler Tank B3	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
430-MSS-04	Uranium Mixer Settler Tank B4	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
420-MSS-05 430-MSS-05	Raffinate Settlers		
420-TKH-02	Uranium SX Raffinate Tank	Provides solution storage between the uranium and vanadium circuits.	No controls since emissions are not generated.

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AREA 440 - URANIUM SCRUB AND STRIP			
440-TKH-01	Uranium SX Loaded Organic Tank	EPA TANKS Program, Version 4.09d.	No controls.
440-TKH-02	Uramium SX Barren Organic Tank	EPA TANKS Program, Version 4.09d.	No controls.
440-MSS-01	Uranium Scrubber Mixer Settler	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
440-MSS-02	Uranium Stripper Mixer Settler #1	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
440-MSS-03	Uranium Stripper Mixer Settler #2	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
AREA 510 - URANIUM PRECIPITATION AND THICKENING			
510-TKP-01	Uranium Precipitation Feed Tank		
510-TKP-02	Uranium Precipitation Feed Tank #2	Sulfuric Acid emissions negligible because the free acid in solution is onlyapproximately 0.001%.	Vents to scrubber (530-GHS-01)
510-TKP-03	Uranium Precipitation Feed Tank #3	Sulfuric Acid emissions negligible because the free acid in solution is onlyapproximately 0.001%.	Vents to scrubber (530-GHS-01)
510-TKP-04	Uranium Precipitation Feed Tank #4	Sulfuric Acid emissions negligible because the free acid in solution is onlyapproximately 0.001%.	Vents to scrubber (530-GHS-01)
510-TKP_05-06	Uranium Precipitation Feed Tank #5 and #6	Sulfuric Acid emissions negligible because the free acid in solution is onlyapproximately 0.001%.	
510-TKM-01	Uranium Thickener Feed Box		
510-THK-01	Uranium Thickener		
510-TKH-01	Uranium Thickener Overflow Pipe		
AREA 530 - URANIUM DRYING AND PACKAGING			
530-FP-001	Uranium Filter Press	Wet process.	No controls.
	Uranium Decant Tank	Wet process. Enclosed to dryer.	No controls.
530-DR-001	Uranium Dryer	Exhaust goes through a condenser and recycled back into system.	
530-CVS-02	Dry Uranium Cake Conveyor	Dryer, Feed hopper, packaging systems and associated conveyors are totally enclosed and interconnected.	Conveyor is enclosed.
530-HPF-01	Uranium Product Feed Hopper	Dryer, Feed hopper, packaging systems and associated conveyors are totally enclosed and interconnected.	Building totally enclosed with ventilation system
530-CVR-01	Uranium Product Conveyor	Dryer, Feed hopper, packaging systems and associated conveyors are totally enclosed and interconnected.	Conveyor is enclosed.
530-PKS-01	Uranium Packaging System	Dryer, Feed hopper, packaging systems and associated conveyors are totally enclosed and interconnected.	Packaging system is enclosed.
530-GHS-01	Uranium Vent Gas Scrubber	Emissions based on 99% control efficiency of inlet emission streams.	Receives vent gases from uranium precipitation tanks.

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AREA 610 - VANADIUM OXIDATION			
610-TKL-01-05	Vanadium Oxidation Tanks #1 - #5		
610-TKH-01	Vanadium Polishing Filter Feed Tank		
610-FLL-01	Vanadium Polishing Filter		
610-TKH-02	Vanadium SX Feed Tank		
AREA 620 and 630 - VANADIUM SX EXTRACTION TRAINS A AND B			
620-MSS-01	Vanadium Mixer Settler Tank A1	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
620-MSS-02	Vanadium Mixer Settler Tank A2	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
620-MSS-03	Vanadium Mixer Settler Tank A3	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
620-MSS-04	Vanadium Mixer Settler Tank A4	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
620-MSS-05	Vanadium Mixer Settler Tank A5	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
630-MSS-01	Vanadium Mixer Settler Tank B1	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
630-MSS-02	Vanadium Mixer Settler Tank B2	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
630-MSS-03	Vanadium Mixer Settler Tank B3	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
630-MSS-04	Vanadium Mixer Settler Tank B4	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
630-MSS-05	Vanadium Mixer Settler Tank B5	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
620-MSS-06 630-MSS-06	Raffinate Settlers		
620-TKH-01	Vanadium SX Raffinate Tank		

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AREA 640 - VANADIUM SX SCRUB, STRIP, AND REGENERATION			
640-MSS-01	Vanadium Scrubber Mixer Settler	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
640-MSS-02	Vanadium Stripper Mixer Settler #1	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
640-MSS-03	Vanadium Stripper Mixer Settler #2	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
640-MSS-04	Vanadium Stripper Mixer Settler #3	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CF)	No controls.
640-TKH-01	Vanadium SX Loaded Organic Tank	EPA TANKS Program, Version 4.09d.	No controls.
640-TKH-02	Vanadium SX Barren Organic Tank	EPA TANKS Program, Version 4.09d.	No controls.
AREA 710 - VANADIUM PRECIPITATION			
710-TKH-01	Vanadium Precipitation Feed Tank		
710-TKP-01	Vanadium Precipitation Tank #1	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CE)	Enclosed at top. Vented to packed bed wet scrubber to remove ammonia fumes (730-GHS-01)
710-TKP-02	Vanadium Precipitation Tank #2	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CE)	Enclosed at top. Vented to packed bed wet scrubber to remove ammonia fumes (730-GHS-01)
710-TKP-03	Vanadium Precipitation Tank #3	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CE)	Enclosed at top. Vented to packed bed wet scrubber to remove ammonia fumes (730-GHS-01)
710-TKP-04	Vanadium Precipitation Tank #4	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CE)	Enclosed at top. Vented to packed bed wet scrubber to remove ammonia fumes (730-GHS-01)
710-TKP-05	Vanadium Precipitation Tank #5	Based on the EPA Diffusion Equation:VGR = (3.1536x107) x F x MKAP x (1-CE)	Enclosed at top. Vented to packed bed wet scrubber to remove ammonia fumes (730-GHS-01)

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AREA 730 - VANADIUM DRYING AND PACKAGING			
730-FLB-01	Vanadium Belt Filter	Mass balance for ammonia. Particulates based on 10 ppm at inlet of scrubber	Vents to 730-GHS-01
730-CVS-01	Vanadium Wet Cake Conveyor	Negligible emissions due to wet product and enclosed screw conveyor	
730-DYS-01	Vanadium Steam Dryer		Vents to 730-DCS-01
730-DCS-01	Vanadium Dryer Dust Collector	Based on 0.02 gr/scf exhaust from the dryer.	Vents to 730-GHS-01
730-CVS-02	Vanadium Dry Cake Conveyor	Outlet of dryer and conveyor completely enclosed.	
730-HPF-01	Rotary Kiln Feed Hopper	Completely enclosed	
730-CVS-03	Rotary Kiln Feed Conveyor	Completely enclosed	
730-KLR-01	Vanadium Rotary Kiln	Mass balance for ammonia. Particulates based on 10 ppm at inlet of scrubber	Vents to 730-GHS-01
730-CVS-04	Granular Vanadium Conveyor	Completely enclosed	
730-FUH-01	Fusion Furnace	Based on 200 ppm of particulate to scrubber inlet.	Vents to 730-GHS-02
730-CWW-01	Casting Water Wheel	Based on 200 ppm of particulate to scrubber inlet.	Vents to 730-GHS-02
730-BKT-01	Bucket Conveyor	Completely enclosed	
730-HPF-02	Vanadium Product Feed Hopper		
730-CVR-01	Vanadium Product Conveyor		
730-PKS-01	Vanadium Packaging System	Based on 200 ppm of particulate to scrubber inlet.	Vents to 730-GHS-02
730-GHS-01	Packed Bed Wet Vent Scrubber	Based on 117 lb/hr ammonia and 10 ppm particulate at inlet of scrubber as well as ammonia from precip tanks	
730-GHS-02	Wet Venturi Scrubber	200 ppm particulate at inlet of scrubber	

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AREA 800 - REAGENTS			
810-TKH-01	Sulfuric Acid Tank #1	Not a HAP, but reportable per Regulation 3, Appendix B, "Non-criteria Reportable Pollutants"	
810-TKH-02	Sulfuric Acid Tank #2	Not a HAP, but reportable per Regulation 3, Appendix B, "Non-criteria Reportable Pollutants"	
810-TKH-03	Sulfuric Acid Tank #3	Not a HAP, but reportable per Regulation 3, Appendix B, "Non-criteria Reportable Pollutants"	
820-TKH-01	Ammonia Tank #1	Not a HAP, but reportable per Regulation 3, Appendix B, "Non-criteria Reportable Pollutants"	
820-TKH-02	Ammonia Tank #2	Not a HAP, but reportable per Regulation 3, Appendix B, "Non-criteria Reportable Pollutants"	
820-VEV-01	Ammonia Vaporizer	Not a HAP, but reportable per Regulation 3, Appendix B, "Non-criteria Reportable Pollutants"	
820-CVS-01	Ammonium Sulfate transfer conveyor		Transfer points equipped with water sprays
820-CVS-02	Ammonium Sulfate feed conveyor		Transfer points equipped with water sprays
820-DCB-01	Ammonium Sulfate dust collector		
820-HPF-01	Ammonim Sulfate Storage Hopper		Equipped with dust collector 820-DCB-01.
820-HPF-02	Ammonium Sulfate Weigh Hopper		
820-TKH-03	Ammonium Sulfate Solution tank	Not on "Non-criteria Reportable Pollutant" list per Regulation 3, Appendix B.	
830-TKH-01	Dilute Sodium Hydroxide Tank	Exempt from APEN reporting by Regulation 3, Section II.D.1.aaaa.(ii)	
840-TKH-01	Sodium Carbonate Slurry Tank	Not on "Non-criteria Reportable Pollutant" list per Regulation 3, Appendix B.	
840-TKH-02	Dilute Sodium Carbonate Tank	Not on "Non-criteria Reportable Pollutant" list per Regulation 3, Appendix B.	
850-HPF-01	Flocculant Hopper		
850-CVS-01	Flocculant Feed Conveyor		
850-TKH-01	Flocculant Tank		
850-TKM-01	Flocculant Mix Tank		
860-TKH-01	Kerosene Tank	Exempt from APEN reporting by Regulation 3, Section II.D.1.fff	
860-TKH-02	Organic Make-Up Tank	Exempt from APEN reporting by Regulation 3, Section II.D.1.fff	
870-TKH-01	Sodium Chlorate Tank	Not on "Non-criteria Reportable Pollutant" list per Regulation 3, Appendix B.	
870-TKM-01	Sodium Chlorate Mix Tank	Not on "Non-criteria Reportable Pollutant" list per Regulation 3, Appendix B.	
870-TKH-02	Hydrogen Peroxide Tank	Not on "Non-criteria Reportable Pollutant" list per Regulation 3, Appendix B.	

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AREA910 - WATER			
910-PPL-01	Fire Water Diesel Pump	AP-42 Section 3.3 Gasoline and Diesel Industrial Engines, Final Section, October 1996.	No controls. For emergency purposes only.
AREA 920 - STEAM			
920-BLR-01	Steam Boiler #1	(A) AP-42 Section 1.5, Liquified Petroleum Gas Combustion, Final Section July 2008.	Boiler contains Low NO_x Burner.
920-BLR-02	Steam Boiler #2	(A) AP-42 Section 1.5, Liquified Petroleum Gas Combustion, Final Section July 2008.	Boiler contains Low NO_x Burner.
920-BLR-03	Steam Boiler #3	(A) AP-42 Section 1.5, Liquified Petroleum Gas Combustion, Final Section July 2008.	Boiler contains Low NO_x Burner.
920-STK-01	Combined Boiler Stack	Emissions from all operational boilers share one stack.	
AREA 950 - FUEL STORAGE			
950-VEP-01	Propane Storage Tank	Exempt from APEN reporting by Regulation 3, Section II.D.1.zz.	
950-TKH-01	Diesel Main Tank	Exempt from APEN reporting by Regulation 3, Section II.D.1.fff	
950-TKH-02	Standby Generator Diesel Day Tank	Exempt from APEN reporting by Regulation 3, Section II.D.1.fff	
950-TKH-03	Fire Water Pump Diesel Day Tank	Exempt from APEN reporting by Regulation 3, Section II.D.1.fff	
950-TKH-04	Gasoline Tank	TANKS 4.0.9d, Storage Tank Emissions Calculation Software, October 3, 2005	
AREA 1000 - EMERGENCY EQUIPMENT			
1000-SG-01	Standby Generator	AP-42 Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines, Final Section, October 1996.	No controls. For emergency purposes only.

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5. UNPAVED MAIN PLANT ROAD

Unpaved Main Plant Road

AP-42 Section 13.2.2 Unpaved Haul Roads, Final Section, November 2006.

Emission Factor Equation: $E=[k(s/12)^a(W/3)^b]*[(365-P)/365]$ Equation 13.2.2-1a and 13.2.2-2

where:
E = particulate emission factor (pounds per vehicle mile traveled, lb/VMT)
k, a, b = dimensionless constants
s = surface material silt content (%)
W = mean vehicle weight of the vehicles traveling the road (tons)
P = number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period

Operating Parameters:

Amount of ore delivered per day	1,000	tons per day
Delivery hours per day	10	hours per day
Delivery days per year[1]	365	days per year
Ore truck empty weight	18.5	tons
Ore truck capacity	24	tons
Water truck empty weight	13	tons
Water truck capacity	5,000	gallons
FedEx type vehicle weight	8	tons
Product truck empty weight	18.5	tons
Product truck capacity	26	tons
Worker hours per day	24	hours per day
Worker days per year	365	days per year
Worker vehicle weight	2.4	tons

Emission Factor Parameters:

Mean Silt Content[4]	s	10	%	AP-42, Table 13.2.2-1. Stone quarrying and processing
Average Weight of Ore Trucks	W	30.5	tons	
Average Weight of Water/Consumables Trucks[2]	W	23.4	tons	
Average Weight of Worker Vehicles	W	2.4	tons	
Average Weight of FedEx Trucks	W	8.0	tons	
Average Weight of Product trucks	W	31.5	tons	
Average Weight of Fleet	W	14.7	tons	
Mean Days > 0.01-in precipitation	P	75	days	AP-42, Figure 13.2.2-1. Avg of 90 and 60 days contours
Control Efficiency	CE	85%	%	March 10 UDEQ memo from Regg Olsen

		PM	PM_{10}	$PM_{2.5}$
Particle Size Multipliers for Unpaved Road Equation Table 13.2.2-2	k	4.9	1.5	0.15
	a	0.7	0.9	0.9
	b	0.45	0.45	0.45

Emission Factor:

		PM	PM_{10}	$PM_{2.5}$
Average Fleet Emission Factor (lb/VMT)	EF	7.00	2.07	0.21

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Unpaved Main Plant Road

VMT Calculations:

Ore Trucks		
Ore Delivery Trucks per Day:	42	trucks/day
Number of Trucks to North dumping pad	20	trucks/day
Number of Trucks to South dumping pad	20	trucks/day
Number of Trucks to North Ore Pad	1	truck/day
Number of Trucks to South Ore Pad	1	truck/day
Distance to North Dumping Pad	5,570	feet
Distance to South Dumping Pad	6,410	feet
Distance to North Ore Pad	5630	feet
Distance to South Ore Pad	6230	feet
Daily VMT to North Dumping Pad	42	miles/day
Daily VMT to South Dumping Pad	49	miles/day
Daily VMT to North Ore Pad	2	miles/day
Daily VMT to South Ore Pad	2	miles/day
Total Daily VMT	95	miles/day

FedEx Trucks		
FedEx trucks per day	3	trucks/day
Distance to delivery area	4550	feet
Total Daily VMT	5	miles/day

Worker Vehicles		
Number of worker vehicles to administration building[3]	27	vechicles/day
Number of worker vehicles to mill area[3]	60	vechicles/day
Distance to administration building	1800	feet
Distance to mill area	7300	feet
Daily VMT to administration building	18	miles/day
Daily VMT to mill area	166	miles/day
Total Daily VMT	184	miles/day

Water/Consumable Trucks		
Non-potable water delivery trucks per day	30	trucks/day
Potable water delivery trucks per day	1	trucks/day
Fuel and Consumables trucks per day	16	trucks/day
Distance to Non-potable Water Delivery Area	7300	feet
Distance to Potable Water Delivery Area (average of two sites	4550	feet
Distance to Reagent Unloading Area	7300	feet
Daily VMT to Non-potable Water Delivery Area	83	miles/day
Daily VMT to Potable Water Delivery Area	2	miles/day
Daily VMT to Reagent Unloading Area	44	miles/day
Total Daily VMT	129	miles/day

Product Shipping Trucks		
Product shipping trucks per day	1	trucks/day
Distance from shipping area	8180	feet
Total Daily VMT	3	miles/day

Overall VMT Numbers		
Total Vechicles per Day	180	vehicles/day
Total VMT per Day	417	miles/day

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Unpaved Main Plant Road

Emissions:

PM		Uncontrolled			Controlled		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
UPMAIN	Unpaved Main Road	291.87	2918.72	532.67	43.78	437.81	79.90

PM_{10}		Uncontrolled			Controlled		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
UPMAIN	Unpaved Main Road	86.15	861.49	157.22	12.92	129.22	23.58

$PM_{2.5}$		Uncontrolled			Controlled		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
UPMAIN	Unpaved Main Road	8.61	86.15	15.72	1.29	12.92	2.36

Notes:

1. All delivery is assumed to be on a 7 day per week schedule as an upper bound value even though delivery will most likely not occur each day.

2. Delivery trucks with consumables such as fuel and chemicals are assumed to be the same size and capacity as the water trucks. Emissions from water and consumable trucks are combined into the water truck category.

3. Worker vehicles are calculated as the maximum that could occur per day even though the weekend shifts will not have as many employees on site.

4. The Roadway Pavement Design Recommendations Report, dated October 30, 2008, states that the top 5 inches of aggregate on the unpaved portion of road will be such that 6-12% of the material passes the No. 200 sieve. Thus, a silt value of 10% from AP-42 falls within the upper bound of the actual design range for silt.

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6. PAVED MAIN PLANT ROAD

Paved Main Plant Road

AP-42 Section 13.2.1 Paved Haul Roads, Final Section, November 2006.

Emission Factor Equation: $E=[k(sL/2)^{0.65}(W/3)^{1.5}-C]*(1-(P/(4N)))$ Equation 13.2.1.3(1) and 13.2.1.3(2)

where:
E = particulate emission factor (pounds per vehicle mile traveled, lb/VMT)
k = particle size multiplier
sL = road surface silt loading (g/m^2)
W = mean vehicle weight of the vehicles traveling the road (tons)
C = emission factor for 1980's vehicle fleet exhaust, break wear and tire wear
N = number of days in the averaging period
P = number of "wet" days with at least 0.254 mm (0.01-in) of precipitation during the averaging period

Operating Parameters:

Amount of ore delivered per day	1,000	tons per day
Delivery hours per day	10	hours per day
Delivery days per year[1]	365	days per year
Ore truck empty weight	18.5	tons
Ore truck capacity	24	tons
Water truck empty weight	13	tons
Water truck capacity	5,000	gallons
FedEx type vehicle weight	8	tons
Product truck empty weight	18.5	tons
Product truck capacity	26	tons
Worker hours per day	24	hours per day
Worker days per year	365	days per year
Worker vehicle weight	2.4	tons

Emission Factor Parameters:

Mean Silt Content[2]	sL	0.6	g/m^2	AP-42, Table 13.2.1-3. Baseline silt loading value for public roads
Average Weight of Ore Trucks	W	30.5	tons	
Average Weight of Water/Consumables Trucks[3]	W	23.4	tons	
Average Weight of Worker Vehicles	W	2.4	tons	
Average Weight of FedEx Trucks	W	8.0	tons	
Average Weight of Product trucks	W	31.5	tons	
Weighted Average of Fleet	W	14.7	tons	
Number of days in the averaging period	N	365	days	
Mean Days > 0.01-in precipitation	P	75	days	AP-42, Figure 13.2.2-1. Avg of 90 and 60 days contours
Control Efficiency	CE	0%	%	No controls specified for paved section.

		PM_{30}	PM_{10}	$PM_{2.5}$	
Constants for Paved Road Equation	k	0.082	0.016	0.0024	Table 13.2.1-1
	C	0.00047	0.00047	0.00036	Table 13.2.1-2

Emission Factor:

		PM_{30}	PM_{10}	$PM_{2.5}$
Weighted Average Fleet Emission Factor (lb/VMT)	EF	0.38	0.07	0.01

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Paved Main Plant Road

VMT Calculations:

Ore Delivery Trucks per Day:	42	trucks/day
FedEx trucks per day	3	trucks/day
Number of worker vehicles to administration building[4]	27	vechicles/day
Number of worker vehicles to mill area[4]	60	vechicles/day
Non-potable water delivery trucks per day	30	trucks/day
Potable water delivery trucks per day	1	trucks/day
Fuel and Consumables trucks per day	16	trucks/day
Product shipping trucks per day	1	trucks/day
Total number of vehicles per day	180	vechicles/day
Length of Paved Road Segment	150	feet
Total Daily VMT	10	miles/day

Emissions:

PM		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
PMAIN	Paved Main Road	0.39	3.94	0.72	0.39	3.94	0.72

PM_{10}		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
PMAIN	Paved Main Road	0.08	0.76	0.14	0.08	0.76	0.14

$PM_{2.5}$		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
PMAIN	Paved Main Road	0.01	0.11	0.02	0.01	0.11	0.02

Notes:

1. All delivery is assumed to be on a 7 day per week schedule as a upper bound even though delivery will most likely not occur each day.

2. Paved portion of the main haul road is immediately adjacent to the highway and approximatley one mile from the facility processing areas. Therefore it was not treated as an industrial paved road and the silt loading value for a public road was applied.

3. Delivery trucks with consumables such as fuel and chemicals are assumed to be the same size and capacity as the water trucks. Emissions from water and consumable trucks are combined into the water truck category.

4. Worker vehicles are calculated as the maximum that could occur per day even though the weekend shifts will not have as many employees on site.

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7. SECONDARY ROADS

Unpaved Secondary Service Roads

AP-42 Section 13.2.2 Unpaved Haul Roads, Final Section, November 2006.

Emission Factor Equation: $E=[k(s/12)^a(W/3)^b]*[(365-P)/365]$ Equation 13.2.2-1a and 13.2.2-2

where:
E = particulate emission factor (pounds per vehicle mile traveled, lb/VMT)
k, a, b = dimensionless constants
s = surface material silt content (%)
W = mean vehicle weight of the vehicles traveling the road (tons)
P = number of "wet" days with at least 0.254 mm (0.01-in) of precipitation during the averaging period

Operating Parameters:

Hours per day for monitoring	10	hours per day
Days per year for monitoring	365	days per year
One way trips per day for monitoring	6.4	trips per day
Hours per day for Security travel	24	hours per day
Days per year for Security travel	365	days per year
Round trips per day for security travel	6	trips per day
Weight of vehicle	2.4	tons

Emission Factor Parameters:

Mean Silt Content	s	%	46	Average value from borings <=10 feet from Table 1 of Golder's Geotech report and Table C-1 of Kleinfelder's Geotech report.
Weight of Trucks	W	tons	2.4	
Mean Days > 0.01-in precipitation	P	days	75	AP-42, Figure 13.2.2-1. Avg of 90 and 60 days contours
Control Efficiency	CE	%	0%	Will use magnesium chloride if necessary. No gravel.

		PM	PM_{10}	$PM_{2.5}$
Particle Size Multipliers for Unpaved Road Equation Table 13.2-2	k	4.9	1.5	0.15
	a	0.7	0.9	0.9
	b	0.45	0.45	0.45

Emission Factor:

		PM	PM_{10}	$PM_{2.5}$
Emission Factor (lb/VMT)	EF	9.02	3.61	0.36

VMT Calculations:

One way trips per day for monitoring	6.4	trips
Round trips per day for security travel	6	trips
Monitoring distance	7245	feet
Security loop distance	14951	feet
Monitoring Daily VMT	9	miles/day
Security Daily VMT	17	miles/day

* one way distance
* round trip distance

Emissions:

PM		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
MONRD	Unpaved Monitoring Road	7.92	79.21	14.46	7.92	79.21	14.46
SECRD	Unpaved Security Road	6.39	153.24	27.97	6.39	153.24	27.97

PM_{10}		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
MONRD	Unpaved Monitoring Road	3.17	31.72	5.79	3.17	31.72	5.79
SECRD	Unpaved Security Road	2.56	61.38	11.20	2.56	61.38	11.20

$PM_{2.5}$		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
MONRD	Unpaved Monitoring Road	0.32	3.17	0.58	0.32	3.17	0.58
SECRD	Unpaved Security Road	0.26	6.14	1.12	0.26	6.14	1.12

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8. STOCKPILE AREA

Unpaved Secondary Service Roads

AP-42 Section 13.2.2 Unpaved Haul Roads, Final Section, November 2006.

Emission Factor Equation: $E=[k(s/12)^a(W/3)^b]*[(365-P)/365]$ Equation 13.2.2-1a and 13.2.2-2

where:
E = particulate emission factor (pounds per vehicle mile traveled, lb/VMT)
k, a, b = dimensionless constants
s = surface material silt content (%)
W = mean vehicle weight of the vehicles traveling the road (tons)
P = number of "wet" days with at least 0.254 mm (0.01-in) of precipitation during the averaging period

Operating Parameters:

Hours per day for monitoring	10	hours per day
Days per year for monitoring	365	days per year
One way trips per day for monitoring	6.4	trips per day
Hours per day for Security travel	24	hours per day
Days per year for Security travel	365	days per year
Round trips per day for security travel	6	trips per day
Weight of vehicle	2.4	tons

Emission Factor Parameters:

Mean Silt Content	s	%	46	Average value from borings <=10 feet from Table 1 of Golder's Geotech report and Table C-1 of Kleinfelder's Geotech report.
Weight of Trucks	W	tons	2.4	
Mean Days > 0.01-in precipitation	P	days	75	AP-42, Figure 13.2.2-1. Avg of 90 and 60 days contours
Control Efficiency	CE	%	0%	Will use magnesium chloride if necessary. No gravel.

		PM	PM_{10}	$PM_{2.5}$
Particle Size Multipliers for Unpaved Road Equation Table 13.2-2	k	4.9	1.5	0.15
	a	0.7	0.9	0.9
	b	0.45	0.45	0.45

Emission Factor:

		PM	PM_{10}	$PM_{2.5}$
Emission Factor (lb/VMT)	EF	9.02	3.61	0.36

VMT Calculations:

One way trips per day for monitoring	6.4	trips
Round trips per day for security travel	6	trips
Monitoring distance	7245	feet
Security loop distance	14951	feet
Monitoring Daily VMT	9	miles/day
Security Daily VMT	17	miles/day

* one way distance
* round trip distance

Emissions:

PM		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
MONRD	Unpaved Monitoring Road	7.92	79.21	14.46	7.92	79.21	14.46
SECRD	Unpaved Security Road	6.39	153.24	27.97	6.39	153.24	27.97

PM_{10}		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
MONRD	Unpaved Monitoring Road	3.17	31.72	5.79	3.17	31.72	5.79
SECRD	Unpaved Security Road	2.56	61.38	11.20	2.56	61.38	11.20

$PM_{2.5}$		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
MONRD	Unpaved Monitoring Road	0.32	3.17	0.58	0.32	3.17	0.58
SECRD	Unpaved Security Road	0.26	6.14	1.12	0.26	6.14	1.12

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8. STOCKPILE AREA

Dumping Platform and Ore Pad

Ore Unloading

AP-42 Section 11.24 Metallic Minerals Processing, Final Section, August 1982.

Operating Parameters:

Delivery hours per day	10	hours/day
Delivery days per year	365	days/year
Mill operating hours per day	16	hours/day
Mill operating days per year	365	days/year
Amount of Ore delivered	1,000	tons/day
Amount of Ore transferred from Platform to Pad	1,000	tons/day

Emission Factor Parameters:

Control Efficiency (water spray)[1]	CE	50%

		PM	PM_{10}	$PM_{2.5}$	Reference
Particle Size Multipliers	k	0.74	0.35	0.053	Table 13.2.4-4

Emission Factors:

		PM	PM_{10}	$PM_{2.5}$ [2,3]	Reference
Emission Factor (lb/ton)	EF	0.01	0.004	0.000605714	Table 11.24-2 [4]

Emissions:

PM		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
UNLOAD1	Ore Unloading from Trucks	1.00	10.00	1.83	0.50	5.00	0.91
UNLOAD2	Unloading from dumping platform to ore pad	0.63	10.00	1.83	0.31	5.00	0.91

PM_{10}		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
UNLOAD1	Ore Unloading from Trucks	0.40	4.00	0.73	0.20	2.00	0.37
UNLOAD2	Unloading from dumping platform to ore pad	0.25	4.00	0.73	0.13	2.00	0.37

$PM_{2.5}$		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
UNLOAD1	Ore Unloading from Trucks	0.06	0.61	0.11	0.03	0.30	0.06
UNLOAD2	Unloading from dumping platform to ore pad	0.04	0.61	0.11	0.02	0.30	0.06

Notes:

1. WRAP Fugitive Dust Handbook, Chapter 4 Materials Handling, lists 62% for continuous water spray at transfer points. Since water spray will be intermittent, then control efficiency was reduced to 50%.
2. No Emission factor for $PM_{2.5}$ listed in Table 11.24-2.
3. $PM_{2.5}$ Emission Factor calculated using a ratio of k factors from AP-42, Section 13.2.4, Aggregate Handling and Storage Piles, and applying the k factors to the PM_{10} emission factor from Section 11.24.
4. Emission factors for high moisture ore were used (ore with 4% or greater moisture content)

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Dumping Platform and Ore Pad

Driving between Dumping Platform and Ore Pad

AP-42 Section 13.2.2 Unpaved Haul Roads, Final Section, November 2006.

Emission Factor Equation:

$$E=[k(s/12)^a(W/3)^b]*[(365-P)/365]$$

Equation 13.2.2-1a and 13.2.2-2

where:
E = particulate emission factor (pounds per vehicle mile traveled, lb/VMT)
k, a, b = dimensionless constants
s = surface material silt content (%)
W = mean vehicle weight of the vehicles traveling the road (tons)
P = number of "wet" days with at least 0.254 mm (0.01-in) of precipitation during the averaging period

Operating Parameters:

Mill hours per day	16	hours/day
Mill operating days per year	365	days/year
Amount of ore moved per day[1]	1,000	tons/day
Caterpillar 988 operating weight	54.6	tons
Caterpillar 988 capacity	9	cubic yards
Rated Payload of Cat 988	12.5	tons

Emission Factor Parameters:

Mean Silt Content	s	%	10	Table 13.2.2-1
Average Weight of 988 Catepillar	W	tons	61	
Mean Days > 0.01-in precipitation	P	days	75	AP-42, Figure 13.2.2-1. Avg of 90 and 60 days contours
Control Efficiency	CE	%	75%	March 10 UDEQ memo, Regg Olsen

		PM	PM_{10}	$PM_{2.5}$
Particle Size Multipliers for Unpaved Road	k	4.9	1.5	0.15
Equation	a	0.7	0.9	0.9
Table 13.2.2-2	b	0.45	0.45	0.45

Emission Factor:

		PM	PM_{10}	$PM_{2.5}$
Loader Emission Factor (lb/VMT)	EF	13.29	3.92	0.39

VMT Calculations:

Amount of Ore moved per day	1,000	tons/day
Maximum capacity of the loader	12.5	tons
Loader trips per day	80	trips/day
Average trip distance from dumping platform to ore pad	420	feet
Daily VMT to ore pad	13	miles/day

Emissions:

PM		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
ORERD	Ore Pad Travel	10.57	169.16	30.87	2.64	42.29	7.72

PM_{10}		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
ORERD	Ore Pad Travel	3.12	49.93	9.11	0.78	12.48	2.28

$PM_{2.5}$		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
ORERD	Ore Pad Travel	0.31	4.99	0.91	0.08	1.25	0.23

Notes:

1. Dumping platform can hold 20 loads (24 tons each) of ore, so assume all ore that comes in each day must also be moved to keep available space on the dumping platform.

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Dumping Platform and Ore Pad

Wind Erosion of Ore Pad Stockpiles

AP-42 Section 11.9 Western Surface Coal Mining, Final Section, August 1982.

Emission Factor Equation:

0.72u tons PM/acre-year Table 11.9-1

where: u=wind speed (mph)

Operating Parameters:

Average wind speed	6.33	mph	*average of on site 10m tower wind speed
Total acreage of stockpiles	3.4	acres	
Wind Erosion hours per day	24	hours/day	
Wind Erosion days per year	365	days/year	

Emission Factor Parameters:

Control Efficiency (water/raffinate spray)[1]	CE	50%

		PM	PM_{10}	$PM_{2.5}$	Reference
Particle Size Multipliers [2]	k	1	0.5	0.075	Table on page 13.2.5-3

Emission Factors:

		PM	PM_{10}	$PM_{2.5}$ [2,3]	Reference
Emission Factor for stockpiles (ton/acre-year)	EF	4.56	2.28	0.34	Table 11.9-1

Emissions:

PM		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
WIND1	Wind erosion of ore stockpiles	3.54	84.91	15.50	1.77	42.45	7.75

PM_{10}		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
WIND1	Wind erosion of ore stockpiles	1.77	42.45	7.75	0.88	21.23	3.87

$PM_{2.5}$		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
WIND1	Wind erosion of ore stockpiles	0.27	6.37	1.16	0.13	3.18	0.58

Notes:

1. WRAP Fugitive Dust Handbook, Chapter 9 Storage Pile Wind Erosion, lists 90% for hand watering or covering. Since water spray will be intermittent and covers will not be used, then control efficiency was reduced to 50%.
2. No emission factor for $PM_{2.5}$ listed in Table 11.9-1.
3. $PM_{2.5}$ Emission Factor calculated using a ratio of k factors from AP-42, Section 13.2.5, Industrial Wind Erosion, and applying the k factors to the PM_{10} emission factor from Section 11.9.

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Dumping Platform and Ore Pad

Radionuclide Emissions

Emission Basis: **Based on MILDOS-Area Assesment of Off-site Radiation Doses Report, Rev B., dated June 2, 2009**

Specific Activity of Radionuclides

Radium-226	1	Ci/g
Thorium-230	0.019	Ci/g
Lead-210	88	Ci/g
Uranium-238	3.30E-07	Ci/g
Radon-222	1.50E+05	Ci/g

Emissions:

Radionuclides			**Uncontrolled**		**Controlled**
Source ID	Emission Source	Compound	(Ci/yr)	(lb/yr)	(lb/yr)
WIND1	Wind erosion of ore stockpiles	Radium-226	1.0E-03	2.20E-06	1.10E-06
		Thorium-230	1.0E-03	1.16E-04	5.80E-05
		Lead-210	1.0E-03	2.51E-08	1.25E-08
		Uranium-238 and Uranium-234	1.0E-03	6.68	3.34
		Radon-222	11.6	1.70E-07	8.52E-08
		Total Radionuclides	11.6	6.68	3.34

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9. OVERSIZED ORE FRAGMENTING

Oversized Ore Fragmenting

AP-42 Section 11.24 Metallic Minerals Processing, Final Section, August 1982.

Emission Factor: **E=0.02 lb PM/ton** Table 11.24-2, Primary crushing
E=0.009 lb PM_{10}/ton Table 11.24-2, Primary crushing

Operating Parameters:

Total ore delivered per day	1,000	tons/day
Fragmenting days per week	1	days/week
Fragmenting days per year	52	days/year
Amount of total fragmented	1%	

Emission Factor Parameters:

		PM	PM_{10}	$PM_{2.5}$	Reference
Emission Factors for scaling $PM_{2.5}$ (lb/ton)[2]	EF	0.0012	0.00054	0.0001	Table 11.19.2-2

Emission Factors:

		PM	PM_{10}	$PM_{2.5}$ [2]	Reference
Emission Factor (lb/ton)	EF	0.02	0.009	0.002	Table 11.24-2 [1]

Emissions:

PM		**Uncontrolled**		
Source ID	Emission Source	(lb/hr)[3]	(lb/day)	(ton/yr)
110-FRAG	Oversized ore fragmenting	3.33E-02	2.00E-01	5.20E-03

PM_{10}		**Uncontrolled**		
Source ID	Emission Source	(lb/hr)[3]	(lb/day)	(ton/yr)
110-FRAG	Oversized ore fragmenting	1.50E-02	9.00E-02	2.34E-03

$PM_{2.5}$		**Uncontrolled**		
Source ID	Emission Source	(lb/hr)[3]	(lb/day)	(ton/yr)
110-FRAG	Oversized ore fragmenting	2.78E-03	1.67E-02	4.33E-04

Notes:
1. Emission factors for high moisture ore were used (ore with 4% or greater moisture content)
2. Emission factor for PM2.5 scaled from the PM10 emission factor from Table 11.24-2 and the ratio of PM2.5/PM10 from Table 11.19.2-2
3. Assume fragmenting takes 6 hours each day the process is carried out.

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10. AREA 100 FEED SYSTEM

Area 110 Feed Hopper and Conveyor

AP-42 Section 11.24 Metallic Minerals Processing, Final Section, August 1982.

Operating Parameters:

Amount of ore processed	1,000	tons/day
Maximum amount of ore delivered by conveyor to mill	100	tons/hour
Mill operating hours per day	16	hours/day
Mill operating days per year	365	days/year

Source Parameters:

Source ID	Emission Source	Stack Flow Rate (scfm)	Stack Diameter (ft)	Stack Height (ft)	Gas Temperature (deg F)	Control Efficiency %
110-STK-01	Feed System Dust Collector	39,000	4	35	Ambient	99%

Emission Factor Parameters:

Control Efficiency of Baghouse	99%	99% from Farr brochure

		PM	PM_{10}	$PM_{2.5}$	Reference
Particle Size Multipliers [2]	k	0.74	0.35	0.053	Table, page 13.2.4-4

Emission Factors:

		PM	PM_{10}	$PM_{2.5}$ [2]	Reference
Emission Factor (lb/ton)	EF	0.01	0.004	0.00061	Table 11.24-2[1]

Emissions:

PM		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
110-SNG-01	Unloading to Grizzly Screen	0.63	10.00	1.83	-----	-----	-----
110-FDA-01	Ore transfer - Apron Feeder to Conveyor	1.00	10.00	1.83	-----	-----	-----
110-STK-01	Feed System Dust Collector	-----	-----	-----	1.63E-02	2.00E-01	0.04

PM_{10}		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
110-SNG-01	Unloading to Grizzly Screen	0.25	4.00	0.73	-----	-----	-----
110-FDA-01	Ore transfer - Apron Feeder to Conveyor	0.40	4.00	0.73	-----	-----	-----
110-STK-01	Feed System Dust Collector	-----	-----	-----	6.50E-03	8.00E-02	0.01

$PM_{2.5}$		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
110-SNG-01	Unloading to Grizzly Screen	0.04	0.61	0.11	-----	-----	-----
110-FDA-01	Ore transfer - Apron Feeder to Conveyor	0.06	0.61	0.11	-----	-----	-----
110-STK-01	Feed System Dust Collector	-----	-----	-----	9.84E-04	1.21E-02	2.21E-03

Notes:
1. Emission Factors for high moisture ore were used (ore with 4% or greater moisture).
2. $PM_{2.5}$ Emission Factor calculated using a ratio of k factors from AP-42, Section 13.2.4, Aggregate Handling and Storage Piles, and applying the k factors to the PM_{10} emission factor from Section 11.24.

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11. AREA 120 SAG MILL

Area 120 SAG Mill

AP-42 Section 11.24 Metallic Minerals Processing, Final Section, August 1982.
AP-42 Section 11.19.2 Crushed Stone Processing and Pulverized Mineral Processing, Final Section, August 2004.

Operating Parameters:

Amount of ore processed	1,000	tons/day
Maximum amount of ore delivered by conveyor	100	tons/hour
Mill operating hours per day	16	hours/day
Mill operating days per year	365	days/year

Emission Factor Parameters:

		PM	PM_{10}	$PM_{2.5}$	Reference
Particle Size Multipliers	k	0.74	0.35	0.053	Table, page 13.2.4-4

Emission Factors:

		PM	PM_{10}	$PM_{2.5}$	Unit	Reference
Emission Factor for material transfer points	EF	0.01	0.004	0.0006	lb/ton	Table 11.24-2 [1,2]
Emission Factor for wet grinding	EF	Negligible	Negligible	Negligible	lb/ton	Table 11.24-2 [1,2]
Emission Factor for screening (controlled)	EF	0.0022	0.00074	0.00005	lb/ton	Table 11.19.2-2 [3]

Source Parameters:

Source ID	Emission Source	Stack Flow Rate (scfm)	Stack Diameter (ft)	Stack Height (ft)	Gas Temperature (deg F)	Control Efficiency %
120-DCS-01	SAG Mill Dust Scrubber	2,000	1	35	Ambient	99%

Emissions:

PM		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
UNLOAD3	Unloading to Vibrating Feeder	1.00	10.00	1.83	---	---	---
120-FDV-01	Vibrating Feeder	0.22	2.20	0.40	---	---	---
120-DCS-01	SAG Mill Dust Scrubber	---	---	---	1.22E-02	0.12	0.02

PM_{10}		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
UNLOAD3	Unloading to Vibrating Feeder	0.40	4.00	0.73	---	---	---
120-FDV-01	Vibrating Feeder	0.07	0.74	0.14	---	---	---
120-DCS-01	SAG Mill Dust Scrubber	---	---	---	4.74E-03	0.05	0.01

$PM_{2.5}$		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
UNLOAD3	Unloading to Vibrating Feeder	0.06	0.61	0.11	---	---	---
120-FDV-01	Vibrating Feeder	0.01	0.05	0.01	---	---	---
120-DCS-01	SAG Mill Dust Scrubber	---	---	---	6.56E-04	0.01	0.001

Notes:
1. Emission factors (from 11.24-2) for high moisture ore were used (ore with 4% or greater moisture content)
2. $PM_{2.5}$ Emission Factor for material transfer point calculated using a ratio of k factors from AP-42, Section 13.2.4, Aggregate Handling and Storage Piles, and applying the k factors to the PM_{10} emission factor from Section 11.24.
3. Controlled screening emission factor used because water is added as part of the process at this point.

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Area 120 SAG Mill

Radionuclide Emissions

Emission Basis: Based on MILDOS-Area Assesment of Off-site Radiation Doses Report, Rev B., dated June 2, 2009

Specific Activity of Radionuclides

Radium-226	1	Ci/g
Thorium-230	0.019	Ci/g
Lead-210	88	Ci/g
Uranium-238	3.30E-07	Ci/g
Radon-222	1.50E+05	Ci/g

Source Parameters:

Source ID	Emission Source	Stack Flow Rate (scfm)	Stack Diameter (ft)	Stack Height (ft)	Gas Temperature (deg F)	Control Efficiency %
120-DCS-01	SAG Mill Dust Scrubber	2,000	1	35	Ambient	99%

Emissions:

Radionuclides			**Uncontrolled**		**Controlled**	
Source ID	Emission Source	Radionuclide Compound	(Ci/yr)	(lb/yr)	(Ci/yr)	(lb/yr)
120-DCS-01	SAG Mill Dust Scrubber	Radium-226	1.0E-03	2.2E-06	1.0E-05	2.2E-08
		Thorium-230	1.0E-03	1.2E-04	1.0E-05	1.2E-06
		Lead-210	1.0E-03	2.5E-08	1.0E-05	2.5E-10
		Uranium-238	1.0E-03	6.7	1.0E-05	6.7E-02
		Radon-222	11.6	1.7E-07	1.2E-01	1.7E-09
		Total Radionuclides	11.60	6.7	0.12	6.7E-02

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12. AREA 200 LEACH SYSTEM

Area 200 Pre-Leach and Leach Systems

Sulfuric Acid Emissions

Source Parameters:

Source ID	Emission Source	Stack Flow Rate	Stack Diameter	Stack Height	Stack Temp.	Gas Temperature	Control Efficiency
		(scfm)	(ft)	(ft)	(deg F)	(deg C)	%
220-GHS-01	Leach Train Vent Gas Scrubber	2,500	1	35	Ambient	21	99%

Basis/Assumptions:

Sulfuric acid has an extremely low vapor pressure and a high boiling point, meaning that sulfuric acid does not readily volatilize to form gaseous H_2SO_4. However, acid mist will be carried within water vapor in the inlet stream to the scrubber. Therefore, water vapor is assumed to be the volatile substance in the EPA diffusion equation. Then the basis of acid emissions will be that the aqueous solution in the pre-leach tanks contains 1-5% H_2SO_4, assumed 5% for these calculations. Additionally, the basis of acid emissions will be that the aqueous solution in the leach tanks contains 11% H_2SO_4.

Reference	From Estimating Releases and Waste Treatment Efficiencies for the Toxic Chemical Release Inventory Form, dated December 1987.

Based on the EPA Diffusion Equation:

$$VGR = (3.1536 \times 10^7) \times F \times \frac{MKAP}{RT} \times (1-CE)$$

Where:
VGR = Vapor Generation Rate (lb/yr)
M = MW of Species i, (lb/lbmol) (Water = 18.02 lb/lbmol)
A = Tank Surface Area (ft^2)
P = Partial Pressure of the Volatile Chemical, species i, in the mixture (psia)
R = Universal Gas Constant, psia-$ft^3/^oR$-lbmol
= 10.73 psia-$ft^3/^oR$-lbmol
T = Temperature ^oR
= $100^oF = 559.67^oR$ (Pre-Leach Tanks)
= $185^oF = 644.67^oR$ (Leach Tanks - Steam Added)
K = Gas-Phase Mass Transfer Coefficient, ft/s
= $0.00438 \times (U)^{0.78} \times (18/M)^{1/3}$
U = Speed of air across liquid surface, miles/hr
= 1.7 mph (EPA default value, as defined in the attached EPCRA example calc)
3.1536×10^7 = Conversion factor for lb/s to lb/yr
F = Dimensionless Factor
= 1.1 for agitated tank
CE = Scrubber Control Efficiency

Pre-Leach Tank Surface Area Dimensions=	346.36 ft^2	P_{Water} =	0.951 psia	at 37.8^oC / $100\ ^oF$
Leach Tank Surface Area Dimensions=	346.36 ft^2	P_{Water} =	8.38 psia	at 85^oC / $185\ ^oF$

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Area 200 Pre-Leach and Leach Systems

Leach Circuit Calculation Parameters:

Source ID	Emission Source	Chemical Species (i)	Mol Wt. (Species i) (lb/lbmol)	Partial Pressure (psia)	Bath Surface Area (ft^2)	Temp. (^oR)	Gas Constant R (psia-ft^3/^oR-lbmol)	Air Speed Across Liq. Surface (mph)	Gas Phase Mass Transfer Coeff. (ft/s)	Agitated Tank Factor	Percent Acid in Solution	Scrubber Control Efficiency (99%)
210-TKL-01	Pre-Leach Tank #1	Water	18.02	9.51E-01	346.4	559.67	10.73	1.7	0.00662314	1.1	5%	99%
210-TKL-02	Pre-Leach Tank #2	Water	18.02	9.51E-01	346.4	559.67	10.73	1.7	0.00662314	1.1	5%	99%
220-TKL-01	Leach Tank #1	Water	18.02	8.38E+00	346.4	644.67	10.73	1.7	0.00662314	1.1	11%	99%
220-TKL-02	Leach Tank #2	Water	18.02	8.38E+00	346.4	644.67	10.73	1.7	0.00662314	1.1	11%	99%
220-TKL-03	Leach Tank #3	Water	18.02	8.38E+00	346.4	644.67	10.73	1.7	0.00662314	1.1	11%	99%
220-TKL-04	Leach Tank #4	Water	18.02	8.38E+00	346.4	644.67	10.73	1.7	0.00662314	1.1	11%	99%
220-TKL-05	Leach Tank #5	Water	18.02	8.38E+00	346.4	644.67	10.73	1.7	0.00662314	1.1	11%	99%
220-TKL-06	Leach Tank #6	Water	18.02	8.38E+00	346.4	644.67	10.73	1.7	0.00662314	1.1	11%	99%
220-TKL-07	Leach Tank #7	Water	18.02	8.38E+00	346.4	644.67	10.73	1.7	0.00662314	1.1	11%	99%
220-TKL-08	Leach Tank #8	Water	18.02	8.38E+00	346.4	644.67	10.73	1.7	0.00662314	1.1	11%	99%

Leach Circuit Emissions:		***Uncontrolled Emissions:*** [1]				***Controlled Emissions:***			
Source ID	Emission Source	Sulfuric Acid Emissions (lb/hr)	Sulfuric Acid Emissions (lb/day)	Sulfuric Acid Emissions (lb/yr)	Sulfuric Acid Emissions (ton/yr)	Sulfuric Acid Emissions (lb/hr)	Sulfuric Acid Emissions (lb/day)	Sulfuric Acid Emissions (lb/yr)	Sulfuric Acid Emissions (ton/yr)
210-TKL-01	Pre-Leach Tank #1	0.01	0.31	113.54	0.06	0.013	0.31	113.54	0.06
210-TKL-02	Pre-Leach Tank #2	0.01	0.31	113.54	0.06	0.013	0.31	113.54	0.06
220-TKL-01	Leach Tank #1	0.22	5.24	1910.93	0.96	0.22	5.24	1910.93	0.96
220-TKL-02	Leach Tank #2	0.22	5.24	1910.93	0.96	0.22	5.24	1910.93	0.96
220-TKL-03	Leach Tank #3	0.22	5.24	1910.93	0.96	0.22	5.24	1910.93	0.96
220-TKL-04	Leach Tank #4	0.22	5.24	1910.93	0.96	0.22	5.24	1910.93	0.96
220-TKL-05	Leach Tank #5	0.22	5.24	1910.93	0.96	0.22	5.24	1910.93	0.96
220-TKL-06	Leach Tank #6	0.22	5.24	1910.93	0.96	0.22	5.24	1910.93	0.96
220-TKL-07	Leach Tank #7	0.22	5.24	1910.93	0.96	0.22	5.24	1910.93	0.96
220-TKL-08	Leach Tank #8	0.22	5.24	1910.93	0.96	0.22	5.24	1910.93	0.96
	Totals:	**1.77**	**43**	**15,515**	**7.76**	**1.77**	**42.51**	**15,515**	**7.76**

Note:

1. The scrubber is integral to the leach process in that it collects and recirculates process solution into the counter current decantation circuit. The leach system would not operate without the scrubber as process solution would be lost. The scrubber is electrically interlocked such that if it malfunctions, the entire leach system will shut down. Because the scrubber is integral to the leach process itself, the uncontrolled emissions are calculated as being the same as the controlled emissions.

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Area 200 Pre-Leach and Leach Systems

Radionuclide Emissions

Emission Basis: **Based on Data from a Similar Uranium Mill - Radionuclide Emission Data**

Operating Parameters:

Operating hours per day	24	hour/day
Operating days per year	365	days/year

Specific Activity of Radionuclides

Radium-226	1	Ci/g
Thorium-230	0.019	Ci/g
Lead-210	88	Ci/g

Source Parameters:

		Stack Parameters					
Source ID	Emission Source	Flow Rate (scfm)	Flow Rate (m^3/min)	Diameter (ft)	Height (ft)	Temperature (deg F)	Control Efficiency
220-GHS-01	Leach Train Vent Gas Scrubber	2,500	71	1	35	Ambient	99%

Emissions:

Radionuclides		**Radionuclide Compound**	**Controlled**					
Source ID	Emission Source		pCi/ml (air)	pCi/m^3	pCi/hr	pCi/day	pCi/yr	lb/yr
220-GHS-01	Leach Train Vent Gas Scrubber	Radium-226	5.0E-07	0.5	2.1E+03	5.1E+04	1.9E+07	4.10E-08
		Thorium-230	7.0E-07	0.7	3.0E+03	7.1E+04	2.6E+07	3.02E-06
		Lead-210	3.0E-07	0.3	1.3E+03	3.1E+04	1.1E+07	2.80E-10
		Total Radionuclides	1.5E-06	1.5E+00	6.4E+03	1.5E+05	5.6E+07	3.06E-06

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13. AREA 300 TAILING CELLS AND EVAPORATION PONDS

Area 300 - Tailing Cells and Evaporation Ponds

Evaporation

Basis: Mass of liquid organic values from "Pinon Ridge Project (Rev. 2) Tailing Stream Analysis", Brett Berg, March 12, 2008.

Operating Parameters:

Evaporation hours per day	24	hours/day
Evaporation days per year	365	days/year
Liquid entering tailings	118	tons/hour
Tailings liquid returning to mill	101.1	tons/hour
Liquid entering Evap Ponds	62,762	lb/hr

Emission Factor Parameters:

Tailings Cells:		
Mass of liquid organic:[1,3]	12	lb/hr
Sulfuric acid concentration:	0.084	g/L
Evaporation Pond:		
Mass of liquid organic:[2,4]	3.1	lb/hr
Sulfuric acid concentration:	0.01	g/L
S.G. Aqueous Liquid	1.07	
Density Aqueous Liquid	8.92	lb/gal

Notes:

1. Assume all organic liquid to the tailing cell that does not get recirculated back to the mill will evaporate and that all of the organic liquid is VOC as defined by regulation.
2. Assume all organic liquid to the evaporation pond will evaporate and that all of the organic liquid is VOC as defined by regulation.
3. For sulfuric acid emissions, assume all aqueous liquid to the tailing cell that does not get recirculated back to the mill will evaporate.
4. For sulfuric acid emissions, assume all aqueous liquid to the evaporation pond will evaporate.

Emissions:

VOCs		**Uncontrolled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)
EVAP1	Tailing Cell Evaporation	1.72	41.25	7.53
EVAP2	Evaporation Pond Evaporation	3.10	74.40	13.58

Example Calc EVAP1 VOC (lb/hr): Mass Liquid Organic Entering - (Mass Org Entering x (Total Liq Entering/Liquid Recycled to Mill))

Emissions:

Sulfuric Acid		**Uncontrolled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)
EVAP1	Tailing Cell Evaporation	2.66	63.72	11.63
EVAP2	Evaporation Pond Evaporation	0.59	14.09	2.57

Example Calc EVAP1 H_2SO_4 (lb/hr): (Total Liquid Entering - Liquid Recycled to Mill) (ton/hr) x (lb/ton) / Liq Density (lb/gal) x Sulfuric Conc (g/L) x (lb/g) x L/gal
Example Calc EVAP2 H_2SO_4 (lb/hr): (Total Liquid Entering) (lb/hr) / Liq Density (lb/gal) x Sulfuric Conc (g/L) x (lb/g) x L/gal

Radionuclide Emissions

Emission Basis: **Based on MILDOS-Area Assesment of Off-site Radiation Doses Report, Rev B., dated June 2, 2009**

Specific Activity of Radionuclides

Radium-226	1	Ci/g
Thorium-230	0.019	Ci/g
Lead-210	88	Ci/g
Uranium-238	3.30E-07	Ci/g
Radon-222	1.50E+05	Ci/g

Emissions:

Radionuclides		**Radionuclide Compound**	**Uncontrolled**	
Source ID	Emission Source		(Ci/yr)	(lb/yr)
EVAP1	Tailing Cell Evaporation	Radium-226	1.5E-02	3.31E-05
		Thorium-230	2.0E-01	2.37E-02
		Lead-210	2.0E-01	5.11E-06
		Uranium-238 and Uranium-234	2.0E-01	1362.86
		Radon-222	119.0	1.75E-06
		Total Radionuclides	119.6	1362.89

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Area 300 - Tailing Cells and Evaporation Ponds

Wind Erosion

AP-42 Section 11.9 Western Surface Coal Mining, Final Section, August 1982.

Emission Factor: **0.38 tons PM/acre-year** Table 11.9-4

Operating Parameters:

Size of each Tailing Cell	30	acres
Maximum active Tailing Cells	2	cells
Maximum exposed % of Cell	80%	%
Size of Evaporation Pond Set	40	acres
Number of Pond Sets	2	sets
Maximum exposed % of pond[3]	50%	%
Wind Erosion hours per day	24	hours/day
Wind Erosion days per year	365	days/year

Emission Factor Parameters:

Control Efficiency (water/raffinate spray)[4]	CE	50%

		PM	PM_{10}	$PM_{2.5}$	Reference
Particle Size Multipliers	k	1	0.5	0.075	Table on page 13.2.5-3

Emission Factors:

		PM	PM_{10}	$PM_{2.5}$ [1,2]	Reference
Emission Factor for open areas (ton/acre-year)	EF	0.38	0.19	0.0285	Table 11.9-4

Notes:

1. No emission factor for $PM_{2.5}$ listed in Table 11.9-4.
2. $PM_{2.5}$ Emission Factor calculated using a ratio of k factors from AP-42, Section 13.2.5, Industrial Wind Erosion, and applying the k factors to the PM_{10} emission factor from Section 11.9.
3. As an upper bound estimate, it is assumed that only 50% of the Tailings ponds are covered with aqueous solution, so 50% is exposed to wind erosion.
4. The WRAP Fugitive Dust Control Handbook lists 84% control for dust suppressants to stabilize open areas. Routine watering is assumed to provide 50% control.

Emissions:

PM		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
WIND2	Tailings Cell Wind Erosion	4.16	99.95	18.24	2.08	49.97	9.12
WIND3	Evaporation Pond Wind Erosion	3.47	83.29	15.20	1.74	41.64	7.60

PM_{10}		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
WIND2	Tailings Cell Wind Erosion	2.08	49.97	9.12	1.04	24.99	4.56
WIND3	Evaporation Pond Wind Erosion	1.74	41.64	7.6	0.87	20.82	3.80

$PM_{2.5}$		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
WIND2	Tailings Cell Wind Erosion	0.31	7.50	1.37	0.16	3.75	0.68
WIND3	Evaporation Pond Wind Erosion	0.26	6.25	1.14	0.13	3.12	0.57

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14. AREA 400 URANIUM SX

Area 400 Uranium Solvent Extraction

Particulate Emissions

AP-42, Section 8.12, Sodium Carbonate, Final Section, July 1993

Basis/Assumptions:

A bag breaker is used to break 100 pound bags of diatomaceous earth (DE) and pour it into the DE mix tank. The process is controlled by a dust filter. Emissions are assumed to be similar to the contolled emission factor presented for sodium carbonate storage/loading and unloading, as provided in AP-42 Table 8.12-2 The process requires 958 pounds of DE per day and bag breaking will occur every day. Because the bags weigh 100 pounds each, it is asssumed that the process will use 10 bags per day (total of 1,000 pounds per day). Although bag breaking does not occur all day, hourly emissions are averaged over the 24-hr period.

Operating Parameters:

Diatomaceous Earth (DE) used	1,000	lb/day
Bags of DE used per day	10	bags/day
Size of DE bags	100	lbs
Operation hours per day	24	hrs/day
Operational days per year	365	days/yr
Efficiency of bag breaker dust collector	99%	

Emission Factor (Controlled):

0.0051	lb PM/ton	Table 8.12-2

Emissions:

$PM/PM_{10}/PM_{2.5}$		**Controlled PM**			**Controlled PM_{10}[1]**			**Controlled $PM_{2.5}$[1]**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
410-BBB-01	DE Bag Breaker	1.06E-04	2.55E-03	4.65E-04	1.06E-04	2.55E-03	4.65E-04	5.31E-05	1.28E-03	2.33E-04

Notes:
1. Diatomaceous earth has a median particle size of 5 um. Therefore, all of the particulate is assumed to be PM_{10} and half of the particulate is assumed to be $PM_{2.5}$.

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Area 400 Uranium Solvent Extraction

VOC Emissions

Uranium SX Extraction Circuit

Basis/Assumptions:

Based on the EPA Diffusion Equation:

$$VGR = (3.1536 \times 10^7) \times F \times \frac{MKAP}{RT} \times (1-CF)$$

Where:
VGR = Vapor Generation Rate (lb/yr)
M = MW of Species i, (lb/lbmol) (Kerosene = 170 lb/lbmol (approx))
A = Bath Surface Area (ft^2)
P = Partial Pressure of the Volatile Chemical, species i, in the mixture (psia)
R = Universal Gas Constant, psia-ft^3/°R-lbmol
= 10.73 psia-ft^3/°R-lbmol
T = Temperature °R
= 70°F = 529.67°R
K = Gas-Phase Mass Transfer Coefficient, ft/s
= $0.00438 \times (U)^{0.78} \times (18/M)^{1/3}$
U = Speed of air across liquid surface, miles/hr
= 1.7 mph (EPA suggested value)
3.1536×10^7 = Conversion factor for lb/s to lb/yr
F = Dimensionless Factor
= 1.1 for agitated tank
CF = Control factor for a covered tank / without active air flow (75% control)

Tank Surface Area Dimensions= 10.5 feet x 20 feet = 210 ft^2
Scrubber Mixer Settler Dimensions= 15 feet x 7.5 feet = 112.5 ft^2
$P_{Kerosene}$ = 0.019 psia at 21°C

Uranium SX VOC Emissions:

Source ID	Emission Source	Chemical Species (i)	Mol Wt. (Species i) (lb/lbmol)	Partial Pressure (psia)	Bath Surface Area (ft^2)	Temp. (°R)	Gas Constant R (psia-ft^3/°R-lbmol)	Air Speed Across Liq. Surface (mph)	Gas Phase Mass Transfer Coeff. (ft/s)	Covered Tank Control Factor	Agitated Tank Factor	VOC Emissions (lb/hr)	VOC Emissions (lb/day)	VOC Emissions (ton/yr)
420-MSS-01	Uranium Mixer Settler Tank A1	Kerosene	170	1.90E-02	210.0	529.67	10.73	1.7	0.003136827	75%	1.1	0.37	8.90	1.62
420-MSS-02	Uranium Mixer Settler Tank A2	Kerosene	170	1.90E-02	210.0	529.67	10.73	1.7	0.003136827	75%	1.1	0.37	8.90	1.62
420-MSS-03	Uranium Mixer Settler Tank A3	Kerosene	170	1.90E-02	210.0	529.67	10.73	1.7	0.003136827	75%	1.1	0.37	8.90	1.62
420-MSS-04	Uranium Mixer Settler Tank A4	Kerosene	170	1.90E-02	210.0	529.67	10.73	1.7	0.003136827	75%	1.1	0.37	8.90	1.62
430-MSS-01	Uranium Mixer Settler Tank B1	Kerosene	170	1.90E-02	210.0	529.67	10.73	1.7	0.003136827	75%	1.1	0.37	8.90	1.62
430-MSS-02	Uranium Mixer Settler Tank B2	Kerosene	170	1.90E-02	210.0	529.67	10.73	1.7	0.003136827	75%	1.1	0.37	8.90	1.62
430-MSS-03	Uranium Mixer Settler Tank B3	Kerosene	170	1.90E-02	210.0	529.67	10.73	1.7	0.003136827	75%	1.1	0.37	8.90	1.62
430-MSS-04	Uranium Mixer Settler Tank B4	Kerosene	170	1.90E-02	210.0	529.67	10.73	1.7	0.003136827	75%	1.1	0.37	8.90	1.62
440-MSS-01	Uranium Scrubber Mixer Settler	Kerosene	170	1.90E-02	112.5	529.67	10.73	1.7	0.003136827	75%	1.1	0.20	4.77	0.87
440-MSS-02	Uranium Stripper Mixer Settler #1	Kerosene	170	1.90E-02	112.5	529.67	10.73	1.7	0.003136827	75%	1.1	0.20	4.77	0.87
440-MSS-03	Uranium Stripper Mixer Settler #2	Kerosene	170	1.90E-02	112.5	529.67	10.73	1.7	0.003136827	75%	1.1	0.20	4.77	0.87
											TOTAL:	**3.56**	**85.46**	**15.60**

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Area 400 Uranium Solvent Extraction

Uranium SX Organic Process Tanks

Source ID	Emission Source	Chemical Species	Capacity (gal)	Length (ft.)	Dia (ft.)	Annual Throughput (gal.)	VOC Emissions (lb/hr)	VOC Emissions (lb/day)	VOC Emissions (ton/yr)
860-TKH-01	Kerosene Tank	Kerosene	38,071	20.0	18.0	202,222	0.0014	0.0327	0.0060
860-TKH-02	Organic Make-Up Tank	94% Kerosene, 1% Trimethylamine, 3% Isodecanol	5,875	10.0	10.0	202,222	0.0006	0.0156	0.0028
440-TKH-01	Uranium SX Loaded Organic Tank	94% Kerosene, 1% Trimethylamine, 3% Isodecanol	64,298	19.0	24.0	202,222	0.002	0.047	0.009
440-TKH-02	Uramium SX Barren Organic Tank	94% Kerosene, 1% Trimethylamine, 3% Isodecanol	64,298	19.0	24.0	202,222	0.002	0.05	0.009
						TOTAL:	**0.004**	**0.09**	**0.02**

Table Notes:
1. Annual VOC Emissions calculated using the EPA TANKS Program, version 4.09d.
2. Based on 8760 hours per year, Hourly Emissions (lbs/ hour) = Annual Emissions (lbs/yr) / 8760 (hours/year)
3. Annual Emissions (tons/yr) = Annual Emissions (lbs/yr) / 2000 (lbs/ton)
4. Since trimethylamine and isodecanol are not listed compounds in the TANKS 4.09d model, the contents are assumed to be 100% kerosene.

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15. AREA 500 URANIUM PRECIPITATION AND PACKAGING

Area 500 Uranium Precipitation and Packaging

Sulfuric Acid Emissions

Basis/Assumptions:

Sulfuric acid is added to the precipitation tanks for pH control. However, since the pH is held between 2.5 and 4.5 for optimal precipitation of the solution, the average amount of free acid in solution is estimated to be about 0.0002 N H_2SO_4 (0.001% H_2SO_4). Therefore, sulfuric acid emissions are assumed to be negligible. Note: Since pH = -log (H^+) and if the average pH is 4, then the Molarity (moles/L) = $10^{-4.}$ Then there are 2 equivalent H+ ions when H_2SO_4 dissociates, so the Normality = 2 x 10^{-4}.

Source Parameters:

Source ID	Emission Source	Stack Flow Rate (scfm)	Stack Diameter (ft)	Stack Height (ft)	Gas Temp (deg F)	Control Efficiency %
530-GHS-01	Uranium Vent Gas Scrubber	2,000	1	35	225	99%

Particulate Emissions

Basis/Assumptions:

The yellowcake dryer is a vacuum dryer, where water vapor exhaust will be sent through a condenser and the water will be recycled back into the system. This system is considered a 'no emission' dryer.

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16. AREA 600 VANADIUM SX

Area 600 Vanadium Oxidation and Solvent Extraction

Inorganic Emissions

Basis/Assumptions:

The vanadium oxidation and solvent extraction area will use various inorganic reagents in the oxidation tanks and the mixer settler tanks, including sodium carbonate, sodium hydroxide, sulfuric acid, and ammonia. These reagents are generally added for pH control based on the chemical reactions as the vanadium product moves through the circuit. It is assumed that these reagents are consumed by chemical reactions to maintain the pH and negligible inorganic emissions will occur in this area.

VOC Emissions

Vanadium SX Extraction Circuit

Basis/Assumptions:

Based on the EPA Diffusion Equation:

$$VGR = (3.1536 \times 10^7) \times F \times \frac{MKAP}{RT} \times (1-CF)$$

Where:

VGR = Vapor Generation Rate (lb/yr)

M = MW of Species i, (lb/lbmol) (Kerosene = 170 lb/lbmol (approx))

A = Bath Surface Area (ft^2)

P = Partial Pressure of the Volatile Chemical, species i, in the mixture (psia)

R = Universal Gas Constant, psia-$ft^3/^oR$-lbmol

= 10.73 psia-$ft^3/^oR$-lbmol

T = Temperature ^oR

= $70^oF = 529.67^oR$

K = Gas-Phase Mass Transfer Coefficient, ft/s

= $0.00438 \times (U)^{0.78} \times (18/M)^{1/3}$

U = Speed of air across liquid surface, miles/hr

= 1.7 mph (EPA suggested value)

3.1536×10^7 = Conversion factor for lb/s to lb/yr

F = Dimensionless Factor

= 1.1 for agitated tank

CF = Control factor for a covered tank / without active air flow (75% control)

Tank Surface Area Dimensions=	10.5 feet x 21 feet =	220.5 ft^2
Scrubber Mixer Settler Dimensions=	15 feet x 8 feet =	120 ft^2

$P_{Kerosene}$ = 0.019 psia at 21^oC

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Area 600 Vanadium Oxidation and Solvent Extraction

Vanadium SX VOC Emissions:

Source ID	Emission Source	Chemical Species (i)	Mol Wt. (Species i) (lb/lbmol)	Partial Pressure (psia)	Bath Surface Area (ft^2)	Temp. (^oR)	Gas Constant R (psia-$ft^3/^oR$-lbmol)	Air Speed Across Liq. Surface (mph)	Gas Phase Mass Transfer Coeff. (ft/s)	Covered Tank Control Factor	Agitated Tank Factor	VOC Emissions (lb/hr)	VOC Emissions (lb/day)	VOC Emissions (ton/yr)
620-MSS-01	Vanadium Mixer Settler Tank A1	Kerosene	170	1.90E-02	220.5	529.67	10.73	1.7	0.0031368	75%	1.1	0.39	9.34	1.70
620-MSS-02	Vanadium Mixer Settler Tank A2	Kerosene	170	1.90E-02	220.5	529.67	10.73	1.7	0.0031368	75%	1.1	0.39	9.34	1.70
620-MSS-03	Vanadium Mixer Settler Tank A3	Kerosene	170	1.90E-02	220.5	529.67	10.73	1.7	0.0031368	75%	1.1	0.39	9.34	1.70
620-MSS-04	Vanadium Mixer Settler Tank A4	Kerosene	170	1.90E-02	220.5	529.67	10.73	1.7	0.0031368	75%	1.1	0.39	9.34	1.70
620-MSS-05	Vanadium Mixer Settler Tank A5	Kerosene	170	1.90E-02	220.5	529.67	10.73	1.7	0.0031368	75%	1.1	0.39	9.34	1.70
630-MSS-01	Vanadium Mixer Settler Tank B1	Kerosene	170	1.90E-02	220.5	529.67	10.73	1.7	0.0031368	75%	1.1	0.39	9.34	1.70
630-MSS-02	Vanadium Mixer Settler Tank B2	Kerosene	170	1.90E-02	220.5	529.67	10.73	1.7	0.0031368	75%	1.1	0.39	9.34	1.70
630-MSS-03	Vanadium Mixer Settler Tank B3	Kerosene	170	1.90E-02	220.5	529.67	10.73	1.7	0.0031368	75%	1.1	0.39	9.34	1.70
630-MSS-04	Vanadium Mixer Settler Tank B4	Kerosene	170	1.90E-02	220.5	529.67	10.73	1.7	0.0031368	75%	1.1	0.39	9.34	1.70
630-MSS-05	Vanadium Mixer Settler Tank B5	Kerosene	170	1.90E-02	220.5	529.67	10.73	1.7	0.0031368	75%	1.1	0.39	9.34	1.70
640-MSS-01	Vanadium Scrubber Mixer Settler	Kerosene	170	1.90E-02	120.0	529.67	10.73	1.7	0.0031368	75%	1.1	0.21	5.08	0.93
640-MSS-02	Vanadium Stripper Mixer Settler #1	Kerosene	170	1.90E-02	120.0	529.67	10.73	1.7	0.0031368	75%	1.1	0.21	5.08	0.93
640-MSS-03	Vanadium Stripper Mixer Settler #2	Kerosene	170	1.90E-02	120.0	529.67	10.73	1.7	0.0031368	75%	1.1	0.21	5.08	0.93
640-MSS-04	Vanadium Stripper Mixer Settler #3	Kerosene	170	1.90E-02	120.0	529.67	10.73	1.7	0.0031368	75%	1.1	0.21	5.08	0.93
											TOTAL:	**4.74**	**113.73**	**20.76**

Vanadium SX Organic Process Tanks

Source ID	Emission Source	Chemical Species	Capacity (gal)	Length (ft.)	Dia (ft.)	Annual Throughput (gal.)	VOC Emissions (lb/hr)	VOC Emissions (lb/day)	VOC Emissions (ton/yr)
640-TKH-01	Vanadium SX Loaded Organic Tank	94% Kerosene, 1% Trimethylamine, 3% Isodecanol	64,298	19.0	24.0	200,000	0.002	0.047	0.009
640-TKH-02	Vanadium SX Barren Organic Tank	94% Kerosene, 1% Trimethylamine, 3% Isodecanol	64,298	19.0	24.0	200,000	0.002	0.047	0.009
						TOTAL:	**0.004**	**0.09**	**0.02**

Table Notes:
1. Annual VOC Emissions calculated using the EPA TANKS Program, version 4.09d.
2. Based on 8760 hours per year, Hourly Emissions (lbs/ hour) = Annual Emissions (lbs/yr) / 8760 (hours/year)
3. Annual Emissions (tons/yr) = Annual Emissions (lbs/yr) / 2000 (lbs/ton)
4. Since trimethylamine and isodecanol are not listed compounds in the TANKS 4.09d model, the contents are assumed to be 100% kerosene.

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17. AREA 700 VANADIUM PRECIPITATION AND PACKAGING

Area 700 Vanadium Precipitation and Packaging

Operating Parameters:

Operating hours per day	24	hour/day
Operating days per year	365	days/year

Ammonia Emissions (Drying & Packaging)

Basis/Assumptions:

730-GHS-01: The vanadium precipitation process will use ammonia and ammonium sulfate for pH control to maintain optimal precipitation of the vanadium product. Ammonia emissions are calculated using the EPA Diffusion Equation. Ammonia will then be driven off in the rotary kiln when heated to 698 ^{o}F. By mass balance, the amount of ammonia generated by the belt filter vacuum and the rotary kiln is 117 lb/hr, as inlet to the scrubber.

Source Parameters:

Source ID	Emission Source	Stack Flow	Stack	Stack Height	Gas Exit	Control
		(scfm)	(ft)	(ft)	(deg F)	
730-GHS-01	Packed Bed Wet Vent Scrubber	1,000	0.67	35	225	99%

*vent gases from precip tanks 1-5, belt filter vacuum, rotary kiln, dryer

Ammonia Emission Factor:

$EF_{Ammonia}$ = 117 lb/hr

Emissions:

Ammonia		**Uncontrolled** [1]			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
730-GHS-01	Packed Bed Wet Vent Scrubber	1.17	28.08	5.12	1.17	28.08	5.12

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Area 700 Vanadium Precipitation and Packaging

Ammonia Emissions (Precipitation)

Source Parameters:

Source ID	Emission Source	Stack Flow Rate (scfm)	Stack Diameter (ft)	Stack Height (ft)	Stack Temp. (deg F)	Control Efficiency %
730-GHS-01	Packed Bed Wet Vent Scrubber	1,000	0.67	35	225	99%

Basis/Assumptions:

Since the concentration of ammonia in solution is very small (<0.01%), the vapor pressure of water will be used in the EPA diffusion equation. The concentration of ammonia in solution is estimated to be much less than 1%, however due to buffering and for conservative emission calculations, the basis will be that the aqueous solution in the vanadium precipitation tanks contains 1% ammonia.

Based on the EPA Diffusion Equation:

$$VGR = (3.1536\times10^{7}) \times F \times \frac{MKAP}{RT} \times (1-CE)$$

Where:

VGR = Vapor Generation Rate (lb/yr)

M = MW of Species i, (lb/lbmol) (Ammonia = 17.03 lb/lbmol)

A = Tank Surface Area (ft^2)

P = Partial Pressure of the Volatile Chemical, species i, in the mixture (psia)

R = Universal Gas Constant, psia-ft^3/^oR-lbmol

= 10.73 psia-ft^3/^oR-lbmol

T = Temperature ^oR

= 149^oF = 608.67^oR

K = Gas-Phase Mass Transfer Coefficient, ft/s

= $0.00438 \times (U)^{0.78} \times (18/M)^{1/3}$

U = Speed of air across liquid surface, miles/hr

= 1.7 mph (EPA suggested value)

3.1536×10^{7} = Conversion factor for lb/s to lb/yr

F = Dimensionless Factor

= 1.1 for agitated tank

CE = Scrubber Control Efficiency

Precipitation Tank Surface Area = 50.27 ft^2 P_{Water} = 3.73 psia at 65^oC / 149 ^oF

Vanadium Precipitation Circuit Calculation Parameters:

Source ID	Emission Source	Chemical Species (i)	Mol Wt. (Species i) (lb/lbmol)	Partial Pressure (psia)	Bath Surface Area (ft^2)	Temp. (^oR)	Gas Constant R (psia-ft^3/^oR-lbmol)	Air Speed Across Liq. Surface (mph)	Gas Phase Mass Transfer Coeff. (ft/s)	Agitated Tank Factor	Percent Acid in Solution	Scrubber Control Efficiency (99%)
710-TKP-01	Vanadium Precipitation Tank #1	Ammonia	17.03	3.73E+00	50.3	608.67	10.73	1.7	0.006749064	1.1	1%	99%
710-TKP-02	Vanadium Precipitation Tank #2	Ammonia	17.03	3.73E+00	50.3	608.67	10.73	1.7	0.006749064	1.1	1%	99%
710-TKP-03	Vanadium Precipitation Tank #3	Ammonia	17.03	3.73E+00	50.3	608.67	10.73	1.7	0.006749064	1.1	1%	99%
710-TKP-04	Vanadium Precipitation Tank #4	Ammonia	17.03	3.73E+00	50.3	608.67	10.73	1.7	0.006749064	1.1	1%	99%
710-TKP-05	Vanadium Precipitation Tank #5	Ammonia	17.03	3.73E+00	50.3	608.67	10.73	1.7	0.006749064	1.1	1%	99%

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Area 700 Vanadium Precipitation and Packaging

Vanadium Precipitation Circuit Emissions:		***Uncontrolled Emissions:*** [1]				***Controlled Emissions:***			
Source ID	Emission Source	Ammonia Emissions (lb/hr)	Ammonia Emissions (lb/day)	Ammonia Emissions (lb/yr)	Ammonia Emissions (ton/yr)	Ammonia Emissions (lb/hr)	Ammonia Emissions (lb/day)	Ammonia Emissions (lb/yr)	Ammonia Emissions (ton/yr)
710-TKP-01	Vanadium Precipitation Tank #1	0.001	0.03	11.45	0.01	0.001	0.03	11.45	0.01
710-TKP-02	Vanadium Precipitation Tank #2	0.001	0.03	11.45	0.01	0.001	0.03	11.45	0.01
710-TKP-03	Vanadium Precipitation Tank #3	0.001	0.03	11.45	0.01	0.001	0.03	11.45	0.01
710-TKP-04	Vanadium Precipitation Tank #4	0.001	0.03	11.45	0.01	0.001	0.03	11.45	0.01
710-TKP-05	Vanadium Precipitation Tank #5	0.001	0.03	11.45	0.01	0.001	0.03	11.45	0.01
	Totals:	**0.01**	**0.16**	**57.23**	**0.03**	**0.01**	**0.16**	**57.23**	**0.03**

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Area 700 Vanadium Precipitation and Packaging

Particulate Emissions (Dryer)

Basis/Assumptions:

730-DCS-01: Vanadium particulate from the dryer will be controlled with a baghouse (730-DCS-01), however, the emissions from the baghouse will be further controlled by the packed bed scrubber (730-GHS-01). The baghouse exhaust will be rated at 0.02 gr/scf. The belt filter and rotary kiln exhaust is vented to the packed bed scrubber only (730-GHS-01) and emissions are estimated to be 10 ppm, as inlet to the scrubber.

Dryer Baghouse Exhaust: 0.02 gr/scf
Where lb/hr = gr/scf x lb/gr x scf/hr
E_{PM} = 0.051 lb/hr

Source ID	Emission Source	Stack Flow	Stack	Stack	Gas Exit	Control
		(cfm)	(ft)	(ft)	(deg F)	%
730-DCS-01	Vanadium Dryer Dust Collector	300	TBD	TBD	190	99%

Particulate Emissions Calculation (belt filter and rotary kiln)

$E_{PM} = (C_{PM}) \times Q \times d_{Air} \times (1 \text{ tonne}/1000 \text{ kg}) \times (1 \text{ lb} / 453.59 \text{ g}) \times (60 \text{ min/hr})$

Where:
E_{PM} = Particulate Emissions (kg/yr)
C_{PM} = Conc of PM in gas stream (g/tonne)
Q = Flow Rate (m^3/min) - @STP
d_{Air} = Density of Air (1.29 kg/m^3 at STP)

Basis:
Particulate inlet to scrubber (belt filter & kiln): 10 ppm E_{PM} = 0.048 lb/hr
Where: 10 ppm (mass) = 10 g / tonne

Emissions (Dryer Baghouse + Rotary Kiln + Belt Filter):

Particulate (PM / PM_{10} / $PM_{2.5}$)		**Uncontrolled** [1]			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
730-GHS-01	Packed Bed Wet Vent Scrubber	9.97E-04	2.39E-02	4.37E-03	9.97E-04	2.39E-02	4.37E-03

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Area 700 Vanadium Precipitation and Packaging

Radionuclide Emissions

Emission Basis: **Based on Data from a Similar Uranium Mill - Radionuclide Emission Data**

Operating Parameters:

Operating hours per day	24	hour/day
Operating days per year	365	days/year

Specific Activity of Radionuclides

Radium-226	1	Ci/g
Thorium-230	0.019	Ci/g
Lead-210	88	Ci/g

Source Parameters:

		Stack Parameters					
		Flow Rate	Flow Rate	Diameter	Height	Temp	Control
Source ID	Emission Source	(scfm)	(m^3/min)	(ft)	(ft)	(deg F)	Efficiency
730-GHS-01	Packed Bed Wet Scrubber	1,000	28	0.67	35	225	99%

Emissions:

Radionuclides		**Radionuclide Compound**	**Controlled**					
Source ID	Emission Source		pCi/ml (air)	pCi/m^3	pCi/hr	pCi/day	pCi/yr	lb/yr
730-GHS-01	Packed Bed Wet Scrubber	Radium-226	5.0E-08	0.1	8.5E+01	2.0E+03	7.4E+05	1.64E-09
		Thorium-230	5.0E-07	0.5	8.5E+02	2.0E+04	7.4E+06	8.63E-07
		Lead-210	2.0E-06	2.0	3.4E+03	8.2E+04	3.0E+07	7.46E-10
		Total Radionuclides	2.6E-06	2.6E+00	4.3E+03	1.0E+05	3.8E+07	8.66E-07

Note:

1. The scrubber (730-GHS-01) is integral to the vanadium precipitation process in that it recovers and recirculates process solution into the pre-leach thickener tank as well as cooling the scrubbed air prior to venting. The vanadium precipitation system would not operate without the scrubber as process solution would be lost. Because the scrubber is integral to the vanadium precipitation process, the uncontrolled emissions are calculated as being the same as the controlled emissions.

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Area 700 Vanadium Precipitation and Packaging

Particulate Emissions (Furnace, Casting Wheel, & Packaging)

Basis/Assumptions:
730-GHS-02: The fusion furnace, casting wheel, and packaging system is estimated to yield 200 ppm of vanadium particulate, as inlet to the scrubber.

Source Parameters:

Source ID	Emission Source	Stack Flow Rate (scfm)	Stack Diameter (ft)	Stack Height (ft)	Gas Exit Temperature (deg F)	Control Efficiency %
730-GHS-02	Wet Venturi Scrubber	5,000	1.33	35	250	99%

* vent gases from fusion furnace, hood vent of casting wheel, hood vent of packaging system

Particulate Emissions Calculation:
$E_{PM} = (C_{PM}) \times Q \times d_{Air} \times (1 \text{ tonne}/1000 \text{ kg}) \times (1 \text{ lb} / 453.59 \text{ g}) \times (60 \text{ min/hr})$

Where:
E_{PM} = Particulate Emissions (kg/yr)
C_{PM} = Conc of PM in gas stream (g/tonne)
Q = Flow Rate (m^3/min) - @STP
d_{Air} = Density of Air (1.29 kg/m^3 at STP)

Basis:
Particulate inlet to scrubber: 200 ppm
Where: 200 ppm (mass) = 200 g / tonne

Particulate (PM / PM_{10} / $PM_{2.5}$) Emissions:

Source ID	Emission Source	Uncontrolled (lb/hr)	Uncontrolled (lb/day)	Uncontrolled (ton/yr)	Controlled (lb/hr)	Controlled (lb/day)	Controlled (ton/yr)
730-GHS-02	Wet Venturi Scrubber	4.83	115.97	21.16	0.05	1.16	0.21

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18. AREA 800 REAGENTS

Area 800 Reagents

Operating Parameters:

Operational hours per day	24	hours/day
Operational days per year	365	days/year
Number of H_2SO_4 Tanks	3	tanks
Capacity of each H_2SO_4 tank	128,963	gallons
Number of NH_3 Tanks	2	tanks
Capacity of each NH_3 tank	12,000	gallons
Number of Kerosene tanks	1	tanks
Capacity of each Kerosene tank	38,069	gallons
Number of Organic Tanks	1	tanks
Capacity of each Organic tank	5,875	gallons

Tank Calculations:

Supplied Sulfuric Acid:	15421	lb/hr	* Referenced from 800-PF-001
Density of Sulfuric Acid:	1.84	g/cm^3	
Throughput of Sulfuric Acid:	8,797,323	gal/year	
Throughput of each tank	2,932,441	gal/year/tank	
Turnover per tank	23	tanks	

Supplied Organic:	4.4	lb/hr	* Referenced from 800-PF-003
Throughput of Organic	202,222	gal/year	
Supplied Kerosene:	202,222	gal/year	* 35,000 gallons filled every 9-10 weeks
Turnover of tank	6	tanks	

Emissions:

		Sulfuric Acid			VOC		
Source ID	Emission Source [1]	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
810-TKH-01	Sulfuric Acid Tank #1	0.0004	0.010	0.002	--	--	--
810-TKH-02	Sulfuric Acid Tank #2	0.0004	0.010	0.002	--	--	--
810-TKH-03	Sulfuric Acid Tank #3	0.0004	0.010	0.002	--	--	--
860-TKH-01	Kerosene Tank	--	--	--	0.001	0.033	0.006
860-TKH-02	Organic Make-Up Tank	--	--	--	0.001	0.016	0.003

Notes:
1. Emissions for these tanks were calculated using the TANKS 4.09d model software.

Basis/Assumptions:

Since the ammonia storage tank is a stationary pressure vessel (horizontal cylinder), there are no emissions from this tank.

Ammonia Emissions

Supplied Ammonia:	488.21	lb/hr	* Referenced from 800-PF-001
Density of Liquid Ammonia:	38	lb/ft^3	
Throughput of Ammonia:	841,838	gal/year	
Throughput of each tank	420,919	gal/year/tank	
Turnover per tank	35	turnovers/yr	

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Area 800 Reagents

Fugitive Emissions from Unloading Dry Reagents

AP-42 Section 11.19.2 Crushed Stone Processing and Pulverized Mineral Processing, Final Section, August 2004.

Emission Factors:

0.003	lb PM/ton	Table 11.19.2-2, Conveyor Transfer Point
1.10E-03	lb PM_{10}/ton	Table 11.19.2-2, Conveyor Transfer Point
3.11E-04	lb $PM_{2.5}$/ton	Estimated using the ratio for PM10 controlled vs uncontrolled
0.00014	lb PM/ton	Table 11.19.2-2, Conveyor Transfer Point (controlled)
4.60E-05	lb PM_{10}/ton	Table 11.19.2-2, Conveyor Transfer Point (controlled)
1.30E-05	lb $PM_{2.5}$/ton	Table 11.19.2-2, Conveyor Transfer Point (controlled)

*controlled emission factors are used because water sprays are used at the transfer points.

Operating Parameters:

Operational hours per day	10	hours/day	
Operational days per year	365	days/year	
Supplied Ammonium Sulfate	1798	lb/hr	* Referenced from 800-PF-001
	0.90	tons/hr	
Number of transfer points on each Ammonium Sulfate conveyor	2	transfers	*Emissions are doubled since transfer points occur on each end of conveyors
Supplied Flocculant	43.7	lb/hr	* Referenced from 800-PF-003
	0.02185	tons/hr	

Emissions:

Uncontrolled		PM			PM_{10}			$PM_{2.5}$		
820-CVS-01	Ammonium Sulfate transfer conveyor	5.39E-03	5.39E-02	9.84E-03	1.98E-03	1.98E-02	3.61E-03	5.59E-04	5.59E-03	1.02E-03
820-CVS-02	Ammonium Sulfate feed conveyor	5.39E-03	5.39E-02	9.84E-03	1.98E-03	1.98E-02	3.61E-03	5.59E-04	5.59E-03	1.02E-03
850-HPF-01	Flocculant Hopper	6.56E-05	6.56E-04	1.20E-04	2.40E-05	2.40E-04	4.39E-05	6.79E-06	6.79E-05	1.24E-05
850-CVS-01	Flocculant Feed Conveyor	6.56E-05	6.56E-04	1.20E-04	2.40E-05	2.40E-04	4.39E-05	6.79E-06	6.79E-05	1.24E-05

Controlled		PM			PM_{10}			$PM_{2.5}$		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
820-CVS-01	Ammonium Sulfate transfer conveyor	2.52E-04	2.52E-03	4.59E-04	8.27E-05	8.27E-04	1.51E-04	2.34E-05	2.34E-04	4.27E-05
820-CVS-02	Ammonium Sulfate feed conveyor	2.52E-04	2.52E-03	4.59E-04	8.27E-05	8.27E-04	1.51E-04	2.34E-05	2.34E-04	4.27E-05
850-HPF-01	Flocculant Hopper									
850-HPF-01	Flocculant Hopper	3.06E-06	3.06E-05	5.58E-06	1.01E-06	1.01E-05	1.83E-06	2.84E-07	2.84E-06	5.18E-07
850-CVS-01	Flocculant Feed Conveyor	3.06E-06	3.06E-05	5.58E-06	1.01E-06	1.01E-05	1.83E-06	2.84E-07	2.84E-06	5.18E-07

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19. AREA 900 BOILERS

Area 900 Boilers

(A) AP-42 Section 1.5, Liquified Petroleum Gas Combustion, Final Section July 2008.
(B) AP-42 Section 1.5 LPG Combustion states that PM, CO, and TOC emissions are the same, on a heat input basis, as for natural gas. Thus, VOC factor is scaled from table 1.4-2 factor and heating values of propane and natural gas.

Operating Parameters:

Total fuel supplied	1,135	lb/hr	12.25	MMBtu/hr	* 900-PF-002
Operational hours per day	24	hours/day			
Operational days per year	365	days/year			
Number of total boilers	3	boilers			
Number of operational boilers	2	boilers			

density of propane	4.24	lb/gal	* AP-42, Appendix A, September 1985
HHV of propane	91.5	MMBtu/10^3 gal	* AP-42, Section 1.5
Heat content of methane	1020	MMBtu/10^6 scf	

Stack Parameters:

		StackParameters[5]			
		Flow Rate	Diameter	Height	Temperature
Source ID	Emission Source	(scfm)	(ft)	(ft)	(deg F)
920-STK-01	Combined Boiler Stack	2,418	4	100	455

Emission Factors:

PM Total[6]	0.7	lb/10^3 gal	0.008	lb/MMBtu	Table 1.5-1 for Industrial Boilers
SO_2[1]	0.10S	lb/10^3 gal	0.016	lb/MMBtu	Table 1.5-1 for Industrial Boilers
NO_x	13	lb/10^3 gal	0.142	lb/MMBtu	Table 1.5-1 for Industrial Boilers
Controlled NO_x (as NO_2)[2]	30	ppm	0.036	lb/MMBtu	Low No_x Burner
CO	7.5	lb/10^3 gal	0.082	lb/MMBtu	Table 1.5-1 for Industrial Boilers
TOC	1	lb/10^3 gal	0.011	lb/MMBtu	Table 1.5-1 for Industrial Boilers
VOC	5.5	lb/10^6 scf	0.005	lb/MMBtu	Table 1.4-2 and scaled by heat value

Emissions:

$PM/PM_{10}/PM_{2.5}$		**Uncontrolled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)
920-BLR-01	Steam Boiler #1	0.09	2.25	0.41
920-BLR-02	Steam Boiler #2	0.09	2.25	0.41
920-BLR-03	Steam Boiler #3	0.09	2.25	0.41

NO_x		**Uncontrolled**			**Controlled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)	(lb/hr)	(lb/day)	(ton/yr)
920-BLR-01	Steam Boiler #1	1.74	41.76	7.62	0.45	10.71	1.95
920-BLR-02	Steam Boiler #2	1.74	41.76	7.62	0.45	10.71	1.95
920-BLR-03	Steam Boiler #3	1.74	41.76	7.62	0.45	10.71	1.95

CO		**Uncontrolled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)
920-BLR-01	Steam Boiler #1	1.00	24.09	4.40
920-BLR-02	Steam Boiler #2	1.00	24.09	4.40
920-BLR-03	Steam Boiler #3	1.00	24.09	4.40

SO_2		**Uncontrolled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)
920-BLR-01	Steam Boiler #1	0.20	4.82	0.88
920-BLR-02	Steam Boiler #2	0.20	4.82	0.88
920-BLR-03	Steam Boiler #3	0.20	4.82	0.88

VOC		**Uncontrolled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)
920-BLR-01	Steam Boiler #1	0.07	1.59	0.29
920-BLR-02	Steam Boiler #2	0.07	1.59	0.29
920-BLR-03	Steam Boiler #3	0.07	1.59	0.29

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Area 900 Boilers

HAPs Emissions from Propane Combustion

AP-42 Section 1.4 Natural Gas Combustion, Final Section, July 1998. Tables 1.4-3 and 1.4-4
AP-42 Section 1.5 LPG Combustion states that PM, CO, and TOC emissions are the same, on a heat input basis, as for natural gas. Thus, HAPs from the organic compound table in Section 1.4 are scaled by heating values of propane and natural gas.

Heat content of Propane	91.5	MMBtu/10^3 gal
Heat content of Methane	1020	MMBtu/10^6 scf

	Emission Factor for NG	Emission Factor for Propane	Emissions per Boiler		
HAP [3,4]	(lb/10^6 scf)	(lb/MMBtu)	(lb/hr)	(lb/day)	(ton/yr)
2-Methylnaphthalene	2.4E-05	2.4E-08	2.88E-07	6.92E-06	1.26E-06
Benzene	2.1E-03	2.1E-06	2.52E-05	6.05E-04	1.10E-04
Dichlorobenzene	1.2E-03	1.2E-06	1.44E-05	3.46E-04	6.31E-05
Fluoranthene	3.0E-06	2.9E-09	3.60E-08	8.65E-07	1.58E-07
Fluorene	2.8E-06	2.7E-09	3.36E-08	8.07E-07	1.47E-07
Formaldehyde	7.5E-02	7.4E-05	9.01E-04	2.16E-02	3.94E-03
Hexane	1.8E+00	1.8E-03	2.16E-02	5.19E-01	9.47E-02
Naphthalene	6.1E-04	6.0E-07	7.32E-06	1.76E-04	3.21E-05
Phenanathrene	1.7E-05	1.7E-08	2.04E-07	4.90E-06	8.94E-07
Toluene	3.4E-03	3.3E-06	4.08E-05	9.80E-04	1.79E-04
Arsenic	2.0E-04	2.0E-07	2.40E-06	5.76E-05	1.05E-05
Cadmium	1.1E-03	1.1E-06	1.32E-05	3.17E-04	5.79E-05
Cobalt	8.4E-05	8.2E-08	1.01E-06	2.42E-05	4.42E-06
Manganese	3.8E-04	3.7E-07	4.56E-06	1.10E-04	2.00E-05
Nickel	2.1E-03	2.1E-06	2.52E-05	6.05E-04	1.10E-04
		Total			9.92E-02

Notes:

1. Sulfur concentration based on Gas Processors Association Engineering Data Book (Ninth Edition, 1972), Figure 15-50 (GPA Liquefied Petroleum Gas Specifications, rev. 1979), Commercial Propane = 15 gr/100 scf
2. Controlled emission factors for NOx in parts per million (ppm) converted to lb/MMBtu as follows:

EF (lb/MMBtu) = (C) x (F_d) x (20.9/(20.9-%O2)) EPA Method 19, Eq. 19-1

Where:

C= concentration in lb/dscf

F_d = 8710 dscf/MMBtu EPA Method 19, Table 19-2

convert ppm to lb/dscf:

C= (ppm) x MW / 385.3 / 106 MW = Molecular Weight

MW= 46 (for NOx as NO2)

NOx = 30 ppm

C= 3.58E-06 lb/dscf

%O2 = 3 %

EF = 0.036 lb/MMBtu

3. Only AP-42 factors for pollutants noted as HAPs as defined by Section 112 of the Clean Air Act listed.
4. AP-42 factors marked as "less than (<)" are omitted as emissions are negligible.
5. Emissions from the three boilers exit through a single stack.

6. Since particulate emissions from natural gas & propane combustion are assumed to be less than 1.0 micrometer in diameter, PM, PM_{10}, and $PM_{2.5}$ emissions are assumed to be the same, as stated in note c to Table 1.4-2 of AP-42, Section 1.4, Final Section, dated July 1998.

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20. AREA 900 FIRE WATER PUMP ENGINE

Area 900 - Fire Water Pump Engine

AP-42 Section 3.3 Gasoline and Diesel Industrial Engines, Final Section, October 1996.

Operating Parameters:

Annual Operations[1]	100	hrs/yr
Fire Pump Engine Rated Power	207	hp

Stack Parameters:

		Stack Parameters			
		Flow Rate	Diameter	Height	Temperature
Source ID	Emission Source	(cfm)	(ft)	(ft)	(deg F)
910-PPL-01	Fire Water Diesel Pump	1,189	TBD	TBD	1,030

Emission Factors:

NO_x		4.93	g/hp-hr	0.0108688	lb/hp-hr	Quadna Mnfr Spec Data[3]
SO_2		0.002050	lb/hp-hr	0.002050	lb/hp-hr	AP-42 Table 3.3-1[4]
CO		0.41	g/hp-hr	0.0009039	lb/hp-hr	Quadna Mnfr Spec Data[3]
VOC (as NMHC)		0.17	g/hp-hr	0.0003748	lb/hp-hr	Quadna Mnfr Spec Data[3]
$PM/PM_{10}/PM_{2.5}$		0.16	g/hp-hr	0.0003527	lb/hp-hr	Quadna Mnfr Spec Data[3]

7000	Btu/hp-hr	*AP-42 3.3-1 conversion for lb/Btu to lb/hp-hr

Emissions:

$PM/PM_{10}/PM_{2.5}$		**Uncontrolled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)
910-PPL-01	Fire Water Diesel Pump	0.07	0.15	0.004

NO_x		**Uncontrolled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)
910-PPL-01	Fire Water Diesel Pump	2.25	4.50	0.11

CO		**Uncontrolled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)
910-PPL-01	Fire Water Diesel Pump	0.19	0.37	0.01

SO_2		**Uncontrolled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)
910-PPL-01	Fire Water Diesel Pump	0.42	0.85	0.02

VOC		**Uncontrolled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)
910-PPL-01	Fire Water Diesel Pump	0.08	0.16	0.004

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Area 900 - Fire Water Pump Engine

HAPs Emissions from Diesel Combustion

AP-42 Section 3.3 Gasoline and Diesel Industrial Engines, Final Section, October 1996.

Operating Parameters:

Annual Operations	100	hrs/yr
Rated Fire Pump Engine Power	207	hp

Emission Factors:

HAP [6,7]	Emission Factor (lb/MMBtu)	Emission Factor (lb/hp-hr)
Benzene	9.33E-04	6.53E-06
Toluene	4.09E-04	2.86E-06
Xylenes	2.85E-04	2.00E-06
Formaldehyde	1.18E-03	8.26E-06
Acetaldehyde	7.67E-04	5.37E-06
Naphthalene	8.48E-05	5.94E-07

Emissions:

HAP	(lb/hr)	(lb/day)	(ton/yr)
Benzene	1.35E-03	2.70E-03	6.76E-05
Toluene	5.93E-04	1.19E-03	2.96E-05
Xylenes	4.13E-04	8.26E-04	2.06E-05
Formaldehyde	1.71E-03	3.42E-03	8.55E-05
Acetaldehyde	1.11E-03	2.22E-03	5.56E-05
Naphthalene	1.23E-04	2.46E-04	6.14E-06
Total	5.30E-03	1.06E-02	2.65E-04

Notes:

1. The firewater pump engine will be limited to operation and maintenance testing of 100 hr/yr to comply with 40 CFR Part 60.4211(e). There is no time limit on the use during an emergency situation in 40 CFR Part 60 Subpart IIII.

2. Daily emissions calculated based on a maximum operation time of 2 hr/day. However, the total annual operation time must still stay under 100 hr/year.
3. Emission factors are from the Quadna Diesel Fire Pump Specs Sheet from Clark Fire Protection Products.
4. Emission factor for SO_2 is from Ap-42, Section 3.3, Table 3.3-1, since no manufacturer emission factor is provided.
5. Since particulate emissions from diesel combustion are assumed to be less than 1.0 micrometer in diameter, PM, PM_{10}, and $PM_{2.5}$ emissions are assumed to be the same, as stated in note b to Table 3.3-1 of AP-42, Section 3.3, Final Section, dated October 1996.
6. Only AP-42 factors for pollutants noted as HAPs as defined by Section 112 of the Clean Air Act listed.
7. AP-42 factors marked as "less than" are omitted as emissions are assumed to be negligible.

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21. AREA 900 FUEL STORAGE

22. AREA 1000 STANDBY GENERATOR

Area 900 Fuel Storage

TANKS 4.0.9d, Storage Tank Emissions Calculation Software, October 3, 2005

Operating Parameters:

Operational hours per day	24	hours/day
Operational days per year	365	days/year
Number of Main Diesel Tanks	1	tanks
Capacity of Main Diesel tank	12,000	gallons
Number of Gasoline tanks	1	tanks
Capacity of each Gasoline tank	2,000	gallons
Amount of Diesel delivered	8,000	gal/2 weeks
Amount of Gasoline delivered	2,000	gal/2 weeks

Tank Calculations:

Supplied Diesel:	208,000	gal/year
Tanks per year	17	tanks/year

Supplied Gasoline:	52000	gal/year
Tanks per year	26	tanks/year

Emissions:

VOCs		**Uncontrolled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)
950-TKH-01	Diesel Main Tank	0.001	0.017	0.003
950-TKH-04	Gasoline Tank	0.09	2.10	0.38

Notes:
1. RVP-9 Gasoline used as the tank contents for the gasoline tank.
2. HAPs from the fuel storage tanks are considered negligible.

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Area 900 - Backup Generator

AP-42 Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines, Final Section, October 1996.

Operating Parameters:

Annual Operations[1]	100	hrs/yr
Maximum Fuel Consumption	147.3	gal/hr
Backup Generator Rated Power	2,000	kW
Backup Generator Rated Power	2682	hp

Source Parameters:

		Stack Parameters			
		Flow Rate	Diameter	Height	Temperature
Source ID	Emission Source	(cfm)	(in)	(ft)	(deg F)
1000-SG-01	Standby Generator	16,103	TBD	TBD	896

Emission Factors:

NO_x	0.024	lb/hp-hr	AP-42 Table 3.4-1
SO_2	4.45E-06	lb/hp-hr	AP-42 Table 3.4-1
CO	5.50E-03	lb/hp-hr	AP-42 Table 3.4-1
VOC	6.42E-04	lb/hp-hr	AP-42 Table 3.4-1
Total PM	0.0697	lb/hp-hr	AP-42 Table 3.4-2
Total PM_{10}	0.0573	lb/hp-hr	AP-42 Table 3.4-2
Total $PM_{2.5}$	0.0556	lb/hp-hr	AP-42 Table 3.4-2

S= 0.05%

Heating value of Diesel	19,300	Btu/lb	* AP-42 Table 3.4-1 footnote a
Density of Diesel	7.1	lb/gal	* AP-42 Table 3.4-1 footnote a

Emissions:

PM		**Uncontrolled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)
1000-SG-01	Standby Generator	186.94	373.87	9.35

PM_{10}		**Uncontrolled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)
1000-SG-01	Standby Generator	153.68	307.36	7.68

$PM_{2.5}$		**Uncontrolled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)
1000-SG-01	Standby Generator	149.12	298.24	7.46

NO_x		**Uncontrolled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)
1000-SG-01	Standby Generator	64.37	128.74	3.22

CO		**Uncontrolled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)
1000-SG-01	Standby Generator	14.75	29.50	0.74

SO_2		**Uncontrolled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)
1000-SG-01	Standby Generator	0.01	0.02	0.001

VOC		**Uncontrolled**		
Source ID	Emission Source	(lb/hr)	(lb/day)	(ton/yr)
1000-SG-01	Standby Generator	1.72	3.44	0.09

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Area 900 - Backup Generator

HAPs Emissions from Diesel Combustion

AP-42 Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines, Final Section, October 1996.

Operating Parameters:

Annual Operations	100	hrs/yr
Maximum Fuel Consumption	147.3	gal/hr
Rated Fire Pump Engine Power	2000	hp

Emission Factors:

HAP [6,7]	Emission Factor (lb/MMBtu)	Emission Factor (lb/gal)
Benzene	7.76E-04	1.06E-04
Toluene	2.81E-04	3.85E-05
Xylenes	1.93E-04	2.64E-05
Formaldehyde	7.89E-05	1.08E-05
Acetaldehyde	2.52E-05	3.45E-06
Acrolein	7.88E-06	1.08E-06
Naphthalene	1.30E-04	1.78E-05

Emissions:

HAP	(lb/hr)	(lb/day)	(ton/yr)
Benzene	1.57E-02	3.13E-02	7.83E-04
Toluene	5.67E-03	1.13E-02	2.84E-04
Xylenes	3.90E-03	7.79E-03	1.95E-04
Formaldehyde	1.59E-03	3.19E-03	7.96E-05
Acetaldehyde	5.09E-04	1.02E-03	2.54E-05
Acrolein	1.59E-04	3.18E-04	7.95E-06
Naphthalene	2.62E-03	5.25E-03	1.31E-04
Total	2.75E-02	6.02E-02	1.37E-03

Notes:

1. The backup generator will be limited to operation and maintenance testing of 100 hr/yr to comply with 40 CFR Part 60.4211(e). There is no time limit on the use during an emergency situation in 40 CFR Part 60 Subpart IIII.

2. The diesel fuel used for the backup generator is subject to 40 CFR Part 60.4207 which states limits on the sulfur content of the fuel. S=0.05%

3. The VOC EF is based on the non-methane portion of TOC emission factor (Table 3.4-1, note f) = 91 %

4. Total Particulate and total PM10 emission factors are from AP-42, Section 3.4 - Table 3.4-2. The PM2.5 emission factor will be the sum of filterable particulate <3 um plus the condensable particulate from the same table.

5. Daily emissions calculated based on a maximum operation time of 2 hr/day. However, the total annual operation time must still stay under 100 hr/year.

6. Only AP-42 factors for pollutants noted as HAPs as defined by Section 112 of the Clean Air Act listed.

7. AP-42 factors marked as "less than" are omitted as emissions are assumed to be negligible.

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