Statement of Basis

Permit to Construct No. P-2016.0033
Project ID 61734

Nu-West Industries, Inc. (Agrium) Rasmussen Valley Mine
Soda Springs, Idaho

Facility ID 029-00044

Proposed for Public Comment

DRAFT XX, 2016
Craig Woodruff
Permit Writer

The purpose of this Statement of Basis is to satisfy the requirements of IDAPA 58.01.01.et seq, Rules for the Control of Air Pollution in Idaho, for issuing air permits.

ACRONYMS, UNITS, AND CHEMICAL NOMENCLATURE

AAC	acceptable ambient concentrations
AACC	acceptable ambient concentrations for carcinogens
acfm	actual cubic feet per minute
ASTM	American Society for Testing and Materials
BMP	best management practices
Btu	British thermal units
CAA	Clean Air Act
CAS No.	Chemical Abstracts Service registry number
CFR	Code of Federal Regulations
CI	compression ignition
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	CO_2 equivalent emissions
DEQ	Department of Environmental Quality
dscf	dry standard cubic feet
EL	screening emission levels
EPA	U.S. Environmental Protection Agency
GHG	greenhouse gases
gph	gallons per hour
gr	grains (1 lb = 7,000 grains)
HAP	hazardous air pollutants
hp	horsepower
hr/yr	hours per consecutive 12 calendar month period
IDAPA	a numbering designation for all administrative rules in Idaho promulgated in accordance with the Idaho Administrative Procedures Act
lb/hr	pounds per hour
m	meters
mg/dscm	milligrams per dry standard cubic meter
MMBtu	million British thermal units
MMscf	million standard cubic feet
NAAQS	National Ambient Air Quality Standard
NESHAP	National Emission Standards for Hazardous Air Pollutants
NO_2	nitrogen dioxide
NO_X	nitrogen oxides
NSPS	New Source Performance Standards
PC	permit condition
PM	particulate matter
$PM_{2.5}$	particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers
PM_{10}	particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers
ppm	parts per million
PSD	Prevention of Significant Deterioration
PTC	permit to construct
PTE	potential to emit
PW	process weight rate
RICE	reciprocating internal combustion engines
Rules	*Rules for the Control of Air Pollution in Idaho*
scf	standard cubic feet
SCL	significant contribution limits
SIP	State Implementation Plan
SM	synthetic minor
SM80	synthetic minor facility with emissions greater than or equal to 80% of a major source threshold
SO_2	sulfur dioxide

SO_x	sulfur oxides
T/day	tons per calendar day
T/hr	tons per hour
T/yr	tons per consecutive 12 calendar month period
TAP	toxic air pollutants
ULSD	ultra-low sulfur diesel
U.S.C.	United States Code
VOC	volatile organic compounds
$\mu g/m^3$	micrograms per cubic meter

FACILITY INFORMATION

Description

Nu-West Industries, Inc., doing business as Agrium Conda Phosphate Operations (Agrium), has proposed to construct, operate, and reclaim a new open pit phosphate mine that will include external overburden and ore piles, haul roads, mining pits, and other ancillary facilities. Phosphate ore excavated from the mine will be processed off site at Agrium's Conda Phosphate Operations Fertilizer Manufacturing Plant Northeast of Soda Springs. The proposed location of the mine is on the southern end of Rasmussen Ridge in Caribou County approximately 18 miles Northeast of Soda Springs, Idaho.

Permitting History

This is the initial PTC for a new facility thus there is no permitting history.

Application Scope

This permit is the initial PTC for this facility. The Applicant has proposed to construct, operate, and reclaim an open pit phosphate mine.

Application Chronology

June 3, 2016	DEQ received an application and an application fee.
June 30 – July 15, 2016	DEQ provided an opportunity to request a public comment period on the application and proposed permitting action.
July 15, 2016	DEQ determined that the application was complete.
September 1, 2016	DEQ made available the draft permit and statement of basis for peer and regional office review.
September 7, 2016	DEQ made available the draft permit and statement of basis for applicant review.
Month Day – Month Day, Year	DEQ provided a public comment period on the proposed action.
October 3, 2016	DEQ received the permit processing fee.
Month Day, Year	DEQ issued the final permit and statement of basis.

TECHNICAL ANALYSIS

Emissions Units and Control Equipment

Table 1 EMISSIONS UNIT AND CONTROL EQUIPMENT INFORMATION

Source ID No.	Sources	Control Equipment	Emission Point ID No.
1	Drilling, blasting, screening, loading, unloading, and haul roads	Reasonable control	N/A
2	CI Ready Line Engine (or equivalent[a]): Manufacturer: John Deere Model: 4045HFG92 Manufacture Date: 2012 or newer Max. Brake Horsepower: 107 bhp Fuel: Diesel Fuel No. 2	None	Exit height: 5.69 ft (1.73 m) Exit diameter: 0.25 ft (0.08 m) Exit flow rate: 399 cfm Exit temperature: 835 °F (446 ºC)
3	CI Well Pump 1 Engine (or equivalent[a]): Manufacturer: John Deere Model: 4045HF285 Manufacture Date: 2012 or newer Max. Brake Horsepower: 113 bhp Fuel: Diesel Fuel No. 2	None	Exit height: 5.94 ft (1.81 m) Exit diameter: 0.375 ft (0.11 m) Exit flow rate: 674 cfm Exit temperature: 1094 °F (590 ºC)
4	CI Well Pump 2 Engine (or equivalent[a]): Manufacturer: Isuzu Model: 4LE2X Manufacture Date: 2013 or newer Max. Brake Horsepower: 65.7 bhp Fuel: Diesel Fuel No. 2	None	Exit height: 5.09 ft (1.55 m) Exit diameter: 0.2 ft (0.06 m) Exit flow rate: 237 cfm Exit temperature: 1078 °F (581 ºC)
5	CI Light Plant Engines (9 units) (or equivalent[a]): Manufacturer: Caterpillar Model: C1.5T Manufacture Date: 2013 or newer Max. Brake Horsepower: 24.7 bhp Fuel: Diesel Fuel No. 2	None	Exit height: 6.17 ft (1.88 m) Exit diameter: 0.125 ft (0.04 m) Exit flow rate: 127.1 cfm Exit temperature: 869 °F (465 ºC)

a) Or equivalent is defined as an engine whose emission factors and horsepower are less than or equal to what was supplied in the application and whose flow rate, exhaust temperature, and stack height are greater than or equal to what was provided in the application. An engine that meets all of these criteria would be considered an equivalent engine.

Emissions Inventories

Potential to Emit

IDAPA 58.01.01 defines Potential to Emit as the maximum capacity of a facility or stationary source to emit an air pollutant under its physical and operational design. Any physical or operational limitation on the capacity of the facility or source to emit an air pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored or processed, shall be treated as part of its design if the limitation or the effect it would have on emissions is state or federally enforceable. Secondary emissions do not count in determining the potential to emit of a facility or stationary source.

Using this definition of Potential to Emit an emission inventory was developed for the non-emergency engines and mining fugitive sources at the facility (see Appendix A) associated with this proposed project. Emissions estimates of criteria pollutant, GHG, HAP PTE were based on emission factors from AP-42, operation of 8,760 hours per year, and process information specific to the facility for this proposed project.

Uncontrolled Potential to Emit

Using the definition of Potential to Emit, uncontrolled Potential to Emit is then defined as the maximum capacity of a facility or stationary source to emit an air pollutant under its physical and operational design. Any physical or operational limitation on the capacity of the facility or source to emit an air pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored or processed, shall **not** be treated as part of its design **since** the limitation or the effect it would have on emissions **is not** state or federally enforceable.

The uncontrolled Potential to Emit is used to determine if a facility is a "Synthetic Minor" source of emissions. Synthetic Minor sources are facilities that have an uncontrolled Potential to Emit for regulated air pollutants or HAP above the applicable Major Source threshold without permit limits.

The following table presents the uncontrolled Potential to Emit for regulated air pollutants as submitted by the Applicant and verified by DEQ staff. See Appendix A for a detailed presentation of the calculations and the assumptions used to determine emissions for each emissions unit. For this mining operation uncontrolled Potential to Emit is based upon a worst-case for operation of the facility of 8,760 hr/yr (24 hr/day x 365 day/yr).

Table 2 UNCONTROLLED POTENTIAL TO EMIT FOR REGULATED AIR POLLUTANTS

Source	$PM_{10}/PM_{2.5}$	SO_2	NO_X	CO	VOC	CO_2e
	T/yr	T/yr	T/yr	T/yr	T/yr	T/yr
Point Sources						
CI Light Plant Engine 1	0.071	0.001	1.33	1.17	0.27	124
CI Light Plant Engine 2	0.071	0.001	1.33	1.17	0.27	124
CI Light Plant Engine 3	0.071	0.001	1.33	1.17	0.27	124
CI Light Plant Engine 4	0.071	0.001	1.33	1.17	0.27	124
CI Light Plant Engine 5	0.071	0.001	1.33	1.17	0.27	124
CI Light Plant Engine 6	0.071	0.001	1.33	1.17	0.27	124
CI Light Plant Engine 7	0.071	0.001	1.33	1.17	0.27	124
CI Light Plant Engine 8	0.071	0.001	1.33	1.17	0.27	124
CI Light Plant Engine 9	0.071	0.001	1.33	1.17	0.27	124
CI Well Pump 1 (Dust Suppression Well)	0.244	0.005	3.25	4.06	1.24	567
CI Well Pump 2 (Dust Suppression Well)	0.014	0.003	2.22	2.36	0.72	330
CI Ready Line Engine	0.015	0.005	0.31	3.84	0.15	537
Total, Point Sources	**0.91**	**0.02**	**17.75**	**20.79**	**4.54**	**2550.00**
Fugitive Sources						
Source	**$PM_{10}/PM_{2.5}$**	**SO_2**	**NO_X**	**CO**	**VOC**	**CO_2e**
	T/yr	**T/yr**	**T/yr**	**T/yr**	**T/yr**	**T/yr**
Drilling	1.9	N/A	N/A	N/A	N/A	N/A
Blasting and Explosives	0.085	0.39	3.3	13.0	N/A	N/A
Screening	0.13	N/A	N/A	N/A	N/A	N/A
Haul Road – Pit to Overburden Pile	180	N/A	N/A	N/A	N/A	N/A
Haul Road – Pit to Ore Stockpile/Lease Boundary	180	N/A	N/A	N/A	N/A	N/A
Ore Loading at Pit	0.09	N/A	N/A	N/A	N/A	N/A
Ore Unloading at Pile	0.09	N/A	N/A	N/A	N/A	N/A
Ore Loading at Pile	0.09	N/A	N/A	N/A	N/A	N/A
Overburden Loading at Pit	0.33	N/A	N/A	N/A	N/A	N/A
Overburden Unloading at Pile	0.33	N/A	N/A	N/A	N/A	N/A
Overburden Loading at Pile	0.27	N/A	N/A	N/A	N/A	N/A
Overburden Loading Pit Refill	0.27	N/A	N/A	N/A	N/A	N/A
Wind Erosion – Growth Media and Overburden Piles	0.01	N/A	N/A	N/A	N/A	N/A
Wind Erosion – Ore Stock Piles	0.00	N/A	N/A	N/A	N/A	N/A
Total, Fugitive Sources	**363.60**	**0.39**	**3.30**	**13.00**	**0.00**	**0.00**

The following table presents the uncontrolled Potential to Emit for HAP pollutants as submitted by the Applicant and verified by DEQ staff. See Appendix A for a detailed presentation of the calculations and the assumptions used to determine emissions for each emissions unit. For this mining operation uncontrolled Potential to Emit is based upon a worst-case for operation of the facility of 8,760 hr/yr (24 hr/day x 365 day/yr). Then, the worst-case maximum HAP Potential to Emit was determined for the combustion sources.

Table 3 UNCONTROLLED POTENTIAL TO EMIT FOR HAZARDOUS AIR POLLUTANTS

Hazardous Air Pollutants	PTE (T/yr)
Benzene	0.0145
Toluene	0.00637
Xylene	0.00444
Formaldehyde	0.0184
Acetaldehyde	0.0119
Acrolein	0.00144
Naphthalene	0.00132
1,3-Butadiene	0.000609
PAH	0.0013
Total	**0.06**

Pre-Project Potential to Emit

Pre-project Potential to Emit is used to establish the change in emissions at a facility as a result of this project.

This is a new facility. Therefore, pre-project emissions are set to zero for all criteria pollutants.

Post Project Potential to Emit

Post project Potential to Emit is used to establish the change in emissions at a facility and to determine the facility's classification as a result of this project. Post project Potential to Emit includes all permit limits resulting from this project.

The following table presents the post project Potential to Emit for criteria and GHG pollutants from all emissions units at the facility as determined by DEQ staff. See Appendix A for a detailed presentation of the calculations of these emissions for each emissions unit.

Table 4 POST PROJECT POTENTIAL TO EMIT FOR REGULATED AIR POLLUTANTS

Source	$PM_{10}/PM_{2.5}$		SO_2		NO_X		CO		VOC		CO_2e
	lb/hr[a]	T/yr[b]	lb/hr[a]	T/yr[b]	lb/hr[a]	T/yr[b]	lb/hr[a]	T/yr[b]	lb/hr[a]	T/yr[b]	T/yr[b]
CI Light Plant Engine 1	0.016	0.071	0.00	0.001	0.30	1.33	0.27	1.17	0.06	0.27	124
CI Light Plant Engine 2	0.016	0.071	0.00	0.001	0.30	1.33	0.27	1.17	0.06	0.27	124
CI Light Plant Engine 3	0.016	0.071	0.00	0.001	0.30	1.33	0.27	1.17	0.06	0.27	124
CI Light Plant Engine 4	0.016	0.071	0.00	0.001	0.30	1.33	0.27	1.17	0.06	0.27	124
CI Light Plant Engine 5	0.016	0.071	0.00	0.001	0.30	1.33	0.27	1.17	0.06	0.27	124
CI Light Plant Engine 6	0.016	0.071	0.00	0.001	0.30	1.33	0.27	1.17	0.06	0.27	124
CI Light Plant Engine 7	0.016	0.071	0.00	0.001	0.30	1.33	0.27	1.17	0.06	0.27	124
CI Light Plant Engine 8	0.016	0.071	0.00	0.001	0.30	1.33	0.27	1.17	0.06	0.27	124
CI Light Plant Engine 9	0.016	0.071	0.00	0.001	0.30	1.33	0.27	1.17	0.06	0.27	124
CI Well Pump 1 (Dust Suppression Well)	0.056	0.244	0.001	0.005	0.74	3.25	0.93	4.06	0.28	1.24	567
CI Well Pump 2 (Dust Suppression Well)	0.003	0.014	0.001	0.003	0.51	2.22	0.54	2.36	0.17	0.72	330
CI Ready Line Engine	0.004	0.015	0.001	0.005	0.07	0.31	0.88	3.84	0.03	0.15	537
Total, Point Sources	**0.21**	**0.91**	**0.00**	**0.02**	**4.02**	**17.75**	**4.78**	**20.79**	**1.02**	**4.54**	**2550.00**
Fugitive Sources											
Drilling	0.07	0.30	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Blasting and Explosives	0.02	0.09	0.09	0.39	0.75	3.30	2.97	13.01	N/A	N/A	N/A
Screening	0.01	0.01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Haul Road – Pit to Overburden Pile	4.12	18.03	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Haul Road – Pit to Ore Stockpile/Lease Boundary	4.12	18.03	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ore Loading at Pit	0.02	0.09	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ore Unloading at Pile	0.02	0.09	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ore Loading at Pile	0.02	0.09	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Overburden Loading at Pit	0.07	0.33	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Overburden Unloading at Pile	0.07	0.33	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Overburden Loading at Pile	0.06	0.27	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Overburden Loading Pit Refill	0.06	0.27	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Wind Erosion – Growth Media and Overburden Piles	0.00	0.01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Wind Erosion – Ore Stock Piles	0.00	0.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Post Project Totals	**8.66**	**37.94**	**0.09**	**0.39**	**0.75**	**3.30**	**2.97**	**13.01**	**0.00**	**0.00**	**0.00**

b) Controlled average emission rate in pounds per hour is a daily average, based on the proposed daily operating schedule and daily limits.
c) Controlled average emission rate in tons per year is an annual average, based on the proposed annual operating schedule and annual limits.

Change in Potential to Emit

The change in facility-wide potential to emit is used to determine if a public comment period may be required and to determine the processing fee per IDAPA 58.01.01.225. The following table presents the facility-wide change in the potential to emit for criteria pollutants.

Table 5 CHANGES IN POTENTIAL TO EMIT FOR REGULATED AIR POLLUTANTS

Source	$PM_{10}/PM_{2.5}$		SO_2		NO_X		CO		VOC		CO_2e
	lb/hr	T/yr	lb/hr	T/yr	lb/hr	T/yr	lb/hr	T/yr	lb/hr	T/yr	T/yr
Pre-Project Potential to Emit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Post Project Potential to Emit	0.21	0.91	0.00	0.02	4.02	17.75	4.78	20.79	1.02	4.54	2550.00
Changes in Potential to Emit	**0.21**	**0.91**	**0.00**	**0.02**	**4.02**	**17.75**	**4.78**	**20.79**	**1.02**	**4.54**	**2550.0**

Non-Carcinogenic TAP Emissions

A summary of the estimated PTE for emissions increase of non-carcinogenic toxic air pollutants (TAP) is provided in the following table.

Pre- and post-project, as well as the change in, non-carcinogenic TAP emissions are presented in the following table:

Table 6 PRE- AND POST PROJECT POTENTIAL TO EMIT FOR NON-CARCINOGENIC TOXIC AIR POLLUTANTS

Non-Carcinogenic Toxic Air Pollutants	Pre-Project 24-hour Average Emissions Rates for Units at the Facility (lb/hr)	Post Project 24-hour Average Emissions Rates for Units at the Facility (lb/hr)	Change in 24-hour Average Emissions Rates for Units at the Facility (lb/hr)	Non-Carcinogenic Screening Emission Level (lb/hr)	Exceeds Screening Level? (Y/N)
Aluminum	0.00E-03	6.58E-02	0.0658	0.667	No
Antimony	0.00E-03	5.29E-06	0.0000	0.033	No
Chromium	0.00E-03	8.06E-04	0.0008	0.033	No
Cobalt	0.00E-03	1.73E-04	0.0002	0.033	No
Copper	0.00E-03	1.91E-04	0.0002	0.067	No
Iron	**0.00E-03**	**7.87E-02**	**0.0787**	**0.067**	**Yes**
Manganese	0.00E-03	1.88E-03	0.0019	0.333	No
Molybdenum	0.00E-03	2.68E-05	0.0000	0.333	No
Selenium	0.00E-03	4.58E-05	0.0000	0.013	No
Silver	0.00E-03	3.79E-06	0.0000	0.007	No
Tungsten	0.00E-03	8.67E-06	0.0000	0.067	No
Uranium	0.00E-03	7.22E-05	0.0001	0.013	No
Zirconium	0.00E-03	1.45E-03	0.0015	0.333	No
Zinc	0.00E-03	2.35E-03	0.0024	0.667	No

Some of the PTEs for non-carcinogenic TAP were exceeded as a result of this project. Therefore, modeling is required for iron because the 24-hour average non-carcinogenic screening ELs identified in IDAPA 58.01.01.586 were exceeded.

Carcinogenic TAP Emissions

A summary of the estimated PTE for emissions increase of carcinogenic toxic air pollutants (TAP) is provided in the following table.

Pre- and post-project, as well as the change in, carcinogenic TAP emissions are presented in the following table:

Table 7 PRE- AND POST PROJECT POTENTIAL TO EMIT FOR CARCINOGENIC TOXIC AIR POLLUTANTS

Carcinogenic Toxic Air Pollutants	Pre-Project Annual Average Emissions Rates for Units at the Facility (lb/hr)	Post Project Annual Average Emissions Rates for Units at the Facility (lb/hr)	Change in Annual Average Emissions Rates for Units at the Facility (lb/hr)	Carcinogenic Screening Emission Level (lb/hr)	Exceeds Screening Level? (Y/N)
Arsenic	**0.00E-03**	**4.47E-05**	**0.0000**	**1.50E-06**	**Yes**
Beryllium	0.00E-03	4.83E-06	0.0000	2.80E-05	No
Cadmium	**0.00E-03**	**8.38E-05**	**0.0001**	**3.70E-06**	**Yes**
Nickel	**0.00E-03**	**4.29E-04**	**0.0004**	**2.70E-05**	**Yes**

Some of the PTEs for carcinogenic TAP were exceeded as a result of this project. Therefore, modeling is required for arsenic, cadmium, and nickel because the annual average carcinogenic screening ELs identified in IDAPA 58.01.01.586 were exceeded.

Post Project HAP Emissions

The following table presents the post project potential to emit for HAP pollutants from all the combustion sources as submitted by the Applicant and verified by DEQ staff. See Appendix A for a detailed presentation of the calculations of these emissions for each emissions unit.

Table 8 HAZARDOUS AIR POLLUTANTS EMISSIONS POTENTIAL TO EMIT SUMMARY

Hazardous Air Pollutants	PTE (lb/hr)	PTE (T/yr)
Benzene	3.32E-03	0.01
Toluene	1.45E-03	0.01
Xylenes	1.01E-03	0.00
Formaldehyde	4.20E-03	0.02
Acetaldehyde	2.73E-03	0.01
Acrolein	3.29E-04	0.00
Naphthalene	3.02E-04	0.00
1,3-Butadiene	1.39E-04	0.00
PAH	2.96E-04	0.00
Totals	**0.01**	**0.05**

Ambient Air Quality Impact Analyses

As presented in the Modeling Memo in Appendix B, the estimated emission rates of PM_{10}, $PM_{2.5}$, SO_2, NO_X, CO, VOC, and TAP from this project were below applicable screening emission levels (EL) and published DEQ modeling thresholds established in IDAPA 58.01.01.585-586 and in the State of Idaho Air Quality Modeling Guideline[1]. Refer to the Emissions Inventories section for additional information concerning the emission inventories.

The applicant has demonstrated pre-construction compliance to DEQ's satisfaction that emissions from this facility will not cause or significantly contribute to a violation of any ambient air quality standard. The applicant has also demonstrated pre-construction compliance to DEQ's satisfaction that the emissions increase due to this permitting action will not exceed any acceptable ambient concentration (AAC) or acceptable ambient concentration for carcinogens (AACC) for toxic air pollutants (TAP). A summary of the Ambient Air Impact Analysis for TAP is provided in Appendix A.

An ambient air quality impact analyses document has been crafted by DEQ based on a review of the modeling analysis submitted in the application. That document is part of the final permit package for this permitting action (see Appendix B).

REGULATORY ANALYSIS

Attainment Designation (40 CFR 81.313)

The facility is located in Caribou County, which is designated as attainment or unclassifiable for $PM_{2.5}$, PM_{10}, SO_2, NO_2, CO, and Ozone. Refer to 40 CFR 81.313 for additional information.

Facility Classification

The AIRS/AFS facility classification codes are as follows:

For THAPs (Total Hazardous Air Pollutants) Only:

A = Use when any one HAP has actual or potential emissions $\geq$ 10 T/yr or if the aggregate of all HAPS (Total HAPs) has actual or potential emissions $\geq$ 25 T/yr.

1 Criteria pollutant thresholds in Table 2, State of Idaho Guideline for Performing Air Quality Impact Analyses, Doc ID AQ-011, September 2013.

SM80 = Use if a synthetic minor (potential emissions fall below applicable major source thresholds if and only if the source complies with federally enforceable limitations) and the permit sets limits ≥ 8 T/yr of a single HAP or ≥ 20 T/yr of THAP.

SM = Use if a synthetic minor (potential emissions fall below applicable major source thresholds if and only if the source complies with federally enforceable limitations) and the potential HAP emissions are limited to < 8 T/yr of a single HAP and/or < 20 T/yr of THAP.

B = Use when the potential to emit without permit restrictions is below the 10 and 25 T/yr major source threshold

UNK = Class is unknown

For All Other Pollutants:

A = Actual or potential emissions of a pollutant are ≥ 100 T/yr.

SM80 = Use if a synthetic minor for the applicable pollutant (potential emissions fall below 100 T/yr if and only if the source complies with federally enforceable limitations) and potential emissions of the pollutant are ≥ 80 T/yr.

SM = Use if a synthetic minor for the applicable pollutant (potential emissions fall below 100 T/yr if and only if the source complies with federally enforceable limitations) and potential emissions of the pollutant are < 80 T/yr.

B = Actual and potential emissions are < 100 T/yr without permit restrictions.

UNK = Class is unknown.

Table 9 REGULATED AIR POLLUTANT FACILITY CLASSIFICATION

Pollutant	Uncontrolled PTE (T/yr)	Permitted PTE (T/yr)	Major Source Thresholds (T/yr)	AIRS/AFS Classification
PM	0.91	0.91	**100**	B
$PM_{10}/PM_{2.5}$	0.91	0.91	**100**	B
SO_2	0.02	0.02	**100**	B
NO_X	17.75	17.75	**100**	B
CO	20.79	20.79	**100**	B
VOC	4.54	4.54	**100**	B
HAP (single)	0.02	0.02	**10**	B
HAP (Total)	0.06	0.06	**25**	B

Permit to Construct (IDAPA 58.01.01.201)

IDAPA 58.01.01.201... Permit to Construct Required

The permittee has requested that a PTC be issued to the facility for the open pit phosphate mine and associated emission sources. Therefore, a permit to construct is required to be issued in accordance with IDAPA 58.01.01.220. This permitting action was processed in accordance with the procedures of IDAPA 58.01.01.200-228.

Tier II Operating Permit (IDAPA 58.01.01.401)

IDAPA 58.01.01.401... Tier II Operating Permit

The application was submitted for a permit to construct (refer to the Permit to Construct section), and an optional Tier II operating permit has not been requested. Therefore, the procedures of IDAPA 58.01.01.400–410 were not applicable to this permitting action.

Rules for Control of Fugitive Dust Emissions (IDAPA 58.01.01.650-651)

IDAPA 58.01.01.650-651.................................... Rules for Control of Fugitive Dust

All sources of fugitive dust emissions at the facility are subject to the State of Idaho rules for controlling fugitive dust. Reasonable precautions shall be taken to prevent particulate matter from becoming airborne. This requirement is assured by Permit Conditions 2.4, 2.5, 2.6, 2.7, and 2.8.

Fuel Sulfur Content (IDAPA 58.01.01.725)

IDAPA 58.01.01.725.. Rules for Sulfur Content of Fuels

The permittee shall comply with the requirements of IDAPA 58.01.01.725. The permittee shall maintain documentation of supplier verification of distillate fuel oil sulfur content on an as-received basis. This requirement is assured by permit condition 3.5. The facility is subject to 40 CFR 60, Subpart IIII which requires all fuel combusted to have a maximum fuel sulfur content of 15 parts per million by weight.

Visible Emissions (IDAPA 58.01.01.625)

IDAPA 58.01.01.625.. Visible Emissions

The sources of PM_{10} emissions at this facility are subject to the State of Idaho visible emissions standard of 20% opacity. This requirement is assured by Permit Conditions 2.2 and 2.3.

Particulate Matter – New Equipment Process Weight Limitations (IDAPA 58.01.01.701)

IDAPA 58.01.01.701.. Particulate Matter – New Equipment Process Weight Limitations

IDAPA 58.01.01.700 through 703 set PM emission limits for process equipment based on when the piece of equipment commenced operation and the piece of equipment’s process weight (PW) in pounds per hour (lb/hr). IDAPA 58.01.01.701 and IDAPA 58.01.01.702 establish PM emission limits for equipment that commenced operation on or after October 1, 1979 and for equipment operating prior to October 1, 1979, respectively.

For equipment that commenced operation on or after October 1, 1979, the PM allowable emission rate (E) is based on one of the following four equations:

IDAPA 58.01.01.701.01.a: If PW is $< 9{,}250$ lb/hr; $E = 0.045\ (PW)^{0.60}$

IDAPA 58.01.01.701.01.b: If PW is $\geq 9{,}250$ lb/hr; $E = 1.10\ (PW)^{0.25}$

For equipment that commenced prior to October 1, 1979, the PM allowable emission rate is based on one of the following equations:

IDAPA 58.01.01.702.01.a: If PW is $< 17{,}000$ lb/hr; $E = 0.045\ (PW)^{0.60}$

IDAPA 58.01.01.702.01.b: If PW is $\geq 17{,}000$ lb/hr; $E = 1.12\ (PW)^{0.27}$

For the new screening emissions unit proposed to be installed as a result of this project with a proposed throughput of 30,000 T/yr, E is calculated as follows:

Proposed throughput = 30,000 T/yr x 1 yr/8,760 hr x 2,000 lb/1 T = 6,849 lb/hr

Therefore, E is calculated as:

$E = 0.045 \times PW^{0.60} = 0.045 \times (6{,}849)^{0.60} = 9.01$ lb-PM/hr

As presented previously in the Emissions Inventories Section of this evaluation the post project PTE for this emissions unit is 0.01 lb-PM_{10}/hr. Assuming PM is 50% PM_{10} means that PM emissions will be 0.02 lb-PM/hr (0.01 lb-PM_{10}/hr ÷ 0.5 lb-PM_{10}/lb-PM). Therefore, compliance with this requirement has been demonstrated.

Many of the operations at the mine do not have a throughput that is usable for this calculation. This demonstration shows that for the processes at the mine that have a throughput limitation, compliance is shown.

Title V Classification (IDAPA 58.01.01.300, 40 CFR Part 70)

IDAPA 58.01.01.301 .... Requirement to Obtain Tier I Operating Permit

Post project facility-wide emissions from this facility do not have a potential to emit greater than 100 tons per year for PM_{10}, SO_2, NO_X, CO, and VOC or 10 tons per year for any one HAP or 25 tons per year for all HAP combined as demonstrated previously in the Emissions Inventories Section of this analysis. Therefore, the facility is not a Tier I source in accordance with IDAPA 58.01.01.006 and the requirements of IDAPA 58.01.01.301 do not apply.

PSD Classification (40 CFR 52.21)

40 CFR 52.21 .... Prevention of Significant Deterioration of Air Quality

The facility is not a major stationary source as defined in 40 CFR 52.21(b)(1), nor is it undergoing any physical change at a stationary source not otherwise qualifying under paragraph 40 CFR 52.21(b)(1) as a major stationary source, that would constitute a major stationary source by itself as defined in 40 CFR 52. Therefore in accordance with 40 CFR 52.21(a)(2), PSD requirements are not applicable to this permitting action. The facility is/is not a designated facility as defined in 40 CFR 52.21(b)(1)(i)(a), and does not have facility-wide emissions of any criteria pollutant that exceed 250 T/yr.

NSPS Applicability (40 CFR 60)

Because the facility has 12 compression ignition engines the following NSPS requirements may apply to this facility:

- 40 CFR 60, Subpart IIII - Standards of Performance for Stationary Compression Ignition Internal Combustion Engines. DEQ is delegated this Subpart.

The applicable parts are highlighted in yellow.

40 CFR 60, Subpart IIII....................................... Standards of Performance for Stationary Compression Ignition Internal Combustion Engines

§ 60.4200 .... Am I subject to this subpart?

(a) The provisions of this subpart are applicable to manufacturers, owners, and operators of stationary compression ignition (CI) internal combustion engines (ICE) and other persons as specified in paragraphs (a)(1) through (4) of this section. For the purposes of this subpart, the date that construction commences is the date the engine is ordered by the owner or operator.

(1) Manufacturers of stationary CI ICE with a displacement of less than 30 liters per cylinder where the model year is:

(i) 2007 or later, for engines that are not fire pump engines;

(ii) The model year listed in Table 3 to this subpart or later model year, for fire pump engines.

(2) Owners and operators of stationary CI ICE that commence construction after July 11, 2005, where the stationary CI ICE are:

(i) Manufactured after April 1, 2006, and are not fire pump engines, or

(ii) Manufactured as a certified National Fire Protection Association (NFPA) fire pump engine after July 1, 2006.

(3) Owners and operators of any stationary CI ICE that are modified or reconstructed after July 11, 2005 and any person that modifies or reconstructs any stationary CI ICE after July 11, 2005.

(4) The provisions of §60.4208 of this subpart are applicable to all owners and operators of stationary CI ICE that commence construction after July 11, 2005.

(b) The provisions of this subpart are not applicable to stationary CI ICE being tested at a stationary CI ICE test cell/stand.

(c) If you are an owner or operator of an area source subject to this subpart, you are exempt from the obligation to obtain a permit under 40 CFR part 70 or 40 CFR part 71, provided you are not required to obtain a permit under 40 CFR 70.3(a) or 40 CFR 71.3(a) for a reason other than your status as an area source under this subpart. Notwithstanding the previous sentence, you must continue to comply with the provisions of this subpart applicable to area sources.

(d) Stationary CI ICE may be eligible for exemption from the requirements of this subpart as described in 40 CFR part 1068, subpart C (or the exemptions described in 40 CFR part 89, subpart J and 40 CFR part 94, subpart J, for engines that would need to be certified to standards in those parts), except that owners and operators, as well as manufacturers, may be eligible to request an exemption for national security.

(e) Owners and operators of facilities with CI ICE that are acting as temporary replacement units and that are located at a stationary source for less than 1 year and that have been properly certified as meeting the standards that would be applicable to such engine under the appropriate nonroad engine provisions, are not required to meet any other provisions under this subpart with regard to such engines.

§ 60.4201 .... What emission standards must I meet for non-emergency engines if I am a stationary CI internal combustion engine manufacturer?

(a) Stationary CI internal combustion engine manufacturers must certify their 2007 model year and later non-emergency stationary CI ICE with a maximum engine power less than or equal to 2,237 kilowatt (KW) (3,000 horsepower (HP)) and a displacement of less than 10 liters per cylinder to the certification emission standards for new nonroad CI engines in 40 CFR 89.112, 40 CFR 89.113, 40 CFR 1039.101, 40 CFR 1039.102, 40 CFR 1039.104, 40 CFR 1039.105, 40 CFR 1039.107, and 40 CFR 1039.115, as applicable, for all pollutants, for the same model year and maximum engine power.

Nu-West Industries Rasmussen Valley Mine is not directly subject to §60.4201(a) but as outlined later in §60.4204(b) the engines used at the facility must be certified to be in compliance with the emission standards outlined in the applicable subparts as listed in §60.4201(a).

(b) Stationary CI internal combustion engine manufacturers must certify their 2007 through 2010 model year non-emergency stationary CI ICE with a maximum engine power greater than 2,237 KW (3,000 HP) and a displacement of less than 10 liters per cylinder to the emission standards in table 1 to this subpart, for all pollutants, for the same maximum engine power.

(c) Stationary CI internal combustion engine manufacturers must certify their 2011 model year and later non-emergency stationary CI ICE with a maximum engine power greater than 2,237 KW (3,000 HP) and a displacement of less than 10 liters per cylinder to the certification emission standards for new nonroad CI engines in 40 CFR 1039.101, 40 CFR 1039.102, 40 CFR 1039.104, 40 CFR 1039.105, 40 CFR 1039.107, and 40 CFR 1039.115, as applicable, for all pollutants, for the same maximum engine power.

(d) Stationary CI internal combustion engine manufacturers must certify the following non-emergency stationary CI ICE to the certification emission standards for new marine CI engines in 40 CFR 94.8, as applicable, for all pollutants, for the same displacement and maximum engine power:

(1) Their 2007 model year through 2012 non-emergency stationary CI ICE with a displacement of greater than or equal to 10 liters per cylinder and less than 30 liters per cylinder;

(2) Their 2013 model year non-emergency stationary CI ICE with a maximum engine power greater than or equal to 3,700 KW (4,958 HP) and a displacement of greater than or equal to 10 liters per cylinder and less than 15 liters per cylinder; and

(3) Their 2013 model year non-emergency stationary CI ICE with a displacement of greater than or equal to 15 liters per cylinder and less than 30 liters per cylinder.

(e) Stationary CI internal combustion engine manufacturers must certify the following non-emergency stationary CI ICE to the certification emission standards and other requirements for new marine CI engines in 40 CFR 1042.101, 40 CFR 1042.107, 40 CFR 1042.110, 40 CFR 1042.115, 40 CFR 1042.120, and 40 CFR

1042.145, as applicable, for all pollutants, for the same displacement and maximum engine power:

(1) Their 2013 model year non-emergency stationary CI ICE with a maximum engine power less than 3,700 KW (4,958 HP) and a displacement of greater than or equal to 10 liters per cylinder and less than 15 liters per cylinder; and

(2) Their 2014 model year and later non-emergency stationary CI ICE with a displacement of greater than or equal to 10 liters per cylinder and less than 30 liters per cylinder.

(f) Notwithstanding the requirements in paragraphs (a) through (c) of this section, stationary non-emergency CI ICE identified in paragraphs (a) and (c) may be certified to the provisions of 40 CFR part 94 or, if Table 1 to 40 CFR 1042.1 identifies 40 CFR part 1042 as being applicable, 40 CFR part 1042, if the engines will be used solely in either or both of the following locations:

(1) Areas of Alaska not accessible by the Federal Aid Highway System (FAHS); and

(2) Marine offshore installations.

(g) Notwithstanding the requirements in paragraphs (a) through (f) of this section, stationary CI internal combustion engine manufacturers are not required to certify reconstructed engines; however manufacturers may elect to do so. The reconstructed engine must be certified to the emission standards specified in paragraphs (a) through (e) of this section that are applicable to the model year, maximum engine power, and displacement of the reconstructed stationary CI ICE.

§ 60.4202 .... What emission standards must I meet for emergency engines if I am a stationary CI internal combustion engine manufacturer?

Nu-West Industries Rasmussen Valley Mine is does not operate emergency engines subject to this subpart. Therefore §60.4202 is not applicable.

§ 60.4203 .... How long must my engines meet the emission standards if I am a manufacturer of stationary CI internal combustion engines?

Engines manufactured by stationary CI internal combustion engine manufacturers must meet the emission standards as required in §§60.4201 and 60.4202 during the certified emissions life of the engines.

Nu-West Industries Rasmussen Valley Mine does not manufacture stationary CI internal combustion engines. Therefore, §60.4203 is not applicable.

§ 60.4204 .... What emission standards must I meet for non-emergency engines if I am an owner or operator of a stationary CI internal combustion engine?

(a) Owners and operators of pre-2007 model year non-emergency stationary CI ICE with a displacement of less than 10 liters per cylinder must comply with the emission standards in table 1 to this subpart. Owners and operators of pre-2007 model year non-emergency stationary CI ICE with a displacement of greater than or equal to 10 liters per cylinder and less than 30 liters per cylinder must comply with the emission standards in 40 CFR 94.8(a)(1).

(b) Owners and operators of 2007 model year and later non-emergency stationary CI ICE with a displacement of less than 30 liters per cylinder must comply with the emission standards for new CI engines in §60.4201 for their 2007 model year and later stationary CI ICE, as applicable.

Nu-West Industries Rasmussen Valley Mine operates CI internal combustion engines with a displacement of less than 30 liters per cylinder. Therefore, §60.4204(b) is applicable and is assured by permit condition 3.1.

(c) Owners and operators of non-emergency stationary CI engines with a displacement of greater than or equal to 30 liters per cylinder must meet the following requirements:

(1) For engines installed prior to January 1, 2012, limit the emissions of NOX in the stationary CI internal combustion engine exhaust to the following:

(i) 17.0 grams per kilowatt-hour (g/KW-hr) (12.7 grams per horsepower-hr (g/HP-hr)) when maximum engine speed is less than 130 revolutions per minute (rpm);

(ii) 45 · $n^{-0.2}$ g/KW-hr (34 · $n^{-0.2}$ g/HP-hr) when maximum engine speed is 130 or more but less than 2,000 rpm, where n is maximum engine speed; and

(iii) 9.8 g/KW-hr (7.3 g/HP-hr) when maximum engine speed is 2,000 rpm or more.

(2) For engines installed on or after January 1, 2012 and before January 1, 2016, limit the emissions of NOX in the stationary CI internal combustion engine exhaust to the following:

(i) 14.4 g/KW-hr (10.7 g/HP-hr) when maximum engine speed is less than 130 rpm;

(ii) 44 · $n^{-0.23}$ g/KW-hr (33 · $n^{-0.23}$ g/HP-hr) when maximum engine speed is greater than or equal to 130 but less than 2,000 rpm and where n is maximum engine speed; and

(iii) 7.7 g/KW-hr (5.7 g/HP-hr) when maximum engine speed is greater than or equal to 2,000 rpm.

(3) For engines installed on or after January 1, 2016, limit the emissions of NOX in the stationary CI internal combustion engine exhaust to the following:

(i) 3.4 g/KW-hr (2.5 g/HP-hr) when maximum engine speed is less than 130 rpm;

(ii) 9.0 · $n^{-0.20}$ g/KW-hr (6.7 · $n^{-0.20}$ g/HP-hr) where n (maximum engine speed) is 130 or more but less than 2,000 rpm; and

(iii) 2.0 g/KW-hr (1.5 g/HP-hr) where maximum engine speed is greater than or equal to 2,000 rpm.

(4) Reduce particulate matter (PM) emissions by 60 percent or more, or limit the emissions of PM in the stationary CI internal combustion engine exhaust to 0.15 g/KW-hr (0.11 g/HP-hr).

(d) Owners and operators of non-emergency stationary CI ICE with a displacement of less than 30 liters per cylinder who conduct performance tests in-use must meet the not-to-exceed (NTE) standards as indicated in §60.4212.

(e) Owners and operators of any modified or reconstructed non-emergency stationary CI ICE subject to this subpart must meet the emission standards applicable to the model year, maximum engine power, and displacement of the modified or reconstructed non-emergency stationary CI ICE that are specified in paragraphs (a) through (d) of this section.

§ 60.4205 .... What emission standards must I meet for emergency engines if I am an owner or operator of a stationary CI internal combustion engine?

Nu-West Industries Rasmussen Valley Mine does not operate emergency engines subject to this subpart. §60.4206 is not applicable.

§ 60.4206 .... How long must I meet the emission standards if I am an owner or operator of a stationary CI internal combustion engine?

Owners and operators of stationary CI ICE must operate and maintain stationary CI ICE that achieve the emission standards as required in §§60.4204 and 60.4205 over the entire life of the engine.

Nu-West Industries Rasmussen Valley Mine owns and operates CI internal combustion engines and §60.4206 is applicable. This is assured by permit condition 3.3.

§ 60.4207 .... What fuel requirements must I meet if I am an owner or operator of a stationary CI internal combustion engine subject to this subpart?

(a) Beginning October 1, 2007, owners and operators of stationary CI ICE subject to this subpart that use diesel fuel must use diesel fuel that meets the requirements of 40 CFR 80.510(a).

(b) Beginning October 1, 2010, owners and operators of stationary CI ICE subject to this subpart with a displacement of less than 30 liters per cylinder that use diesel fuel must use diesel fuel that meets the requirements of 40 CFR 80.510(b) for nonroad diesel fuel, except that any existing diesel fuel purchased (or otherwise obtained) prior to October 1, 2010, may be used until depleted.

(c) [Reserved]

(d) Beginning June 1, 2012, owners and operators of stationary CI ICE subject to this subpart with a displacement of greater than or equal to 30 liters per cylinder are no longer subject to the requirements of paragraph (a) of this section, and must use fuel that meets a maximum per-gallon sulfur content of 1,000 parts per million (ppm).

(e) Stationary CI ICE that have a national security exemption under §60.4200(d) are also exempt from the fuel requirements in this section.

Nu-West Industries Rasmussen Valley Mine operates CI internal combustion engines with a displacement of less than 30 liters per cylinder. Therefore §60.4207(b) is applicable and is assured by permit condition 3.5.

§ 60.4208 .... What is the deadline for importing or installing stationary CI ICE produced in previous model years?

(a) After December 31, 2008, owners and operators may not install stationary CI ICE (excluding fire pump engines) that do not meet the applicable requirements for 2007 model year engines.

(b) After December 31, 2009, owners and operators may not install stationary CI ICE with a maximum engine power of less than 19 KW (25 HP) (excluding fire pump engines) that do not meet the applicable requirements for 2008 model year engines.

(c) After December 31, 2014, owners and operators may not install non-emergency stationary CI ICE with a maximum engine power of greater than or equal to 19 KW (25 HP) and less than 56 KW (75 HP) that do not meet the applicable requirements for 2013 model year non-emergency engines.

(d) After December 31, 2013, owners and operators may not install non-emergency stationary CI ICE with a maximum engine power of greater than or equal to 56 KW (75 HP) and less than 130 KW (175 HP) that do not meet the applicable requirements for 2012 model year non-emergency engines.

Nu-West Industries Rasmussen Valley Mine is installing 12 CI internal combustion engines. Nine of those engines are rated at 24.1 bhp, two are rated at greater than 100 bhp, and one is rated at greater than 25 bhp and less than 75 bhp. Therefore §60.4208 (b), (c), and (d) are applicable. This is assured by permit condition 3.1.

(e) After December 31, 2012, owners and operators may not install non-emergency stationary CI ICE with a maximum engine power of greater than or equal to 130 KW (175 HP), including those above 560 KW (750 HP), that do not meet the applicable requirements for 2011 model year non-emergency engines.

(f) After December 31, 2016, owners and operators may not install non-emergency stationary CI ICE with a maximum engine power of greater than or equal to 560 KW (750 HP) that do not meet the applicable requirements for 2015 model year non-emergency engines.

(g) After December 31, 2018, owners and operators may not install non-emergency stationary CI ICE with a maximum engine power greater than or equal to 600 KW (804 HP) and less than 2,000 KW (2,680 HP) and a displacement of greater than or equal to 10 liters per cylinder and less than 30 liters per cylinder that do not meet the applicable requirements for 2017 model year non-emergency engines.

(h) In addition to the requirements specified in §§60.4201, 60.4202, 60.4204, and 60.4205, it is prohibited to import stationary CI ICE with a displacement of less than 30 liters per cylinder that do not meet the applicable requirements specified in paragraphs (a) through (g) of this section after the dates specified in paragraphs (a) through (g) of this section.

(i) The requirements of this section do not apply to owners or operators of stationary CI ICE that have been modified, reconstructed, and do not apply to engines that were removed from one existing location and reinstalled at a new location.

§ 60.4209 .... What are the monitoring requirements if I am an owner or operator of a stationary CI internal combustion engine?

If you are an owner or operator, you must meet the monitoring requirements of this section. In addition, you must also meet the monitoring requirements specified in §60.4211.

(a) If you are an owner or operator of an emergency stationary CI internal combustion engine that does not meet the standards applicable to non-emergency engines, you must install a non-resettable hour meter prior to startup of the engine.

(b) If you are an owner or operator of a stationary CI internal combustion engine equipped with a diesel particulate filter to comply with the emission standards in §60.4204, the diesel particulate filter must be installed with a backpressure monitor that notifies the owner or operator when the high backpressure limit of the engine is approached.

Nu-West Industries Rasmussen Valley Mine is an owner and operator of CI internal combustion engines subject to this subpart that have diesel particulate filters installed. §60.4209(b) is applicable and is assured by permit condition 3.4.

§ 60.4210 .... What are my compliance requirements if I am a stationary CI internal combustion engine manufacturer?

Nu-West Industries Rasmussen Valley Mine does not manufacture stationary CI internal combustion engines. §604210 is not applicable.

§ 60.4211 .... What are my compliance requirements if I am an owner or operator of a stationary CI internal combustion engine?

(a) If you are an owner or operator and must comply with the emission standards specified in this subpart, you must do all of the following, except as permitted under paragraph (g) of this section:

(1) Operate and maintain the stationary CI internal combustion engine and control device according to the manufacturer's emission-related written instructions;

(2) Change only those emission-related settings that are permitted by the manufacturer; and

(3) Meet the requirements of 40 CFR parts 89, 94 and/or 1068, as they apply to you.

Nu-West Industries Rasmussen Valley Mine operates engines subject to this subpart. Therefore §60.4211(a)(1)-, (2), and (3) are applicable and are assured by permit condition 3.2.

(b) If you are an owner or operator of a pre-2007 model year stationary CI internal combustion engine and must comply with the emission standards specified in §§60.4204(a) or 60.4205(a), or if you are an owner or operator of a CI fire pump engine that is manufactured prior to the model years in table 3 to this subpart and must comply with the emission standards specified in §60.4205(c), you must demonstrate compliance according to one of the methods specified in paragraphs (b)(1) through (5) of this section.

(1) Purchasing an engine certified according to 40 CFR part 89 or 40 CFR part 94, as applicable, for the same model year and maximum engine power. The engine must be installed and configured according to the manufacturer's specifications.

(2) Keeping records of performance test results for each pollutant for a test conducted on a similar engine. The test must have been conducted using the same methods specified in this subpart and these methods must have been followed correctly.

(3) Keeping records of engine manufacturer data indicating compliance with the standards.

(4) Keeping records of control device vendor data indicating compliance with the standards.

(5) Conducting an initial performance test to demonstrate compliance with the emission standards according to the requirements specified in §60.4212, as applicable.

(c) If you are an owner or operator of a 2007 model year and later stationary CI internal combustion engine and must comply with the emission standards specified in §60.4204(b) or §60.4205(b), or if you are an owner or operator of a CI fire pump engine that is manufactured during or after the model year that applies to your fire pump engine power rating in table 3 to this subpart and must comply with the emission standards specified in §60.4205(c), you must comply by purchasing an engine certified to the emission standards in §60.4204(b), or §60.4205(b) or (c), as applicable, for the same model year and maximum (or in the case of fire pumps, NFPA nameplate) engine power. The engine must be installed and configured according to the manufacturer's emission-related specifications, except as permitted in paragraph (g) of this section.

Nu-West Industries Rasmussen Valley Mine must comply with the emission standards outlined in §60.4204(b). §60.4211(c) is applicable and is assured by permit condition 3.2.

(d) If you are an owner or operator and must comply with the emission standards specified in §60.4204(c) or §60.4205(d), you must demonstrate compliance according to the requirements specified in paragraphs (d)(1) through (3) of this section.

(1) Conducting an initial performance test to demonstrate initial compliance with the emission standards as specified in §60.4213.

(2) Establishing operating parameters to be monitored continuously to ensure the stationary internal combustion engine continues to meet the emission standards. The owner or operator must petition the Administrator for approval of operating parameters to be monitored continuously. The petition must include the information described in paragraphs (d)(2)(i) through (v) of this section.

(i) Identification of the specific parameters you propose to monitor continuously;

(ii) A discussion of the relationship between these parameters and NOX and PM emissions, identifying how the emissions of these pollutants change with changes in these parameters, and how limitations on these parameters will serve to limit NOX and PM emissions;

(iii) A discussion of how you will establish the upper and/or lower values for these parameters which will establish the limits on these parameters in the operating limitations;

(iv) A discussion identifying the methods and the instruments you will use to monitor these parameters, as well as the relative accuracy and precision of these methods and instruments; and

(v) A discussion identifying the frequency and methods for recalibrating the instruments you will use for monitoring these parameters.

(3) For non-emergency engines with a displacement of greater than or equal to 30 liters per cylinder, conducting annual performance tests to demonstrate continuous compliance with the emission standards as specified in §60.4213.

(e) If you are an owner or operator of a modified or reconstructed stationary CI internal combustion engine and must comply with the emission standards specified in §60.4204(e) or §60.4205(f), you must demonstrate compliance according to one of the methods specified in paragraphs (e)(1) or (2) of this section.

(1) Purchasing, or otherwise owning or operating, an engine certified to the emission standards in §60.4204(e) or §60.4205(f), as applicable.

(2) Conducting a performance test to demonstrate initial compliance with the emission standards according to the requirements specified in §60.4212 or §60.4213, as appropriate. The test must be conducted within 60 days after the engine commences operation after the modification or reconstruction.

(f) If you own or operate an emergency stationary ICE, you must operate the emergency stationary ICE according to the requirements in paragraphs (f)(1) through (3) of this section. In order for the engine to be considered an emergency stationary ICE under this subpart, any operation other than emergency operation, maintenance and testing, emergency demand response, and operation in non-emergency situations for 50 hours per year, as described in paragraphs (f)(1) through (3) of this section, is prohibited. If you do not operate the engine according to the requirements in paragraphs (f)(1) through (3) of this section, the engine will not be considered an emergency engine under this subpart and must meet all requirements for non-emergency engines.

(1) There is no time limit on the use of emergency stationary ICE in emergency situations.

(2) You may operate your emergency stationary ICE for any combination of the purposes specified in paragraphs (f)(2)(i) through (iii) of this section for a maximum of 100 hours per calendar year. Any operation for non-emergency situations as allowed by paragraph (f)(3) of this section counts as part of the 100 hours per calendar year allowed by this paragraph (f)(2).

(i) Emergency stationary ICE may be operated for maintenance checks and readiness testing, provided that the tests are recommended by federal, state or local government, the manufacturer, the vendor, the regional transmission organization or equivalent balancing authority and transmission operator, or the insurance company associated with the engine. The owner or operator may petition the Administrator for approval of additional hours to be used for maintenance checks and readiness testing, but a petition is not required if the owner or operator maintains records indicating that federal, state, or local standards require maintenance and testing of emergency ICE beyond 100 hours per calendar year.

(ii) Emergency stationary ICE may be operated for emergency demand response for periods in which the Reliability Coordinator under the North American Electric Reliability Corporation (NERC) Reliability Standard EOP-002-3, Capacity and Energy Emergencies (incorporated by reference, see §60.17), or other authorized entity as determined by the Reliability Coordinator, has declared an Energy Emergency Alert Level 2 as defined in the NERC Reliability Standard EOP-002-3.

(iii) Emergency stationary ICE may be operated for periods where there is a deviation of voltage or frequency of 5 percent or greater below standard voltage or frequency.

(3) Emergency stationary ICE may be operated for up to 50 hours per calendar year in non-emergency situations. The 50 hours of operation in non-emergency situations are counted as part of the 100 hours per calendar year for maintenance and testing and emergency demand response provided in paragraph (f)(2) of this section. Except as provided in paragraph (f)(3)(i) of this section, the 50 hours per calendar year for non-emergency situations cannot be used for peak shaving or non-emergency demand response, or to generate income for a facility to an electric grid or otherwise supply power as part of a financial arrangement with another entity.

(i) The 50 hours per year for non-emergency situations can be used to supply power as part of a financial arrangement with another entity if all of the following conditions are met:

(A) The engine is dispatched by the local balancing authority or local transmission and distribution system operator;

(B) The dispatch is intended to mitigate local transmission and/or distribution limitations so as to avert potential voltage collapse or line overloads that could lead to the interruption of power supply in a local area or region.

(C) The dispatch follows reliability, emergency operation or similar protocols that follow specific NERC, regional, state, public utility commission or local standards or guidelines.

(D) The power is provided only to the facility itself or to support the local transmission and distribution system.

(E) The owner or operator identifies and records the entity that dispatches the engine and the specific NERC, regional, state, public utility commission or local standards or guidelines that are being followed for dispatching the engine. The local balancing authority or local transmission and distribution system operator may keep these records on behalf of the engine owner or operator.

(ii) [Reserved]

(g) If you do not install, configure, operate, and maintain your engine and control device according to the manufacturer's emission-related written instructions, or you change emission-related settings in a way that is not permitted by the manufacturer, you must demonstrate compliance as follows:

(1) If you are an owner or operator of a stationary CI internal combustion engine with maximum engine

power less than 100 HP, you must keep a maintenance plan and records of conducted maintenance to demonstrate compliance and must, to the extent practicable, maintain and operate the engine in a manner consistent with good air pollution control practice for minimizing emissions. In addition, if you do not install and configure the engine and control device according to the manufacturer's emission-related written instructions, or you change the emission-related settings in a way that is not permitted by the manufacturer, you must conduct an initial performance test to demonstrate compliance with the applicable emission standards within 1 year of such action.

(2) If you are an owner or operator of a stationary CI internal combustion engine greater than or equal to 100 HP and less than or equal to 500 HP, you must keep a maintenance plan and records of conducted maintenance and must, to the extent practicable, maintain and operate the engine in a manner consistent with good air pollution control practice for minimizing emissions. In addition, you must conduct an initial performance test to demonstrate compliance with the applicable emission standards within 1 year of startup, or within 1 year after an engine and control device is no longer installed, configured, operated, and maintained in accordance with the manufacturer's emission-related written instructions, or within 1 year after you change emission-related settings in a way that is not permitted by the manufacturer.

(3) If you are an owner or operator of a stationary CI internal combustion engine greater than 500 HP, you must keep a maintenance plan and records of conducted maintenance and must, to the extent practicable, maintain and operate the engine in a manner consistent with good air pollution control practice for minimizing emissions. In addition, you must conduct an initial performance test to demonstrate compliance with the applicable emission standards within 1 year of startup, or within 1 year after an engine and control device is no longer installed, configured, operated, and maintained in accordance with the manufacturer's emission-related written instructions, or within 1 year after you change emission-related settings in a way that is not permitted by the manufacturer. You must conduct subsequent performance testing every 8,760 hours of engine operation or 3 years, whichever comes first, thereafter to demonstrate compliance with the applicable emission standards.

Nu-West Industries Rasmussen Valley Mine is required to comply with §60.4211(g)(1) for the engines with a maximum horsepower rating less than 100 and §60.4211(g)2) for engines with a maximum brake horsepower of greater than 100 if they do not install, configure, operate and maintain the engine and control device according to the manufacturer's emission-related written instruction. This is assured by permit condition 3.2.

§ 60.4212 .... What test methods and other procedures must I use if I am an owner or operator of a stationary CI internal combustion engine with a displacement of less than 30 liters per cylinder?

Nu-West Industries Rasmussen Valley Mine is not required to perform any performance tests. Therefore, §60.4212 is not applicable.

§ 60.4213 .... What test methods and other procedures must I use if I am an owner or operator of a stationary CI internal combustion engine with a displacement of greater than or equal to 30 liters per cylinder?

Nu-West Industries Rasmussen Valley Mine does not operate any CI internal combustion engines subject to this subpart with a displacement of greater than 30 liters per cylinder. §60.4213 is not applicable.

§ 60.4214 .... What are my notification, reporting, and recordkeeping requirements if I am an owner or operator of a stationary CI internal combustion engine?

(a) Owners and operators of non-emergency stationary CI ICE that are greater than 2,237 KW (3,000 HP), or have a displacement of greater than or equal to 10 liters per cylinder, or are pre-2007 model year engines that are greater than 130 KW (175 HP) and not certified, must meet the requirements of paragraphs (a)(1) and (2) of this section.

(1) Submit an initial notification as required in §60.7(a)(1). The notification must include the information in paragraphs (a)(1)(i) through (v) of this section.

(i) Name and address of the owner or operator;

(ii) The address of the affected source;

(iii) Engine information including make, model, engine family, serial number, model year, maximum engine power, and engine displacement;

(iv) Emission control equipment; and

(v) Fuel used.

(2) Keep records of the information in paragraphs (a)(2)(i) through (iv) of this section.

(i) All notifications submitted to comply with this subpart and all documentation supporting any notification.

(ii) Maintenance conducted on the engine.

(iii) If the stationary CI internal combustion is a certified engine, documentation from the manufacturer that the engine is certified to meet the emission standards.

(iv) If the stationary CI internal combustion is not a certified engine, documentation that the engine meets the emission standards.

(b) If the stationary CI internal combustion engine is an emergency stationary internal combustion engine, the owner or operator is not required to submit an initial notification. Starting with the model years in table 5 to this subpart, if the emergency engine does not meet the standards applicable to non-emergency engines in the applicable model year, the owner or operator must keep records of the operation of the engine in emergency and non-emergency service that are recorded through the non-resettable hour meter. The owner must record the time of operation of the engine and the reason the engine was in operation during that time.

(c) If the stationary CI internal combustion engine is equipped with a diesel particulate filter, the owner or operator must keep records of any corrective action taken after the backpressure monitor has notified the owner or operator that the high backpressure limit of the engine is approached.

(d) If you own or operate an emergency stationary CI ICE with a maximum engine power more than 100 HP that operates or is contractually obligated to be available for more than 15 hours per calendar year for the purposes specified in §60.4211(f)(2)(ii) and (iii) or that operates for the purposes specified in §60.4211(f)(3)(i), you must submit an annual report according to the requirements in paragraphs (d)(1) through (3) of this section.

(1) The report must contain the following information:

(i) Company name and address where the engine is located.

(ii) Date of the report and beginning and ending dates of the reporting period.

(iii) Engine site rating and model year.

(iv) Latitude and longitude of the engine in decimal degrees reported to the fifth decimal place.

(v) Hours operated for the purposes specified in §60.4211(f)(2)(ii) and (iii), including the date, start time, and end time for engine operation for the purposes specified in §60.4211(f)(2)(ii) and (iii).

(vi) Number of hours the engine is contractually obligated to be available for the purposes specified in §60.4211(f)(2)(ii) and (iii).

(vii) Hours spent for operation for the purposes specified in §60.4211(f)(3)(i), including the date, start time, and end time for engine operation for the purposes specified in §60.4211(f)(3)(i). The report must also identify the entity that dispatched the engine and the situation that necessitated the dispatch of the engine.

(2) The first annual report must cover the calendar year 2015 and must be submitted no later than March 31, 2016. Subsequent annual reports for each calendar year must be submitted no later than March 31 of the following calendar year.

(3) The annual report must be submitted electronically using the subpart specific reporting form in the Compliance and Emissions Data Reporting Interface (CEDRI) that is accessed through EPA's Central Data Exchange (CDX) (www.epa.gov/cdx). However, if the reporting form specific to this subpart is not available in CEDRI at the time that the report is due, the written report must be submitted to the Administrator at the appropriate address listed in §60.4.

Nu-West Industries Rasmussen Valley Mine operates CI internal combustion engines that may be equipped with a diesel particulate filter. The requirements of §60.4214(c) are assured by permit condition 3.4.

§ 60.4215 .... What requirements must I meet for engines used in Guam, American Samoa, or the Commonwealth of the Northern Mariana Islands?

Nu-West Industries Rasmussen Valley Mine does not operate in Guam, American Samoa, or the Commonwealth of the Northern Mariana Islands. §60.4215 is not applicable.

§ 60.4216 .... What requirements must I meet for engines used in Alaska?

Nu-West Industries Rasmussen Valley Mine does not operate in Alaska. Therefore, §60.4216 is not applicable.

§ 60.4217 .... What emission standards must I meet if I am an owner or operator of a stationary internal combustion engine using special fuels?

Owners and operators of stationary CI ICE that do not use diesel fuel may petition the Administrator for approval of alternative emission standards, if they can demonstrate that they use a fuel that is not the fuel on which the manufacturer of the engine certified the engine and that the engine cannot meet the applicable standards required in §60.4204 or §60.4205 using such fuels and that use of such fuel is appropriate and reasonably necessary, considering cost, energy, technical feasibility, human health and environmental, and other factors, for the operation of the engine.

Nu-West Industries Rasmussen Valley Mine uses diesel fuel. §60.4217 does not apply.

§ 60.4218 .... What parts of the General Provisions apply to me?

Table 8 to this subpart shows which parts of the General Provisions in §§60.1 through 60.19 apply to you.

Table 8 to Subpart IIII of Part 60—Applicability of General Provisions to Subpart IIII

General Provisions citation	Subject of citation	Applies to subpart	Explanation
§60.1	General applicability of the General Provisions	Yes	
§60.2	Definitions	Yes	Additional terms defined in §60.4219.
§60.3	Units and abbreviations	Yes	
§60.4	Address	Yes	
§60.5	Determination of construction or modification	Yes	
§60.6	Review of plans	Yes	
§60.7	Notification and Recordkeeping	Yes	Except that §60.7 only applies as specified in §60.4214(a).
§60.8	Performance tests	Yes	Except that §60.8 only applies to stationary CI ICE with a displacement of (≥30 liters per cylinder and engines that are not certified.
§60.9	Availability of information	Yes	
§60.10	State Authority	Yes	
§60.11	Compliance with standards and maintenance requirements	No	Requirements are specified in subpart IIII.
§60.12	Circumvention	Yes	
§60.13	Monitoring requirements	Yes	Except that §60.13 only applies to stationary CI ICE with a displacement of (≥30 liters per cylinder.
§60.14	Modification	Yes	
§60.15	Reconstruction	Yes	
§60.16	Priority list	Yes	
§60.17	Incorporations by reference	Yes	
§60.18	General control device requirements	No	
§60.19	General notification and reporting requirements	Yes	

§ 60.4219 .... What definitions apply to this subpart?

The Definitions of this Subpart are applicable and no further discussion is required.

NESHAP Applicability (40 CFR 61)

The facility is not subject to any NESHAP requirements in 40 CFR 61.

MACT Applicability (40 CFR 63)

Because the facility has 12 compression ignition engines the following MACT requirements may apply to this facility:

- 40 CFR 63, Subpart ZZZZ - National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines. DEQ is delegated this Subpart.

The applicable parts are highlighted in yellow.

40 CFR 63, Subpart ZZZZ .... National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines

§ 63.6580 .... What is the purpose of subpart ZZZZ?

Subpart ZZZZ establishes national emission limitations and operating limitations for hazardous air pollutants (HAP) emitted from stationary reciprocating internal combustion engines (RICE) located at major and area sources of HAP emissions. This subpart also establishes requirements to demonstrate initial and continuous compliance with the emission limitations and operating limitations.

§ 63.6585 .... Am I subject to this subpart?

You are subject to this subpart if you own or operate a stationary RICE at a major or area source of HAP emissions, except if the stationary RICE is being tested at a stationary RICE test cell/stand.

§ 63.6590 .... What parts of my plant does this subpart cover?

This subpart applies to each affected source.

(a) Affected source. An affected source is any existing, new, or reconstructed stationary RICE located at a major or area source of HAP emissions, excluding stationary RICE being tested at a stationary RICE test cell/stand.

(1) Existing stationary RICE.

(i) For stationary RICE with a site rating of more than 500 brake horsepower (HP) located at a major source of HAP emissions, a stationary RICE is existing if you commenced construction or reconstruction of the stationary RICE before December 19, 2002.

(ii) For stationary RICE with a site rating of less than or equal to 500 brake HP located at a major source of HAP emissions, a stationary RICE is existing if you commenced construction or reconstruction of the stationary RICE before June 12, 2006.

(iii) For stationary RICE located at an area source of HAP emissions, a stationary RICE is existing if you commenced construction or reconstruction of the stationary RICE before June 12, 2006.

(iv) A change in ownership of an existing stationary RICE does not make that stationary RICE a new or reconstructed stationary RICE.

(2) New stationary RICE.

(i) A stationary RICE with a site rating of more than 500 brake HP located at a major source of HAP emissions is new if you commenced construction of the stationary RICE on or after December 19, 2002.

(ii) A stationary RICE with a site rating of equal to or less than 500 brake HP located at a major source of HAP emissions is new if you commenced construction of the stationary RICE on or after June 12, 2006.

(iii) A stationary RICE located at an area source of HAP emissions is new if you commenced construction of the stationary RICE on or after June 12, 2006.

(3) Reconstructed stationary RICE.

(i) A stationary RICE with a site rating of more than 500 brake HP located at a major source of HAP emissions is reconstructed if you meet the definition of reconstruction in §63.2 and reconstruction is commenced on or after December 19, 2002.

(ii) A stationary RICE with a site rating of equal to or less than 500 brake HP located at a major source of HAP emissions is reconstructed if you meet the definition of reconstruction in §63.2 and reconstruction is commenced on or after June 12, 2006.

(iii) A stationary RICE located at an area source of HAP emissions is reconstructed if you meet the definition of reconstruction in §63.2 and reconstruction is commenced on or after June 12, 2006.

(b) Stationary RICE subject to limited requirements.

(1) An affected source which meets either of the criteria in paragraphs (b)(1)(i) through (ii) of this section does not have to meet the requirements of this subpart and of subpart A of this part except for the initial notification requirements of §63.6645(f).

(i) The stationary RICE is a new or reconstructed emergency stationary RICE with a site rating of more than 500 brake HP located at a major source of HAP emissions that does not operate or is not contractually obligated to be available for more than 15 hours per calendar year for the purposes specified in §63.6640(f)(2)(ii) and (iii).

(ii) The stationary RICE is a new or reconstructed limited use stationary RICE with a site rating of more than 500 brake HP located at a major source of HAP emissions.

(2) A new or reconstructed stationary RICE with a site rating of more than 500 brake HP located at a major source of HAP emissions which combusts landfill or digester gas equivalent to 10 percent or more of the gross heat input on an annual basis must meet the initial notification requirements of §63.6645(f) and the requirements of §§63.6625(c), 63.6650(g), and 63.6655(c). These stationary RICE do not have to meet the emission limitations and operating limitations of this subpart.

(3) The following stationary RICE do not have to meet the requirements of this subpart and of subpart A of this part, including initial notification requirements:

(i) Existing spark ignition 2 stroke lean burn (2SLB) stationary RICE with a site rating of more than 500 brake HP located at a major source of HAP emissions;

(ii) Existing spark ignition 4 stroke lean burn (4SLB) stationary RICE with a site rating of more than 500 brake HP located at a major source of HAP emissions;

(iii) Existing emergency stationary RICE with a site rating of more than 500 brake HP located at a major source of HAP emissions that does not operate or is not contractually obligated to be available for more than 15 hours per calendar year for the purposes specified in §63.6640(f)(2)(ii) and (iii).

(iv) Existing limited use stationary RICE with a site rating of more than 500 brake HP located at a major source of HAP emissions;

(v) Existing stationary RICE with a site rating of more than 500 brake HP located at a major source of HAP emissions that combusts landfill gas or digester gas equivalent to 10 percent or more of the gross heat input on an annual basis;

(c) Stationary RICE subject to Regulations under 40 CFR Part 60. An affected source that meets any of the criteria in paragraphs (c)(1) through (7) of this section must meet the requirements of this part by meeting the requirements of 40 CFR part 60 subpart IIII, for compression ignition engines or 40 CFR part 60 subpart JJJJ, for spark ignition engines. No further requirements apply for such engines under this part.

(1) A new or reconstructed stationary RICE located at an area source;

(2) A new or reconstructed 2SLB stationary RICE with a site rating of less than or equal to 500 brake HP located at a major source of HAP emissions;

(3) A new or reconstructed 4SLB stationary RICE with a site rating of less than 250 brake HP located at a major source of HAP emissions;

(4) A new or reconstructed spark ignition 4 stroke rich burn (4SRB) stationary RICE with a site rating of less than or equal to 500 brake HP located at a major source of HAP emissions;

(5) A new or reconstructed stationary RICE with a site rating of less than or equal to 500 brake HP located at a major source of HAP emissions which combusts landfill or digester gas equivalent to 10 percent or more of the gross heat input on an annual basis;

(6) A new or reconstructed emergency or limited use stationary RICE with a site rating of less than or equal to 500 brake HP located at a major source of HAP emissions;

(7) A new or reconstructed compression ignition (CI) stationary RICE with a site rating of less than or equal to 500 brake HP located at a major source of HAP emissions.

Agrium's Rasmussen Valley Mine operates compression ignition reciprocation internal combustion engines that commenced construction after June 12, 2006. Agrium's Rasmussen Valley Mine is an area source of HAP emissions. Compliance with 40 CFR 63 Subpart ZZZZ is accomplished by complying with 40 CFR 60 Subpart IIII.

Permit Conditions Review

Initial Permit Condition 1.1

The purpose and scope of the permit is outlined in Permit Condition 1.1.

Initial Permit Condition 2.1

A description of the activities at the Rasmussen Valley Mine that have a potential to emit regulated pollutants is discussed.

Initial Permit Condition 2.2

Permit Condition 2.2 establishes a 20% opacity limit for any point of emission associated with the mining activities for more than three minutes in a 60-minute period

Initial Permit Condition 2.3

Permit Condition 2.3 requires a facility wide inspection of potential sources of visible emissions. It establishes the permittee evaluate, take corrective action, report exceedance, and maintain records of visible emissions.

Initial Permit Condition 2.4

Permit Condition 2.4 establishes some of the reasonable precautions that may be used to prevent particulate matter from becoming airborne.

Initial Permit Condition 2.5

Permit Condition 2.5 requires the facility conduct a daily facility-wide inspection of all sources of fugitive emissions and corrective action if fugitive emissions are not being reasonably controlled.

Initial Permit Condition 2.6

Permit Condition 2.6 establishes the permittee must keep records of the results of each fugitive emissions inspection. It also requires the facility to monitor and record any trigger for additional control strategies, corrective action used and results achieved.

Initial Permit Condition 2.7

Permit Condition 2.7 establishes the facility maintain a Fugitive Dust Control Plan.

Initial Permit Condition 2.8

Permit Condition 2.8 establishes the permittee must comply with the requirements of the Fugitive Dust Control Plan at all times and the requirements are incorporated by reference to the permit and shall be enforceable permit conditions.

Initial Permit Condition 2.9

Permit Condition 2.9 establishes incorporation of federal requirements.

Initial Permit Condition 3.1

Permit Condition 3.1 establishes emission limits for the IC engines in accordance with 40 CFR 60.4204(b)

Initial Permit Condition 3.2

Permit Condition 3.2 establishes compliance requirements for the IC engines in accordance with 40 CFR 60.4211.

Initial Permit Condition 3.3

Permit Condition 3.3 establishes operating and maintenance requirement s in accordance with 40 CFR 60.4206

Initial Permit Condition 3.4

Permit Condition 3.4 establishes monitoring and recordkeeping requirements in accordance with 40 CFR 60.4209, 40 CFR 60.4211, 40 CFR 60.4214, and 40 CFR 4204.

Initial Permit Condition 3.5

Permit Condition 3.5 establishes fuel specification limits in accordance with 40 CFR 60.4207.

Initial Permit Condition 3.6

Permit Condition 3.6 outlines the applicable general provision of 40 CFR 60, Subpart A the IC engines are subject to.

Initial Permit Condition 4.1

The duty to comply general compliance provision requires that the permittee comply with all of the permit terms and conditions pursuant to Idaho Code §39-101.

Initial Permit Condition 4.2

The maintenance and operation general compliance provision requires that the permittee maintain and operate all treatment and control facilities at the facility in accordance with IDAPA 58.01.01.211.

Initial Permit Condition 4.3

The obligation to comply general compliance provision specifies that no permit condition is intended to relieve or exempt the permittee from compliance with applicable state and federal requirements, in accordance with IDAPA 58.01.01.212.01.

Initial Permit Condition 4.4

The inspection and entry provision requires that the permittee allow DEQ inspection and entry pursuant to Idaho Code §39-108.

Initial Permit Condition 4.5

The permit expiration construction and operation provision specifies that the permit expires if construction has not begun within two years of permit issuance or if construction has been suspended for a year in accordance with IDAPA 58.01.01.211.02.

Initial Permit Condition 4.6

The notification of construction and operation provision requires that the permittee notify DEQ of the dates of construction and operation, in accordance with IDAPA 58.01.01.211.03.

Initial Permit Condition 4.7

The performance testing notification of intent provision requires that the permittee notify DEQ at least 15 days prior to any performance test to provide DEQ the option to have an observer present, in accordance with IDAPA 58.01.01.157.03.

Initial Permit Condition 4.8

The performance test protocol provision requires that any performance testing be conducted in accordance with the procedures of IDAPA 58.01.01.157, and encourages the permittee to submit a protocol to DEQ for approval prior to testing.

Initial Permit Condition 4.9

The performance test report provision requires that the permittee report any performance test results to DEQ within 60 days of completion, in accordance with IDAPA 58.01.01.157.04-05.

Initial Permit Condition 4.10

The monitoring and recordkeeping provision requires that the permittee maintain sufficient records to ensure compliance with permit conditions, in accordance with IDAPA 58.01.01.211.

Initial Permit Condition 4.11

The excess emissions provision requires that the permittee follow the procedures required for excess emissions events, in accordance with IDAPA 58.01.01.130-136.

Initial Permit Condition 4.12

The certification provision requires that a responsible official certify all documents submitted to DEQ, in accordance with IDAPA 58.01.01.123.

Initial Permit Condition 4.13

The false statement provision requires that no person make false statements, representations, or certifications, in accordance with IDAPA 58.01.01.125.

Initial Permit Condition 4.14

The tampering provision requires that no person render inaccurate any required monitoring device or method, in accordance with IDAPA 58.01.01.126.

Initial Permit Condition 4.15

The transferability provision specifies that this permit to construct is transferable, in accordance with the procedures of IDAPA 58.01.01.209.06.

Initial Permit Condition 4.16

The severability provision specifies that permit conditions are severable, in accordance with IDAPA 58.01.01.211.

PUBLIC REVIEW

Public Comment Opportunity

An opportunity for public comment period on the application was provided in accordance with IDAPA 58.01.01.209.01.c or IDAPA 58.01.01.404.01.c. During this time, there were comments on the application and there was a request for a public comment period on DEQ's proposed action. Refer to the chronology for public comment opportunity dates.

Public Comment Period

{public comment period offered, modify as applicable} A public comment period was made available to the public in accordance with IDAPA 58.01.01.209.01.c. During this time, comments were/were not submitted in response to DEQ's proposed action. Refer to the chronology for public comment period dates.

{comments received} A response to public comments document has been crafted by DEQ based on comments submitted during the public comment period. That document is part of the final permit package for this permitting action.

APPENDIX A – EMISSIONS INVENTORIES

APPENDIX B – AMBIENT AIR QUALITY IMPACT ANALYSES

APPENDIX C – FACILITY DRAFT COMMENTS

The following comments were received from the facility on September 21, 2016:

Facility Comment:

The Facility requested to change the permittee on the permit and statement of basis from Nu West Industries, Inc. (dba Agrium) Rasmussen Valley Mine to Nu-West Industries, Inc. dba Agrium Conda Phosphate Operations (Agrium).

DEQ Response:

The name indicated on form GI was used on the Permit and Statement of Basis. Therefore, there were no changes made because it was not what was included in the application.

Facility Comment:

Table 1.1 (of the Permit) includes detailed specifications for the proposed equipment, such as brake horsepower, fuel consumption rate, and displacement. In addition, Table 1 of the Statement of Basis includes manufacturer and model numbers in the information description. Agrium has not yet purchased the generators, other than the existing CI Well Pump 1 Engine installed in 2015, and the specifications of each engine may vary at the time of purchase depending upon availability. Agrium estimated emissions for the generators and light plants based upon desired units or equivalent units that may be available for purchase and use at the mine. Installed equipment will reflect estimated emissions and control technologies, but may not match precisely the other specifications detailed by the DEQ in the draft permit. Therefore, Agrium proposes to modify the tables to provide flexibility while ensuring the emissions and control technologies conform to the application.

Alternatively, Agrium requests that DEQ include a footnote for Table 1.1 as follows: *The Permittee may install equivalent units, so long as the control technology for each conforms to Table 1.1.*

These changes were also requested in the Statement of Basis.

DEQ Response:

The terminology “or equivalent” was inserted into the permit and statement of basis and defined in a footnote, however the specification used in the permit and statement of basis such as brake horsepower, displacement, and fuel consumption rates was maintained. This information is used for identification purposes.

Facility Comment:

Agrium proposes to add the words “or newer” behind the manufacture years in Table 1.1 of the permit. Doing so would allow for flexibility in purchasing equipment, or facilitating repairs when a piece of equipment needs to go off site for major repairs. It is often challenging to find the exact manufacture year needed to meet the air permit specifications. Engines with newer manufacture years are required to meet the control technologies being permitted, i.e. Tier 4 technologies.

DEQ Response:

The words “or newer” have been added after the manufacturer date for the engines in the Permit and Statement of Basis.

Facility Comment:

In Table 1.1 of the Permit there was a formatting error and tab stops were added.

DEQ Response:

The formatting errors were corrected.

Facility Comment:

These light plants have not been ordered yet and will at least have a manufacture date of 2016; can the manufacture date read ‘2016 or newer’ in Table 1.1 of the Permit

DEQ Response:

The words “or newer” have been added after the manufacture date for the engines.

Facility Comment:

Permit Condition 2.1 in the Permit was reworded from “Secondary processes include diesel-fired engines powering generators and water pumps” to “Other emissions sources operated at the mine include diesel-fired generators and light units”.

DEQ Response:

These changes have been made for clarity; however, the terminology “engines powering generators” has been maintained since this permitting action specifically permits the engines powering the generators not the generators themselves.

Facility Comment:

Sections (Permit conditions) 2.5 and 2.6 are redundant record-keeping because the existing Fugitive Dust Plan noted in Section 2.7 and made enforceable in Section 2.8 establishes the compliance strategy and monitoring approach. Sections 2.5 and 2.6 should therefore be eliminated. This comment pertains to the permit.

DEQ Response:

For dusty sources such as mines, requirements for fugitive dust monitoring and recordkeeping are incorporated. Even though the fugitive dust plan is made enforceable in Permit Condition 2.8, Permit Conditions 2.5 and 2.6 serve as minimum requirements for monitoring and recordkeeping.

Facility Comment:

It is unclear how the process rules apply to mining activities. Agrium’s North Rasmussen Air Permit does not include process weight pm (Permit Condition 2.9).

DEQ Response:

A demonstration of compliance for the screening operation, which is the only process at the mine with a throughput that can be used in the process weight rate calculation, has been incorporated into the statement of basis. Because compliance has been shown, the Permit Condition has been removed.

Facility Comment:

Formatting error on Table 3.1. It was incorrectly listed as Table 2.2 in the Permit.

DEQ Response:

This change has been made to the Permit.

Facility Comment:

The way this (Permit Condition 3.2) is worded is very confusing, it flows more in line with the CFR wording. The same for the following bullet.

DEQ Response:

The clarifications suggested have been incorporated into the Permit.

Facility Comment:

There was a typo in Table 1 of the Statement of Basis.

DEQ Response:

The typos have been corrected.

Facility Comment:

The facility requested that the Uncontrolled Potential to Emit paragraph (page 7) in the Statement of Basis be edited to remove the terminology “synthetic minor” and replace it with “Major”.

DEQ Response:

This is general language used to describe the purpose of uncontrolled potential to emit calculations. This calculation is used for facility classification purposes to determine whether a source is synthetic minor or minor. No changes were made. The analysis of whether a source is Major is discussed in depth later in the Statement of Basis.

Facility Comment:

There were typos in the regulatory review on page 17, 18, and 25 of the Statement of Basis.

DEQ Response:

The typos have been corrected.

Facility Comment:

In the applicability of 40 CFR 63 Subpart ZZZZ there was a missing applicable point under § 63.6590(c).

DEQ Response:

The applicable portion that was not highlighted has been highlighted.

Facility Comment:

In the modeling memo under section 1.0, the facility requested to reword the name from “Nu-West Mining, Inc., doing business as Agrium Conda Phosphate Operations (Agrium CPO)” to “Nu-West Industries, Inc., dba Agrium Conda Phosphate Operations (Agrium)”. The facility also requested to remove CPO in the second paragraph.

DEQ Response:

The proposed changes have been accepted and implemented in the modeling memo.

Facility Comment:

In Table 1 of the modeling memo, the facility stated the Tier 2 Ambient Ratio Method (ARM) was used with a 0.75 annual multiplier and a 0.8 1-hr multiplier was used for NO to NO_2 conversion rather than a Tier 1 NO_x analysis. This was also noted on page 20.

DEQ Response:

The Table has been revised to reflect the use of the Tier 2 method used in the model.

Facility Comment:

In Section 2.1 of the modeling memo, there were minor edits for clarification and ease of reading.

DEQ Response:

DEQ has incorporated these edits into the modeling memo.

Facility Comment:

In Table 4 of the modeling memo, the facility requested that the units of tons per year be consistent throughout the document as either tpy or tons/yr.

DEQ Response:

DEQ has revised the modeling memo to use tons/yr for consistency.

Facility Comment:

In Table 4 of the modeling memo, the facility requested that the emission rates are rounded to three decimal points. The facility also requested the emission rate for the volume sources be shown as equal in the three phases stating any inconsistency could be due to rounding errors.

DEQ Response:

DEQ implemented the three decimal point request for some sources; however some emissions sources such as volume sources required more accuracy than three decimal points.

APPENDIX D – PROCESSING FEE

M E M O R A N D U M /<u>DRAFT</u>

DATE: **September 6**, 2016

TO: **Craig Woodruff**, Permit Writer, Air Program

FROM: Thomas Swain, Air Quality Modeler, Analyst 3, Air Program

PROJECT: Agrium Rasmussen Valley Mine, (RVM), in Caribou County, Idaho, Permit to Construct (PTC), P-2016.0033, Project 61734, Facility ID No. 029-00044

SUBJECT: Demonstration of Compliance with IDAPA 58.01.01.203.02 (NAAQS) and 203.03 (TAPs) as it relates to air quality impact analyses.

Contents

1.0 Summary

Nu-West Industries, Inc., dba Agrium Conda Phosphate Operations (Agrium), submitted a Permit to Construct (PTC) in June 23, 2016 for a new mining facility, the Rasmussen Valley Mine (RVM), located in Caribou County, Idaho.

Agrium is planning to develop a new open pit phosphate mine about 18 miles northeast of Soda Springs in Caribou County, Idaho. The proposed operation will include overburden and ore piles, haul roads, mining pits, and other facilities. Excavated ore will be processed off site at the existing Agrium Plant northeast of Soda Springs. The mining operation will occur in nine phases, and the air impact assessment was addressed by modeling a beginning phase (#2), a middle phase (#5), and a later phase (#8).

The entire process is discussed in detail in the main body of the DEQ Statement of Basis supporting the issued proposed PTC. This modeling review memorandum provides a summary and approval of the ambient air impact analyses submitted with the permit application. It also describes DEQ's review of those analyses, DEQ's verification analyses, additional clarifications, and conclusions.

Project-specific air quality impact analyses involving atmospheric dispersion modeling of estimated emissions associated with the facility were submitted to DEQ to demonstrate that the facility would not cause or significantly contribute to a violation of any ambient air quality standard as required by IDAPA 58.01.01.203.02 and 203.03 (Idaho Air Rules Section 203.02 and 203.03).

RTP Environmental Associates (RTP) performed the ambient air impact analyses for this project on behalf of Agrium. -The analyses were performed to demonstrate compliance with air quality standards. The DEQ review summarized by this memorandum addressed only the rules, policies, methods, and data pertaining to the air impact analyses used to demonstrate that the estimated emissions increases at the facility associated with the proposed project will not cause or significantly contribute to a violation of any applicable air quality standard. This review did not evaluate compliance with other rules or analyses that do not pertain to the air impact analyses. Evaluation of emissions estimates was the responsibility of the permit writer and is addressed in the main body of the Statement of Basis. Emissions estimates were not reviewed as part of the modeling review described in this modeling review memorandum.

A modeling protocol was submitted for this project on December 18, 2015. This protocol incorporated several discussions with DEQ to assure methodologies prior to submittal. This protocol was approved with conditions on January 28, 2016 by DEQ. The application was later submitted on June 23, 2016. DEQ responded with a letter of completeness on July 15, 2016.

The final submitted air quality impact analyses: 1) utilized appropriate methods and models; 2) was conducted using reasonably accurate or conservative model parameters and input data (review of emissions estimates was addressed by the DEQ permit writer); 3) adhered to established DEQ guidelines for new source review dispersion modeling; 4) showed either a) that predicted pollutant concentrations from emissions associated with the project as modeled were below Significant Impact Levels (SILs) or other applicable regulatory thresholds; or b) that predicted pollutant concentrations from emissions associated with the project as modeled, when appropriately combined with co-contributing sources and background concentrations, were below applicable National Ambient Air Quality Standards (NAAQS) at ambient air locations where and when the project has a significant impact; 5) showed that Toxic Air Pollutant (TAP) emissions increases associated with the project will not result in increased ambient air impacts exceeding allowable TAP increments.

DEQ requested that RVM include emissions in the adjacent mining operation at Lanes Creek as a co-

contributing source to assure compliance with all NAAQS. RTP did include these sources with all modeling analyses, and these data are included in this report.

Table 1 presents key assumptions and results to be considered in the development of the permit.

Air impact analyses are required by Idaho Air Rules to be conducted according to methods outlined in 40 CFR 51, Appendix W (*Guideline on Air Quality Models*). Appendix W requires that facilities be modeled using emissions and operations representative of design capacity or as limited by a federally enforceable permit condition. The submitted information and analyses demonstrated to the satisfaction of the Department that operation of the proposed facility will not cause or significantly contribute to a violation of any ambient air quality standard, provided the key conditions in Table 1 are representative of facility design capacity or operations as limited by a federally enforceable permit condition.

Table 1. KEY ASSUMPTIONS USED IN MODELING ANALYSES

Criteria/Assumption/Result	Explanation/Consideration
General Emissions Rates. Emissions rates used in the modeling analyses, as listed in this memorandum, represent maximum potential emissions as given by design capacity or as limited by the issued permit for the specific pollutant and averaging period.	Compliance has not been demonstrated for emissions rates greater than those used in the modeling analyses.
Modeling Thresholds for Criteria Pollutant Emissions. Maximum short-term and long-term emissions of PM_{10}, $PM_{2.5}$, and oxides of nitrogen (NOx) associated with the proposed project are above Level 1 modeling thresholds as found in State of Idaho Modeling Guidelines. Therefore, a demonstration of compliance with NAAQS was performed.	Project-specific air impact analyses demonstrating compliance with NAAQS, as required by Idaho Air Rules Section 203.02, are required for pollutants having an emissions increase that is greater than Level I level modeling applicability thresholds. These thresholds are set to assure that impacts are below significant impact levels (SILs). Compliance with NAAQS has not been demonstrated for emissions that exceed the emission estimates presented in the application.
NO to NO_2 Conversion. A Tier 2 level of conversion of NO to NO_2 was used to assess chemical conversion of NO to NO_2. An ARM of 0.75 was applied to annual NOx impacts, and an ARM of 0.80 applied to 1-hr NOx impact	Air impact analyses demonstrating compliance with NAAQS for NO_2 was performed with Tier 2 advanced level conversion methodologies. Compliance has not been demonstrated with other methods such as Tier 1 or Tier 3.
TAPS Modeling: Emission rates of TAPS per Idaho Air Rules Sections 585 and 586 for arsenic, cadmium, iron, and nickel exceeded Emissions Screening Level (EL) rates.	Air impact analyses demonstrating compliance with TAPS, as required by Idaho Air Rules Section 203.03, is required for pollutants having an emissions rate greater than ELs. Therefore, a demonstration of compliance with TAPs AAC and AACC was performed.

2.0 Background Information

This section provides background information applicable to the project and the site where the facility is located. It also provides a brief description of the applicable air impact analyses requirements for the project.

2.1 Project Description

The Agrium is seeking to develop a new open pit phosphate mining operation referred to as the Rasmussen Valley Mine (RVM). The proposed RVM is located on the southern end of Rasmussen Ridge in Caribou County, 18 miles northeast of Soda Springs, Idaho. Operations will include excavation, ore piles, haul roads, mining pits, and other associated activities. Phosphate ore will be processed offsite at Agrium's existing CPO Fertilizer Manufacturing Plant, northeast of Soda Springs. The RVM operation will incorporate an existing pit operated by Monsanto. Overall, RVM will consist of the following, as referred to in the DEIS[3] as the “Rasmussen Collaborative Alternative Mine Plan”:

- Development of a large open pit in a sequential manner consisting of nine phases, going from the northwest portion of the property to the southeast. Mining will take approximately 4.8 years, and 7.1 years when including start up and reclamation activities. Operations will be done in 9 phases.
- Placement of overburden during early stages into Monsanto’s reclaimed South Rasmussen Mine main pit, located just north of RVM.
- Development and reclamation of four growth media stockpiles.
- Backfilling the majority of the mined out pit.
- Construction and reclamation of a staging area.
- Operate electrical generators for usage by mine facilities.
- Realignment of several roads in the area.
- Construction and reclamation of sediment control structures.
- Construction of temporary overburden storage piles within the mine footprint.
- Extension of the pit floor to the Lease boundary at the north end to maximize ore recovery.
- Establishment of growth media and alluvium storage and borrow areas for backfill cap.
- Reclamation with a diverse variety of plant species.

2.2 Proposed Location and Area Classification

The RVM facility will be located in Caribou County, Idaho, about 18 miles northeast of Soda Springs, Idaho. This area is designated as an attainment or unclassifiable area for sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), lead (Pb), ozone (O_3), particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers (PM_{10}), and particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers ($PM_{2.5}$). The area is not classified as non-attainment for any criteria pollutants.

2.3 Air Impact Analyses Required for All Permits to Construct

Criteria Pollutant and TAP Impact Analyses for a PTC are addressed in Idaho Air Rules Sections 203.02 and 203.03:

> *No permit to construct shall be granted for a new or modified stationary source unless the applicant shows to the satisfaction of the Department all of the following:*
>
> ***02. NAAQS****. The stationary source or modification would not cause or significantly contribute to a violation of any ambient air quality standard.*
>
> ***03. Toxic Air Pollutants.*** *Using the methods provided in Section 210, the emissions of toxic air pollutants from the stationary source or modification would not injure or unreasonably affect human or animal life or vegetation as required by Section 161. Compliance with all applicable toxic air pollutant carcinogenic increments and toxic air pollutant non-carcinogenic increments will also demonstrate preconstruction compliance with Section 161 with regards to the pollutants listed in Sections 585 and 586.*

Atmospheric dispersion modeling, using computerized simulations, is used to demonstrate compliance with both NAAQS and TAPs. Idaho Air Rules Section 202.02 states:

> ***Estimates of Ambient Concentrations****. All estimates of ambient concentrations shall be based on the*

applicable air quality models, data bases, and other requirements specified in 40 CFR 51 Appendix W (Guideline on Air Quality Models).

2.4 Significant Impact Level and Cumulative NAAQS Impact Analyses

The Significant Impact Level (SIL) analysis for a new facility or proposed modification to a facility involves modeling estimated criteria air pollutant emissions from the facility or modification to determine the potential impacts to ambient air. Air impact analyses are required by Idaho Air Rules to be conducted according to methods outlined in 40 CFR 51, Appendix W (Guideline on Air Quality Models). Appendix W requires that facilities be modeled using emissions and operations representative of design capacity or as limited by a federally enforceable permit condition.

A facility or modification is considered to have a significant impact on air quality if maximum modeled impacts to ambient air exceed the established SIL listed in Idaho Air Rules Section 006 (referred to as a significant contribution in Idaho Air Rules) or as incorporated by reference as per Idaho Air Rules Section 107.03.b. Table 2 lists the applicable SILs.

If modeled maximum pollutant impacts to ambient air from the emissions sources associated with a new facility or modification exceed the SILs, then a cumulative NAAQS impact analysis is necessary to demonstrate compliance with NAAQS and Idaho Air Rules Section 203.02.

DEQ has developed modeling applicability thresholds that effectively assure that project-related emissions increases below stated values will result in ambient air impacts below the applicable SILs. The threshold levels and dispersion modeling analyses supporting those levels are presented in the *State of Idaho Guideline for Performing Air Quality Impact Analyses*[1] (*Idaho Air Modeling Guideline*). Use of a modeling threshold represents the use of conservative modeling, performed in support of the threshold, as a project SIL analysis. Project-specific modeling applicability for this project is addressed in Section 3.1.1 of this memorandum.

A cumulative NAAQS impact analysis for attainment area pollutants involves assessing ambient impacts (typically the design values consistent with the form of the standard) from facility-wide emissions, and emissions from any nearby co-contributing sources, and then adding a DEQ-approved background concentration value to the modeled result that is appropriate for the criteria pollutant/averaging-period at the facility location and the area of significant impact. The resulting pollutant concentrations in ambient air are then compared to the NAAQS listed in Table 2. Table 2 also lists SILs and specifies the modeled design value that must be used for comparison to the NAAQS. NAAQS compliance is evaluated on a receptor-by-receptor basis for the modeling domain.

If the cumulative NAAQS impact analysis indicates a violation of the standard, the permit may not be issued if the proposed project has a significant contribution (exceeding the SIL) to the modeled violation. This evaluation is made specific to both time and space. If the SIL analysis indicates the facility/modification has an impact exceeding the SIL, the facility might not have a significant contribution to a violation if impacts are below the SIL at the specific receptor showing the violation during the time periods when a modeled violation occurred.

Table 2. APPLICABLE REGULATORY LIMITS

Pollutant	Averaging Period	Significant Impact Levels[a] ($\mu g/m^3$)[b]	Regulatory Limit[c] ($\mu g/m^3$)	Modeled Design Value Used[d]
PM_{10}[e]	24-hour	5.0	150[f]	Maximum 6th highest[g]
$PM_{2.5}$[h]	24-hour	1.2	35[i]	Mean of maximum 8th highest[j]
	Annual	0.3	12[k]	Mean of maximum 1st highest[l]

Carbon monoxide (CO)	1-hour	2,000	40,000[m]	Maximum 2nd highest[n]
	8-hour	500	10,000[m]	Maximum 2nd highest[n]
Sulfur Dioxide (SO_2)	1-hour	3 ppb[o] (7.8 μg/m^3)	75 ppb[p] (196 μg/m^3)	Mean of maximum 4th highest[q]
	3-hour	25	1,300[m]	Maximum 2nd highest[n]
	24-hour	5	365[m]	Maximum 2nd highest[n]
	Annual	1.0	80[r]	Maximum 1st highest[n]
Nitrogen Dioxide (NO_2)	1-hour	4 ppb (7.5 μg/m^3)	100 ppb[s] (188 μg/m^3)	Mean of maximum 8th highest[t]
	Annual	1.0	100[r]	Maximum 1st highest[n]
Lead (Pb)	3-month[u]	NA	0.15[r]	Maximum 1st highest[n]
	Quarterly	NA	1.5[r]	Maximum 1st highest[n]
Ozone (O_3)	8-hour	40 TPY VOC[v]	75 ppb[w]	Not typically modeled

a. Idaho Air Rules Section 006 (definition for significant contribution) or as incorporated by reference as per Idaho Air Rules Section 107.03.b.
b. Micrograms per cubic meter.
c. Incorporated into Idaho Air Rules by reference, as per Idaho Air Rules Section 107.
d. The maximum 1st highest modeled value is always used for the significant impact analysis unless indicated otherwise. Modeled design values are calculated for each ambient air receptor.
e. Particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers.
f. Not to be exceeded more than once per year on average over 3 years.
g. Concentration at any modeled receptor when using five years of meteorological data.
h. Particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers.
i. 3-year mean of the upper 98th percentile of the annual distribution of 24-hour concentrations.
j. 5-year mean of the 8th highest modeled 24-hour concentrations at the modeled receptor for each year of meteorological data modeled. For the SIL analysis, the 5-year mean of the 1st highest modeled 24-hour impacts at the modeled receptor for each year.
k. 3-year mean of annual concentration.
l. 5-year mean of annual averages at the modeled receptor.
m. Not to be exceeded more than once per year.
n. Concentration at any modeled receptor.
o. Interim SIL established by EPA policy memorandum.
p. 3-year mean of the upper 99th percentile of the annual distribution of maximum daily 1-hour concentrations.
q. 5-year mean of the 4th highest daily 1-hour maximum modeled concentrations for each year of meteorological data modeled. For the significant impact analysis, the 5-year mean of 1st highest modeled 1-hour impacts for each year is used.
r. Not to be exceeded in any calendar year.
s. 3-year mean of the upper 98th percentile of the annual distribution of maximum daily 1-hour concentrations.
t. 5-year mean of the 8th highest daily 1-hour maximum modeled concentrations for each year of meteorological data modeled. For the significant impact analysis, the 5-year mean of maximum modeled 1-hour impacts for each year is used.
u. 3-month rolling average.
v. An annual emissions rate of 40 ton/year of VOCs is considered significant for O_3.
w. Annual 4th highest daily maximum 8-hour concentration averaged over three years. The O_3 standard was revised (the notice was signed by the EPA Administrator on October 1, 2015) to 70 ppb. However, this standard will not be applicable for permitting purposes until it is incorporated by reference *sine die* into Idaho Air Rules.

Compliance with Idaho Air Rules Section 203.02 is generally demonstrated if: a) all modeled impacts of the SIL analysis are below the applicable SIL or other level determined to be inconsequential to NAAQS compliance; or b) modeled design values of the cumulative NAAQS impact analysis (modeling all emissions from the facility and co-contributing sources, and adding a background concentration) are less than applicable NAAQS at receptors where impacts from the proposed facility/modification exceeded the SIL or other identified level of consequence; or c) if the cumulative NAAQS analysis showed NAAQS violations, the impact of proposed facility/modification to any modeled violation was inconsequential (typically assumed to be less than the established SIL) for that specific receptor and for the specific modeled time when the violation occurred.

2.5 Toxic Air Pollutant Analyses

Emissions of toxic substances are generally addressed by Idaho Air Rules Section 161:

> *Any contaminant which is by its nature toxic to human or animal life or vegetation shall not be emitted in such quantities or concentrations as to alone, or in combination with other contaminants, injure or unreasonably affect human or animal life or vegetation.*

Permitting requirements for toxic air pollutants (TAPs) from new or modified sources are specifically addressed by Idaho Air Rules Section 203.03 and require the applicant to demonstrate to the satisfaction of DEQ the following:

> *Using the methods provided in Section 210, the emissions of toxic air pollutants from the stationary source or modification would not injure or unreasonably affect human or animal life or vegetation as required by Section 161. Compliance with all applicable toxic air pollutant carcinogenic increments and toxic air pollutant non-carcinogenic increments will also demonstrate preconstruction compliance with Section 161 with regards to the pollutants listed in Sections 585 and 586.*

Per Idaho Air Rules Section 210, if the total project-wide emissions increase of any TAP associated with a new source or modification exceeds screening emission levels (ELs) of Idaho Air Rules Section 585 or 586, then the ambient impact of the emissions increase must be estimated. If ambient impacts are less than applicable Acceptable Ambient Concentrations (AACs) for non-carcinogens of Idaho Air Rules Section 585 and Acceptable Ambient Concentrations for Carcinogens (AACCs) of Idaho Air Rules Section 586, then compliance with TAP requirements has been demonstrated.

Idaho Air Rules Section 210.20 states that if TAP emissions from a specific source are regulated by the Department or EPA under 40 CFR 60, 61, or 63, then a TAP impact analysis under Section 210 is not required for that TAP.

3.0 Analytical Methods and Data

This section describes the methods and data used in analyses to demonstrate compliance with applicable air quality impact requirements.

3.1 Emission Source Data

Emissions rates of criteria pollutants and TAPs for the proposed RVM project were provided by the applicant for various applicable averaging periods. Review and approval of estimated emissions was the responsibility of the DEQ permit writer, and is not addressed in this modeling memorandum. DEQ modeling review included verification that the application's potential emissions rates were properly used in the model. The rates listed must represent the maximum allowable rate as averaged over the specified period.

Emissions rates used in the dispersion modeling analyses submitted by RTP should be reviewed by the DEQ permit writer against those in the emissions inventory of the permit application. All modeled criteria air pollutant and TAP emissions rates should be equal to or greater than the facility's emissions calculated in other sections of the PTC application or requested permit allowable emission rates.

3.1.1 Criteria Pollutant Emissions Rates and Modeling Applicability

If facility-wide potential to emit (PTE) values for a specific criteria pollutants would qualify for a below regulatory concern (BRC) permit exemption as per Idaho Air Rules Section 221 if it were not for some pollutants exceeding BRC thresholds, then an air impact analysis for that pollutant may not be required for permit issuance. DEQ's regulatory interpretation policy of exemption provisions of Idaho Air Rules (Policy on NAAQS Compliance Demonstration Requirements, DEQ policy memorandum, July 11, 2014) is that: "A DEQ NAAQS compliance assertion will not be made by the DEQ modeling group for specific criteria pollutants having a project emissions increase below BRC levels, provided the proposed project would have qualified for a Category I Exemption for BRC emissions quantities except for the emissions of another criteria pollutant." The interpretation policy also states that the exemption criteria of uncontrolled PTE not to exceed 100 ton/year (Idaho Air Rules Section 220.01.a.i) is not applicable when evaluating whether a NAAQS impact analyses is required. A permit will be issued limiting PTE below 100 ton/year, thereby negating the need to maintain calculated uncontrolled PTE under 100 ton/year.

An impact analysis must be performed for pollutant increases that would not qualify for the BRC exemption from an impact analysis. RTP did not provide a comparison of project emissions with BRC exemption levels, but rather compared emissions to DEQ defined modeling thresholds.

DEQ has generated non-site-specific project modeling thresholds for those projects that cannot use the BRC exemption from an impact analysis (if there are specific permitted emissions limits that require changing, etc.). Modeling applicability thresholds are provided in the *Idaho Air Modeling Guideline*. These thresholds were based on assuring an ambient impact of less than established SIL for that specific pollutant and averaging period.

If project-specific total emissions rates are below Level I Modeling Thresholds, project-specific air impact analyses are not necessary for permitting. Use of level II modeling thresholds are conditional, requiring DEQ approval. Table 3 provides the emissions-based modeling applicability summary. RTP compared emission estimates with Level I modeling thresholds, and determined that modeling is necessary for $PM_{2.5}$ (24-hour and annual), PM_{10} (24-hour), and NO_2 (1-hour and annual). Emissions as modeled per source for are listed in Table 4 and 5 for RVM and Lanes Creek facilities, respectively.

Table 3. MODELING APPLICABILITY ANALYSIS RESULTS

Pollutant	Averaging Period	Emissions	BRC Threshold (ton/year)	Level I Modeling Thresholds (lb/hour or ton/year)	Level II Modeling Thresholds (lb/hour or ton/year)	Modeling Required
$PM_{2.5}$	Annual	5.0 ton/yr	1.0	0.350	4.1	Yes
	24-hour	1.2 lb/hr		0.054	0.63	Yes
PM_{10}	24-hour	8.87 lb/hr	1.5	0.22	2.6	Yes
NOx	Annual	21.1 ton/yr	4.0	1.2	14	Yes
	1-hour	4.8 lb/hr		0.2	2.4	Yes
SO_2	Annual	0.4 ton/yr	4.0	1.2	14	No
	1-hour	0.1 lb/hr		0.21	2.5	No
CO	Short term	7.7 lb/hr	10.0	15	175	No

Ozone (O_3) differs from other criteria pollutants in that it is not typically emitted directly into the atmosphere. O_3 is formed in the atmosphere through reactions of VOCs, NOx, and sunlight. Atmospheric dispersion models used in stationary source air permitting analyses (see Section 3.3.3) cannot be used to estimate O_3 impacts resulting from VOC and NOx emissions from an industrial facility. O_3 concentrations resulting from area-wide emissions are predicted by using more complex airshed models such as the Community Multi-Scale Air Quality (CMAQ) modeling system. Use of the CMAQ model is very resource intensive and DEQ asserts that performing a CMAQ analysis for a particular permit application is not typically a reasonable or necessary requirement for air quality permitting.

Addressing secondary formation of O_3 has been somewhat addressed in EPA regulation and policy. As stated in a letter from Gina McCarthy of EPA to Robert Ukeiley, acting on behalf of the Sierra Club (letter from Gina McCarthy, Assistant Administrator, United States Environmental Protection Agency, to Robert Ukeiley, January 4, 2012):

> *. . . footnote 1 to sections 51.166(I)(5)(I) of the EPA's regulations says the following: "No de minimis air quality level is provided for ozone. However, any net emission increase of 100 tons per year or more of volatile organic compounds or nitrogen oxides subject to PSD would be required to perform an ambient impact analysis, including the gathering of air quality data."*
>
> *The EPA believes it unlikely a source emitting below these levels would contribute to such a violation of the 8-hour ozone NAAQS, but consultation with an EPA Regional Office should still be conducted in accordance with section 5.2.1.c. of Appendix W when reviewing an application for sources with emissions of these ozone precursors below 100 TPY."*

Allowable emissions estimates of VOCs and NOx are below the 100 tons/year threshold, and DEQ determined it was not appropriate or necessary to require a quantitative source specific O_3 impact analysis.

Table 4. CRITERIA POLLUTANT EMISSIONS MODELED BY SOURCE – RVM FACILITY

Phase[a]	Source ID	Source Description	PM_{10} (lb/hr)[b]	$PM_{2.5}$ (lb/hr)	$PM_{2.5}$ Ann (ton/yr)	NO_X (lb/hr)	NOxAnn (ton/yr)
Point Sources							
2	LP_1_P2	Diesel light plant Phase 2	0.016	0.016	0.070	0.304	1.332
2	LP_2_P2	Diesel light plant Phase 2	0.016	0.016	0.070	0.304	1.332
2	LP_3_P2	Diesel light plant Phase 2	0.016	0.016	0.070	0.304	1.332
2	LP_4_P2	Diesel light plant Phase 2	0.016	0.016	0.070	0.304	1.332
2	LP_5_P2	Diesel light plant Phase 2	0.016	0.016	0.070	0.304	1.332
2	LP_6_P2	Diesel light plant Phase 2	0.016	0.016	0.070	0.304	1.332
2	LP_7_P2	Diesel light plant Phase 2	0.016	0.016	0.070	0.304	1.332
2	LP_8_P2	Diesel light plant Phase 2	0.016	0.016	0.070	0.304	1.332
2	LP_9_P2	Diesel light plant Phase 2	0.016	0.016	0.070	0.304	1.332
2	GEN_1_P2	Mine Pit Equipment Generator Phase 2	0.004	0.004	0.018	0.07	0.307
5	LP_1_P5	Diesel light plant Phase 5	0.016	0.016	0.070	0.304	1.332
5	LP_2_P5	Diesel light plant Phase 5	0.016	0.016	0.070	0.304	1.332
5	LP_3_P5	Diesel light plant Phase 5	0.016	0.016	0.070	0.304	1.332
5	LP_4_P5	Diesel light plant Phase 5	0.016	0.016	0.070	0.304	1.332
5	LP_5_P5	Diesel light plant Phase 5	0.016	0.016	0.070	0.304	1.332
5	LP_6_P5	Diesel light plant Phase 5	0.016	0.016	0.070	0.304	1.332
5	LP_7_P5	Diesel light plant Phase 5	0.016	0.016	0.070	0.304	1.332
5	LP_8_P5	Diesel light plant Phase 5	0.016	0.016	0.070	0.304	1.332
5	LP_9_P5	Diesel light plant Phase 5	0.016	0.016	0.070	0.304	1.332

Table 4. CRITERIA POLLUTANT EMISSIONS MODELED BY SOURCE – RVM FACILITY							
Phase[a]	Source ID	Source Description	PM_{10} (lb/hr)[b]	$PM_{2.5}$ (lb/hr)	$PM_{2.5}$ Ann (ton/yr)	NO_X (lb/hr)	NOxAnn (ton/yr)
5	GEN_1_P5	Mine Pit Equipment Generator Phase 5	0.004	0.004	0.018	0.07	0.307
8	LP_1_P8	Diesel light plant Phase 8	0.016	0.016	0.070	0.304	1.332
8	LP_2_P8	Diesel light plant Phase 8	0.016	0.016	0.070	0.304	1.332
8	LP_3_P8	Diesel light plant Phase 8	0.016	0.016	0.070	0.304	1.332
8	LP_4_P8	Diesel light plant Phase 8	0.016	0.016	0.070	0.304	1.332
8	LP_5_P8	Diesel light plant Phase 8	0.016	0.016	0.070	0.304	1.332
8	LP_6_P8	Diesel light plant Phase 8	0.016	0.016	0.070	0.304	1.332
8	LP_7_P8	Diesel light plant Phase 8	0.016	0.016	0.070	0.304	1.332
8	LP_8_P8	Diesel light plant Phase 8	0.016	0.016	0.070	0.304	1.332
8	LP_9_P8	Diesel light plant Phase 8	0.016	0.016	0.070	0.304	1.332
8	GEN_1_P8	Mine Pit Equipment Generator Phase 8	0.004	0.004	0.018	0.07	0.307
all	WEL_PMP1	Existing Dust Suppression Well	0.056	0.056	0.245	0.742	3.250
all	WEL_PMP2	New Dust Suppression Well	0.003	0.003	0.013	0.507	2.221
Area Sources							
2	PIT_2	Phase 2 Pit	0.255	0.095	0.415	0.754	3.303
5	PIT_5	Phase 5 Pit	0.255	0.095	0.415	0.754	3.303
8	PIT_8	Phase 8 Pit	0.255	0.095	0.415	0.754	3.303
Volume sources							
2	P2R_0001-0065	Phase 2 Haul Road	8.234	0.823	3.61	0	0
5	P5R_0001-0094	Phase 5 Haul Road	8.234	0.823	3.61	0	0
8	P8R_0001-137	Phase 8 Haul Road	8.234	0.823	3.61	0	0
2	PILE_2	North Storage Pile	0.00231	0.00035	0.002	0	0
5	PILE_5	Central Storage Pile	0.00231	0.00035	0.002	0	0
8	PILE_8	South Storage Pile	0.00231	0.00035	0.002	0	0
2	LOAD_2	Load/Unload North Storage Pile	0.176	0.0266	0.117	0	0
5	LOAD_5	Load/Unload Central Storage Pile	0.176	0.0266	0.117	0	0
8	LOAD_8	Load/Unload South Storage Pile	0.176	0.0266	0.117	0	0
TOTALS							
Phase 2			8.88	1.152	5.055	4.809	21.063
Phase 5			8.88	1.152	5.046	4.809	21.063
Phase 8			8.88	1.152	5.046	4.809	21.063

a. Operational phase of the RVM project.
b. Pounds per hour.
c. Tons per year.

Table 5. CRITERIA POLLUTANT EMISSIONS MODELED BY SOURCE – LANES CREEK FACILITY						
Source ID	**Source Description**	**PM_{10} (lb/hr)**	**PM_{25} (lb/hr)**	**PM_{25} Ann (ton/yr)**	**NO_2 (lb/hr)**	**NOxAnn (ton/yr)**
Point Sources						
LC_GEN_1	Diesel Generator	0.105	0.105	0.460	1.222	5.352
LC_GEN_2	Diesel Generator	0.105	0.105	0.460	1.222	5.352
LC_LP_ORE	Diesel Light Plant (ore stockpile)	0.019	0.019	0.083	0.173	0.758
LC_LP_FAC	Diesel Light Plant (facilities area)	0.019	0.019	0.083	0.173	0.758
LC_LPNSA	Diesel Light Plant (north OSA area)	0.019	0.019	0.083	0.173	0.758
LC_LPSSA	Diesel Light Plant (south OSA area)	0.019	0.019	0.083	0.173	0.758
LC_LPIT1	Diesel Light Plant (pit area -1)	0.019	0.019	0.083	0.173	0.758
LC_LPIT2	Diesel Light Plant (pit area -2)	0.019	0.019	0.083	0.173	0.758
LC_LPIT3	Diesel Light Plant (pit area -3)	0.019	0.019	0.083	0.173	0.758
LC_LPIT4	Diesel Light Plant (pit area -4)	0.019	0.019	0.083	0.173	0.758
LC_LPIT5	Diesel Light Plant (pit area -5)	0.019	0.019	0.083	0.173	0.758
Area Sources						
LC_DRILL	Pit Drilling	0.774	0.432	1.892	0.000	0.000
LC_BLAST	Pit Blasting	6.305	0.364	1.594	3.493	15.299
Volume Sources						
LC_Rd1_1-115	Pit to N. OSA Road - Segment 1	2.775	0.278	1.215	0.000	0.000
LC_RD2_1-11	Pit to S. OSA Road - Segment 5	2.134	0.213	0.935	0.000	0.000
LC_RD3_1-18	Pit to Ore Stockpile - Segment 17	1.006	0.101	0.441	0.000	0.000
LC_RD4_1-17	N. OSA to Growth Pile - Segment 7	0.206	0.021	0.090	0.000	0.000
LC_RD5_1-12	Pit to Growth Pile - Segment 1	0.244	0.024	0.107	0.000	0.000
LC_RD6_1-5	S OSA to Growth Pile - Segment 1	0.051	0.005	0.022	0.000	0.000
LC_RD7_1-11	Ore Stockpile to Growth Pile - Seg 1	0.145	0.015	0.064	0.000	0.000
LC_NOSAP	North OSA Pile	0.770	0.116	0.508	0.000	0.000
LC_SOSAP	South OSA Pile	0.770	0.116	0.508	0.000	0.000
LC_ORE_P	Ore Pile	1.510	0.227	0.994	0.000	0.000
LC_GRWTH	Growth Media Pile	0.282	0.042	0.186	0.000	0.000
LC_NOSAT	North OSA Truck Load/Unload	0.330	0.050	0.219	0.000	0.000
LC_SOSAT	South OSA Truck Load/Unload	0.364	0.055	0.241	0.000	0.000
LC_ORE_T	Ore Truck Load/Unload	0.175	0.027	0.117	0.000	0.000
LC_GRTHT	Growth Media Truck Load/Unload	0.059	0.009	0.039	0.000	0.000
LC_PIT_T	Pit Truck Loading	0.094	0.014	0.062	0.000	0.000

[a] Operational phase of the RVM project.
[b] Pounds per hour.
[c] Tons per year.

Secondary Particulate Formation

The impact from secondary particulate formation resulting from emissions of NOx, SO_2, and/or VOCs was assumed by DEQ to be negligible on the basis of the magnitude of emissions and the short distance from emissions sources to modeled receptors where maximum PM_{10} and $PM_{2.5}$ impacts would be anticipated.

3.1.2 Toxic Air Pollutant Emissions Rates

TAP emissions regulations under Idaho Air Rules Section 220 are only applicable for new or modified sources constructed after July 1, 1995. The submitted emissions inventory in the application identified four

TAPs that have potential emissions increases that exceed screening emissions levels (ELs) of Idaho Air Rules Section 586. Potential increases in emissions of other TAPs were all less than applicable ELs. Table 6 lists emission increases for these TAPs and compares them to the EL.

Table 6. MODELED TAP EMISSIONS RATES			
Pollutant	**CAS No.**	**Total Emissions Increase (lb/hr)[a]**	**EL (lb/hr)**
Arsenic	7440-38-2	4.47E-05	1.50E-06
Cadmium	7440-43-9	8.38E-05	3.70E-06
Iron	7439-89-6	7.87E-02	6.70E-02
Nickel	7440-02-0	4.29E-04	2.70E-05

a. Pounds per hour.

Table 7 provides source-specific TAP emission rates used in the air impact analyses.

Table 7. TAPS EMISSIONS MODELED BY SOURCE – RVM						
Phase[a]	**Source ID**	**Source Description**	**Arsenic (lb/hr)[b]**	**Cadmium (lb/hr)**	**Iron (lb/hr)**	**Nickel (lb/hr)**
2	PIT_2	Phase 2 Pit	2.94E-06	7.59E-06	0.00258	2.92E-05
5	PIT_5	Phase 5 Pit	2.94E-06	7.59E-06	0.00258	2.92E-05
8	PIT_8	Phase 8 Pit	2.94E-06	7.59E-06	0.00258	2.92E-05
2	P2R_0001-0065	Phase 2 Haul Road	4.06E-05	7.02E-05	7.47E-02	3.88E-04
5	P5R_0001-0094	Phase 5 Haul Road	4.06E-05	7.00E-05	7.46E-02	3.88E-04
8	P8R_0001-137	Phase 8 Haul Road	4.06E-05	7.00E-05	7.47E-02	3.88E-04
2	PILE_2	North Storage Pile	1.30E-08	4.10E-08	2.04E-05	1.25E-07
5	PILE_5	Central Storage Pile	1.30E-08	4.10E-08	2.04E-05	1.25E-07
8	PILE_8	South Storage Pile	1.30E-08	4.10E-08	2.04E-05	1.25E-07
2	LOAD_2	Load/Unload North Storage Pile	1.21E-06	6.18E-06	0.00148	1.18E-05
5	LOAD_5	Load/Unload Central Storage Pile	1.21E-06	6.18E-06	0.00148	1.18E-05
8	LOAD_8	Load/Unload South Storage Pile	1.21E-06	6.18E-06	0.00148	1.18E-05

a. Operational phase.
b. Pounds per hour.

3.1.3 Emission Release Parameters

Table 8 provides emissions release parameters, including stack height, stack diameter, exhaust temperature, and exhaust velocity for all RVM facility sources as used in the final air impact modeling assessment. Table 9 provides these parameters for all Lanes Creek facility sources as used in the final modeling assessment. Stack parameters used in the modeling analyses were largely documented/justified adequately in the application. Information for the Lanes Creek sources has been approved by DEQ in a prior application. The haul roads were modeled as adjacent volume sources pursuant to procedures adopted by the EPA Haul Road Workgroup [4]. These methods include:

Top of plume height: 1.7 × the vehicle height
Volume source release height: 0.5 x top of plume height
Width of plume: road width + 6m (for two lane road)
Sigma Z: top of plume ÷ 2.15
Sigma Y: width of plume ÷ 2.15

Table 8. MODELED SOURCE RELEASE -PARAMETERS FOR RVM								
Point Sources								
Phase	**Source ID**	**Source Description**	**Easting[a] (X) (m)[c]**	**Northing[b] (Y) (m)**	**Stack Ht (ft)[d]**	**Temp (°F)[e]**	**Exit Velocity (fps)[f]**	**Stack Diam (ft)[d]**
2	LP_1_P2	Diesel light plant Phase 2	470933.24	4743772.2	6.17	869	172.70	0.13
2	LP_2_P2	Diesel light plant Phase 2	471093.61	4743822.38	6.17	869	172.70	0.13
2	LP_3_P2	Diesel light plant Phase 2	471235.84	4743789.94	6.17	869	172.70	0.13
2	LP_4_P2	Diesel light plant Phase 2	471331.9	4743738.79	6.17	869	172.70	0.13
2	LP_5_P2	Diesel light plant Phase 2	471264.53	4743605.3	6.17	869	172.70	0.13
2	LP_6_P2	Diesel light plant Phase 2	471170.96	4743620.27	6.17	869	172.70	0.13
2	LP_7_P2	Diesel light plant Phase 2	471126.05	4743646.47	6.17	869	172.70	0.13
2	LP_8_P2	Diesel light plant Phase 2	471021.25	4743682.65	6.17	869	172.70	0.13
2	LP_9_P2	Diesel light plant Phase 2	471203.08	4743469.08	6.17	869	172.70	0.13
2	GEN_1_P2	Mine Pit Equipment Generator Phase 2	471121.4	4743731.7	7.61	835	135.54	0.25
5	LP_1_P5	Diesel light plant Phase 5	472213.31	4743311.79	6.17	869	172.70	0.13
5	LP_2_P5	Diesel light plant Phase 5	472349.31	4743261.25	6.17	869	172.70	0.13
5	LP_3_P5	Diesel light plant Phase 5	472588.85	4743038.97	6.17	869	172.70	0.13
5	LP_4_P5	Diesel light plant Phase 5	472614.75	4742885.75	6.17	869	172.70	0.13
5	LP_5_P5	Diesel light plant Phase 5	472517.64	4742937.55	6.17	869	172.70	0.13
5	LP_6_P5	Diesel light plant Phase 5	472478.79	4742985.02	6.17	869	172.70	0.13
5	LP_7_P5	Diesel light plant Phase 5	472350.08	4743045.25	6.17	869	172.70	0.13
5	LP_8_P5	Diesel light plant Phase 5	472252.2	4743144.72	6.17	869	172.70	0.13
5	LP_9_P5	Diesel light plant Phase 5	471705.3	4743293.54	6.17	869	172.70	0.13
5	GEN_1_P5	Mine Pit Equipment Generator Phase 5	472381.68	4743138.24	7.61	835	135.54	0.25
8	LP_1_P8	Diesel light plant Phase 8	473434.17	4742199.07	6.17	869	172.70	0.13
8	LP_2_P8	Diesel light plant Phase 8	473520.11	4742203.68	6.17	869	172.70	0.13
8	LP_3_P8	Diesel light plant Phase 8	473628.01	4742108.68	6.17	869	172.70	0.13
8	LP_4_P8	Diesel light plant Phase 8	473719.48	4741904.62	6.17	869	172.70	0.13
8	LP_5_P8	Diesel light plant Phase 8	473606.9	4741925.73	6.17	869	172.70	0.13
8	LP_6_P8	Diesel light plant Phase 8	473504.73	4741982.15	6.17	869	172.70	0.13
8	LP_7_P8	Diesel light plant Phase 8	473458.44	4742013.96	6.17	869	172.70	0.13
8	LP_8_P8	Diesel light plant Phase 8	473388.47	4742077.31	6.17	869	172.70	0.13
8	LP_9_P8	Diesel light plant Phase 8	473078.08	4742202.22	6.17	869	172.70	0.13
8	GEN_1_P8	Mine Pit Equipment Generator Phase 8	473524.14	4742086.33	7.61	835	135.54	0.25
All	WEL_PMP1	Existing Dust Suppression Well	473986.71	4741917.37	9.05	1094	101.76	0.38
All	WEL_PMP2	New Dust Suppression Well	471760.95	4743695.46	5.15	1078	125.80	0.20

a. Universal Transverse Mercator coordinates in the east/west direction.
b. Universal Transverse Mercator coordinates in the north/south direction.
c. Meters.
d. Feet.
e. Degrees Fahrenheit.
f. Feet per second.

Table 8 (continued). MODELED SOURCE RELEASE PARAMETERS

Area Sources

Phase	Source ID	Source Description	Easting[a] (X) (m)[c]	Northing[b] (Y) (m)	Release Height (ft)[d]	Easterly Length (ft)	Northerly Length (ft)	Angle from North	Initial Vert. Dimension (m)
2	PIT_2	Phase 2 Pit	470965.98	4743666.36	15	1000	500	0	4.572
5	PIT_5	Phase 5 Pit	472175.84	4743215.99	15	1500	500	40	4.572

Volume Sources

Phase	Source ID	Source Description	Easting (X) (m)	Northing (Y) (m)	Release Height (ft)	Init. Horiz. Dimension (ft)	Initial Vert. Dimension (ft)
2	P2R_0001-0065	Phase 2 Haul Road	Varies (65 sources)		11.56	55.81	10.75
5	P5R_0001-0094	Phase 5 Haul Road	Varies (94 sources)		11.56	55.81	10.75
8	P8R_0001-137	Phase 8 Haul Road	Varies (137 sources)		11.56	55.81	10.75
2	PILE_2	North Storage Pile	471176.13	4743387.19	115	205.4	53.49
5	PILE_5	Central Storage Pile	471679.76	4743244.41	115	205.4	53.49
8	PILE_8	South Storage Pile	473009.53	4742142.93	115	205.4	53.49
2	LOAD_2	Load/Unload North Storage Pile	471176.13	4743387.19	13.6	8.14	3.16
5	LOAD_5	Load/Unload Central Storage Pile	471679.76	4743244.41	13.6	8.14	3.16
8	LOAD_8	Load/Unload South Storage Pile	473009.53	4742142.93	13.6	8.14	3.16

a. Meters.
b. Universal Transverse Mercator coordinates in the east/west direction.
c. Universal Transverse Mercator coordinates in the north/south direction.
d. Feet.

Table 9. MODELED SOURCE RELEASE PARAMETERS FOR LANES CREEK FACILITY							
Point Sources							
Source ID	Source Description	Easting[a] (X) (m)[c]	Northing[b] (Y) (m)	Stack Ht (ft)[d]	Temp (°F)[e]	Exit Velocity (fps)[f]	Stack Diam (ft)[d]
LC_GEN_1	Diesel Generator	473972.24	4743666.04	6	797	152.73	0.34
LC_GEN_2	Diesel Generator	473977.92	4743648.99	6	797	152.73	0.34
LC_LP_ORE	Diesel Light Plant (ore stockpile)	473999	4742427	4	800	114.28	0.09
LC_LP_FAC	Diesel Light Plant (facilities area)	473991.18	4743712.13	4	800	114.28	0.09
LC_LPNSA	Diesel Light Plant (north OSA area)	473677	4744105	4	800	114.28	0.09
LC_LPSSA	Diesel Light Plant (south OSA area)	473967.28	4743004.79	4	800	114.28	0.09
LC_LPIT1	Diesel Light Plant (pit area -1)	473549	4743567	4	800	114.28	0.09
LC_LPIT2	Diesel Light Plant (pit area -2)	473710	4743238	4	800	114.28	0.09
LC_LPIT3	Diesel Light Plant (pit area -3)	474175	4743282	4	800	114.28	0.09
LC_LPIT4	Diesel Light Plant (pit area -4)	474036.16	4743521.33	4	800	114.28	0.09
LC_LPIT5	Diesel Light Plant (pit area -5)	473695	4743960	4	800	114.28	0.09

a. Universal Transverse Mercator coordinates in the east/west direction.
b. Universal Transverse Mercator coordinates in the north/south direction.
c. Meters.
d. Feet.
e. Degrees Fahrenheit.
f. Feet per second.

Table 9 (continued). MODELED SOURCE RELEASE PARAMETERS FOR LANES CREEK FACILITY								
Area Sources								
Source ID	Source Description	Easting (X)[a] (m)[c]	Northing (Y)[b] (m)	Release Height (ft)[d]	Easterly Length (ft)	Northerly Length (ft)	Angle from North	Initial Vert. Dimen. (m)
LC_DRILL	Pit Drilling	473829.99	4743348.88	32.810039	173.209974	173.209974	-25	0.9997
LC_BLAST	Pit Blasting	473744.18	4743543.86	65.620079	173.209974	173.209974	-25	10.0005

Volume Sources						
Source ID	Source Description	Easting (X) (m)	Northing (Y) (m)	Release Height (ft)	Init. Horiz. Dimen. (ft)	Initial Vert. Dimen. (ft)
LC_Rd1_1-115	Pit to N. OSA Road - Segment 1	Varies (115 sources)		13.60	46.51	12.65
LC_RD2_1-11	Pit to S. OSA Road - Segment 5	Varies (11 sources)		13.60	46.51	12.65
LC_RD3_1-18	Pit to Ore Stockpile - Segment 17	Varies (18 sources)		13.60	46.51	12.65
LC_RD4_1-17	N. OSA to Growth Pile - Segment 7	Varies (17 sources)		13.60	46.51	12.65
LC_RD5_1-12	Pit to Growth Pile - Segment 1	Varies (12 sources)		13.60	46.51	12.65

LC_RD6_1-5	S OSA to Growth Pile - Segment 1	Varies (5 sources)		13.60	46.51	12.65
LC_RD7_1-11	Ore Stockpile to Growth Pile - Seg 1	Varies (11 sources)		13.60	46.51	12.65
LC_NOSAP	North OSA Pile	473717.69	4744039.28	135.00	279.07	62.79
LC_SOSAP	South OSA Pile	473994.51	4742866.66	115.00	279.07	53.49
LC_ORE_P	Ore Pile	474027.15	4742456.12	45.00	148.00	20.93
LC_GRWTH	Growth Media Pile	474411.96	4743225.56	25.00	139.53	11.63
LC_NOSAT	North OSA Truck Load/Unload	473718.21	4743994.03	14.00	8.14	3.16
LC_SOSAT	South OSA Truck Load/Unload	473994.45	4742922.39	14.00	8.14	3.16
LC_ORE_T	Ore Truck Load/Unload	474031.84	4742528.33	14.00	8.14	3.16
LC_GRTHT	Growth Media Truck Load/Unload	474357.13	4743165.04	14.00	8.14	3.16
LC_PIT_T	Pit Truck Loading	473831.52	4743502.99	14.00	8.14	3.16

3.2 Background Concentrations

Background concentrations were obtained by RTP from the Northwest International Air Quality Environmental Science and Technology Consortium (NW AIRQUEST) *Lookup 2009-2011 Design Values of Criteria Pollutants*[2]. These design value air pollutant levels are based on regional scale air pollution modeling of Washington, Oregon, and Idaho, with values influenced by monitoring data as a function of distance from the monitor. DEQ has determined that the NW AIRQUEST background values are reasonably representative of the facility locale. NW AIRQUEST background concentration values are provided in Table 11.

3.3 Impact Modeling Methodology

This section describes the modeling methods used by the applicant to demonstrate preconstruction compliance with applicable air quality standards.

3.3.1 General Overview of Analyses

RVM performed project-specific air impact analyses that were determined by DEQ to be reasonably representative of the proposed facility as described in the application. Results of the submitted analyses demonstrate compliance with applicable air quality standards to DEQ's satisfaction, provided the facility is operated as described in the submitted application and in this memorandum. RTP modeled 3 separate phases, (2, 5, and 8) with worst case emissions to determine maximum impacts. The nearby existing mining operation Lanes Creek, also owned by Agrium, was included in the modeling analyses due to its close proximity. Impacts from the Lake Creek facility are not included in the assessment of impacts within the ambient boundary of Lakes Creek itself, per NSR modeling guidelines.

Table 10 provides a brief description of parameters used in the modeling analyses.

Table 10. MODELING PARAMETERS

Parameter	Description/Values	Documentation/Addition Description
General Facility Location	18 miles northeast of Soda Springs, ID	The facility is located in an area that is attainment or unclassified for all criteria air pollutants
Model	AERMOD	AERMOD with the PRIME downwash algorithm, version 15181.
Meteorological Data	2004-2008 Soda Springs onsite, NWS from Pocatello ID(24156), and upper	The meteorological model input files for this project were provided by and recommended as most representative for this project by IDEQ, as described in the IDEQ modeling protocol and verified by IDEQ's approval of that protocol. RTP reprocessed this data with the latest version of AERMET, 15181.

	air data from Boise, ID	
Terrain	Considered	See section 5.3 below
Building Downwash	Not Considered	Because there are no significant buildings in the vicinity of PVM, BPIP-PRIME was not used to evaluate building dimensions for consideration of downwash effects in AERMOD.
Receptor Grid	**Significant Impact Analyses**	
	Grid 1	25-meter spacing along the ambient air boundary and the county road southwest of the facility out to distance of 150 meters
	Grid 2	100-meter spacing for distances out to 2,500 meters of facility in elevated terrain
	Grid 3	250-meter spacing for distances out to 5,000 meters from the facility

3.3.2 Modeling protocol and Methodology

A modeling protocol was submitted for this project on December 18, 2015. This protocol incorporated several discussions with DEQ to assure methodologies prior to submittal. This protocol was approved with conditions on January 28, 2016 by DEQ. The application was submitted on June 23, 2016. DEQ responded with a letter of completeness on July 15, 2016.

RTP followed the procedures outlined in the submitted modeling protocol. Project-specific modeling and other required impact analyses were generally conducted using data and methods discussed in pre-application correspondence and in the *Idaho Air Quality Modeling Guideline*[1].

3.3.3 Model Selection

Idaho Air Rules Section 202.02 requires that estimates of ambient concentrations be based on air quality models specified in 40 CFR 51, Appendix W (Guideline on Air Quality Models). The refined, steady state, multiple source Gaussian dispersion model AERMOD was promulgated as the replacement model for ISCST3 in December 2005. AERMOD retains the single straight line trajectory of ISCST3, but includes more advanced algorithms to assess turbulent mixing processes in the planetary boundary layer for both convective and stable stratified layers.

AERMOD version 15181 was used by the applicant for the modeling analyses to evaluate impacts of the facility. This version is the current version at the time the application was received by DEQ.

3.3.4 Meteorological Data

RTP used meteorological data collected onsite in Soda Springs by P4 for the period 2004-2008, and supplemented it with NWS data from the Pocatello Idaho, airport, (ID 24156). These data were also used with previously submitted applications in this local. Upper air data was taken from the Boise, Idaho airport. This data has been approved by DEQ previously, and is deemed representative for modeling in the locale of RVM. RTP reprocessed the data with the latest version of AERMET (15181).

3.3.5 Effects of Terrain on Modeled Impacts

Terrain data were extracted from United States Geological Survey (USGS) National Elevation Dataset (NED) files in the WGS84 datum (approximately equal to the NAD83 datum). RTP used 1 Second resolution data, which is adequate for this analysis.

The terrain preprocessor AERMAP Version 11103 was used to extract the elevations from the NED files and assign them to receptors in the modeling domain in a format usable by AERMOD. AERMAP also determined the hill-height scale for each receptor. The hill-height scale is an elevation value based on the surrounding terrain which has the greatest effect on that individual receptor. AERMOD uses those heights to evaluate whether the emissions plume has sufficient energy to travel up and over the terrain or if the plume will travel around the terrain.

DEQ reviewed the area surrounding the facility by using the web-based mapping program Google Earth, which uses the WGS84 datum. DEQ also overlaid modeling files with a digital photograph background images acquired from the 2013 ARCGIS NAIP (National Agriculture Imagery Program) data base. The immediate area is effectively flat with regard to dispersion modeling affects. Elevations in the modeling domain matched those indicated by the background images

3.3.6 Facility Layout

DEQ compared site locations to those in aerial photographs on Google Earth. The modeled location matched well with aerial photographs in Google Earth as well as from those in the ARCGIS 2013 NAIP database.

3.3.7 Effects of Building Downwash on Modeled Impacts

Potential downwash effects on emissions plumes are usually accounted for in the model by using building dimensions and locations (locations of building corners, base elevation, and building heights). Dimensions and orientation of proposed buildings were not needed as input to the Building Profile Input Program for the Plume Rise Model Enhancements downwash algorithm (BPIP-PRIME) because there are no existing structures affecting the proposed and existing sources.

3.3.8 Ambient Air Boundary

Ambient air is defined in Section 006 of the Idaho Air Rules as "that portion of the atmosphere, external to buildings, to which the general public has access." Because of the size and location, RVM does not have a physical barrier such as a fence surrounding the operation. However, as with similar projects permitted by DEQ, RVM has a well-defined facility mine lease boundary which discourages general public access to the facility by means of signs, staff, and physical characteristics of the operation. The boundary is consistent with that utilized in prior application for mining operations in the area and accepted by DEQ.

3.3.9 Receptor Network

Table 10 describes the receptor grid used in the submitted analyses. The receptor grid met the minimum recommendations specified in the *Idaho Air Quality Modeling Guideline*[1]. DEQ determined this grid assured maximum impacts were reasonably resolved by the model considering: 1) types of sources modeled; 2) modeled impacts and the modeled concentration gradient; 3) conservatism of the methods and data used as inputs to the analyses; 4) potential for continual exposures or exposure to sensitive receptors. Additionally, DEQ performed sensitivity analyses using a finer grid spaced receptor network to assure that maximum concentrations were below all applicable standards.

3.3.10 Good Engineering Practice Stack Height

An allowable good engineering practice (GEP) stack height may be established using the following equation in accordance with Idaho Air Rules Section 512.03.b:

H = S + 1.5L, where:

H = good engineering practice stack height measured from the ground-level elevation at the base of the stack.

S = height of the nearby structure(s) measured from the ground-level elevation at the base of the stack.

L = lesser dimension, height or projected width, of the nearby structure.

No buildings exist in the vicinity for all point sources modeled. Therefore, consideration of downwash caused by nearby buildings was not required.

4.0 Impact Modeling Results

4.1 Results for NAAQS Significant Impact Level Analyses

RTP performed air impact dispersion modeling for those criteria pollutants having emissions exceeding level I modeling thresholds ($PM_{2.5}$ and NO_2). RTP chose not to model for comparison to SILs. Therefore, cumulative NAAQS impact analyses were needed for $PM_{2.5,}$ PM_{10}, and NO_2. The results from the cumulative modeling analyses with all sources for these pollutants are listed in Table 11 and shows compliance with NAAQS. It should be noted that modeled impacts within the ambient boundary of the Lanes Creek facility should not include contributions from the Lanes Creek facility itself, and the results listed below reflect this. A Tier 2 method of conversion of NO to NO_2 was used in this analysis.

Table 11. CUMULATIVE NAAQS IMPACT ANALYSES FOR CRITERIA POLLUTANTS

Pollutant	Averaging Period	Maximum Modeled Concentration ($\mu g/m^3$)[a]	Background Concentration ($\mu g/m^3$)	Total Impact ($\mu g/m^3$)	NAAQS[b] ($\mu g/m^3$)
PM_{10}	24-hour	105.8[c]	34.0	139.8	150
$PM_{2.5}$	24-hour	16.3	6.5	22.8	35
	Annual	8.0	1.8	9.8	12.0
NO_2	1-hour	63.5[c]	17.2	80.7	188
	Annual	34.6	1.5	36.1	100

a. Micrograms per cubic meter.
b. National Ambient Air Quality Standard.
c. Maximum concentration from all sources; impacts from the Lanes Creek Facility are excluded at receptors located within the ambient air boundary for Lanes Creek Facility.

4.2 Results for TAPs Impact Analyses

Dispersion modeling is required to demonstrate compliance with TAP increments specified by Idaho Air

Rules Section 585 and 586 for those TAPs with project-specific emission increases exceeding emissions screening levels (ELs). Because there are four TAPs emissions that exceed the ELs, modeling analyses were needed to demonstrate compliance with AACs and AAACs associated with those TAPs. Results are listed in Table 12, and show compliance with applicable AAC and AAAC.

Table 13. TAP MODELING RESULTS

Pollutant	CAS No.	Average	Modeled Conc. (μg/m³)[a]	AAC/AAAC[b] (μg/m³)[a]	%AAC/AAAC
Arsenic	7440-38-2	Annual	1.40E-05	2.3E-04	61%
Cadmium	7440-43-9	Annual	3.10E-04	5.6E-04	55%
Iron	7439-89-6	24-hour [c]	1.24E-00	5.0E+01	2%
Nickel	7440-02-0	Annual	1.34E-03	4.2E-03	32%

a. micrograms per cubic meter.
b. Acceptable Ambient Concentration or Acceptable Ambient Concentration of a Carccinogen.
c. Corrected; listed in modeling report as "Annual."

5.0 Conclusions

The ambient air impact analyses and other air quality analyses submitted with the PTC application demonstrated to DEQ's satisfaction that emissions from the proposed RVM project will not cause or significa ntly contribute to a violation of any ambient air quality standard.

References:

1. *State of Idaho Guideline for Performing Air Quality Impact Analyses.* Idaho Department of Environmental Quality. September 2013. State of Idaho DEQ Air Doc. ID AQ-011. Available at http://www.deq.idaho.gov/media/1029/modeling-guideline.pdf.

2. Air Quality Environmental Science and Technology Consortium (NW AIRQUEST). *Lookup 2009-2011 Design Values of Criteria Pollutants*. Available at: http://lar.wsu.edu/nw-airquest/lookup.html.

3. Draft Environmental Impact Statement, Rasmussen Valley Mine, September 2015

4. Haul Road Workgroup Final Report, EPA Region 5, March 2, 2012

PTC Prcessing Fee Calculation Worksheet

Instructions:
Fill in the following information and answer the following questions with a Y or N. Enter the emissions increases and decreases for each pollutant in the table.

Company:	**Nu-West Industries, Inc. (Agrium)**
Address:	**Approximately 18 miles Northeast of**
City:	**Soda Springs**
State:	**ID**
Zip Code:	**83276**
Facility Contact:	**Alan Haslam**
Title:	**Director of Mining**
AIRS No.:	**029-00044**

N	Does this facility qualify for a general permit (i.e. concrete batch plant, hot-mix asphalt plant)? Y/N
Y	Did this permit require engineering analysis? Y/N
N	Is this a PSD permit Y/N (IDAPA 58.01.01.205.04)

Emissions Inventory			
Pollutant	Annual Emissions Increase (T/yr)	Annual Emissions Reduction (T/yr)	Annual Emissions Change (T/yr)
NO_X	17.8	0	17.8
SO_2	0.0	0	0.0
CO	20.8	0	20.8
PM10	0.9	0	0.9
VOC	4.5	0	4.5
TAPS/HAPS	0.0	0	0.0
Total:	0.0	0	**44.0**
Fee Due	**$ 5,000.00**		

Comments:

Criteria Pollutant Potential to Emit Emissions Summary, Rasmussen Valley Mine Proposed Action															
Emission Source	PM_{10}		$PM_{2.5}$		SO_2		NO_X		CO		VOC		CO		
	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr		
Stationary Fuel Combustion Sources															
Diesel Light Plant 1	0.016	0.071	0.016	0.071	0.000	0.001	0.3	1.3	0.27	1.2	0.06	0.27	28		
Diesel Light Plant 2	0.016	0.071	0.016	0.071	0.000	0.001	0.3	1.3	0.27	1.2	0.06	0.27	28		
Diesel Light Plant 3	0.016	0.071	0.016	0.071	0.000	0.001	0.3	1.3	0.27	1.2	0.06	0.27	28		
Diesel Light Plant 4	0.016	0.071	0.016	0.071	0.000	0.001	0.3	1.3	0.27	1.2	0.06	0.27	28		
Diesel Light Plant 5	0.016	0.071	0.016	0.071	0.000	0.001	0.3	1.3	0.27	1.2	0.06	0.27	28		
Diesel Light Plant 6	0.016	0.071	0.016	0.071	0.000	0.001	0.3	1.3	0.27	1.2	0.06	0.27	28		
Diesel Light Plant 7	0.016	0.071	0.016	0.071	0.000	0.001	0.3	1.3	0.27	1.2	0.06	0.27	28		
Diesel Light Plant 8	0.016	0.071	0.016	0.071	0.000	0.001	0.3	1.3	0.27	1.2	0.06	0.27	28		
Diesel Light Plant 9	0.016	0.071	0.016	0.071	0.000	0.001	0.3	1.3	0.27	1.2	0.06	0.27	28		
Existing Dust Suppression Well	0.056	0.244	0.056	0.244	0.001	0.005	0.7	3.2	0.9	4.1	0.28	1.24	129		
New Dust Suppression Well	0.003	0.014	0.003	0.014	0.001	0.003	0.5	2.2	0.5	2.4	0.17	0.72	75		
Ready Line	0.004	0.015	0.004	0.015	0.001	0.005	0.1	0.3	0.9	3.8	0.03	0.15	123		
Point Source Subtotals	**0.21**	**0.9**	**0.21**	**0.9**	**0.01**	**0.0**	**4.05**	**17.8**	**4.75**	**20.8**	**1.04**	**4.6**	**582**		
Mining Fugitives															
Drilling	0.069	0.304	0.069	0.304	--	--	--	--	--	--	--	--	--		
Blasting & Explosives	0.019	0.085	0.001	0.005	0.089	0.39	0.75	3.3	3.0	13.0	--	--	--		
Screening	0.010	0.011	0.001	0.001	--	--	--	--	--	--	--	--	--		
Haul Road - Pit to Overburden Pile	4.1	18.0	0.4	1.8											
Haul Road - Pit to Ore Stockpile/Lease Boundry	4.1	18.0	0.4	1.8											
Ore Loading at Pit	0.0202	0.089	0.0031	0.0134											
Ore Unloading at Pile	0.0202	0.089	0.0031	0.0134											
Ore Loading at Pile	0.0202	0.089	0.0031	0.0134											
Overburden Loading at Pit	0.0746	0.327	0.0113	0.0494											
Overburden Unloading at Pile	0.0746	0.327	0.0113	0.0494											
Overburden Loading at Pile	0.0609	0.267	0.0092	0.0404											
Overburdent Unloading Pit Refill	0.0609	0.267	0.0092	0.0404											
Wind Erosion - GM and OB Piles	0.0021	0.009	0.0003	0.0014											
Wind Erosion - Ore Stock Piles	0.0002	0.0008	0.0000	0.0001											
Fugitive Source Subtotals	**8.7**	**37.9**	**0.9**	**4.1**	**0.1**	**0.4**	**0.8**	**3.3**	**3.0**	**13.0**	**0.0**	**0.0**	**0.0**		
Project Totals	**9**	**39**	**1**	**5**	**0**	**0**	**5**	**21**	**8**	**34**	**1**	**5**	**582**		

Notes:

Emissions are based on 8760 hours/year, except for screening which is based on operating three months per year (2190 hours/year).

7.3 32.0 0.8 3.6

Combustion Emission Source	Benzene		Toluene		Xylenes		Formaldehyde		Acetaldehyde		Acrolein		Naphtl
	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr
Stationary Fuel Combustion Sources													
Diesel Light Plant 1	1.61E-04	7.07E-04	7.07E-05	3.10E-04	4.93E-05	2.16E-04	2.04E-04	8.94E-04	1.33E-04	5.81E-04	1.60E-05	7.01E-05	1.47E-05
Diesel Light Plant 2	1.61E-04	7.07E-04	7.07E-05	3.10E-04	4.93E-05	2.16E-04	2.04E-04	8.94E-04	1.33E-04	5.81E-04	1.60E-05	7.01E-05	1.47E-05
Diesel Light Plant 3	1.61E-04	7.07E-04	7.07E-05	3.10E-04	4.93E-05	2.16E-04	2.04E-04	8.94E-04	1.33E-04	5.81E-04	1.60E-05	7.01E-05	1.47E-05
Diesel Light Plant 4	1.61E-04	7.07E-04	7.07E-05	3.10E-04	4.93E-05	2.16E-04	2.04E-04	8.94E-04	1.33E-04	5.81E-04	1.60E-05	7.01E-05	1.47E-05
Diesel Light Plant 5	1.61E-04	7.07E-04	7.07E-05	3.10E-04	4.93E-05	2.16E-04	2.04E-04	8.94E-04	1.33E-04	5.81E-04	1.60E-05	7.01E-05	1.47E-05
Diesel Light Plant 6	1.61E-04	7.07E-04	7.07E-05	3.10E-04	4.93E-05	2.16E-04	2.04E-04	8.94E-04	1.33E-04	5.81E-04	1.60E-05	7.01E-05	1.47E-05
Diesel Light Plant 7	1.61E-04	7.07E-04	7.07E-05	3.10E-04	4.93E-05	2.16E-04	2.04E-04	8.94E-04	1.33E-04	5.81E-04	1.60E-05	7.01E-05	1.47E-05
Diesel Light Plant 8	1.61E-04	7.07E-04	7.07E-05	3.10E-04	4.93E-05	2.16E-04	2.04E-04	8.94E-04	1.33E-04	5.81E-04	1.60E-05	7.01E-05	1.47E-05
Diesel Light Plant 9	1.61E-04	7.07E-04	7.07E-05	3.10E-04	4.93E-05	2.16E-04	2.04E-04	8.94E-04	1.33E-04	5.81E-04	1.60E-05	7.01E-05	1.47E-05
Existing Dust Suppression Well	7.38E-04	3.23E-03	3.24E-04	1.42E-03	2.25E-04	9.87E-04	9.33E-04	4.09E-03	6.07E-04	2.66E-03	7.32E-05	3.20E-04	6.71E-05
New Dust Suppression Well	4.29E-04	1.88E-03	1.88E-04	8.24E-04	1.31E-04	5.74E-04	5.43E-04	2.38E-03	3.53E-04	1.55E-03	4.25E-05	1.86E-04	3.90E-05
Ready Line	6.99E-04	3.06E-03	3.06E-04	1.34E-03	2.13E-04	9.35E-04	8.84E-04	3.87E-03	5.74E-04	2.52E-03	6.93E-05	3.03E-04	6.35E-05
Project Totals		**1.45E-02**		**6.37E-03**		**4.44E-03**		**1.84E-02**		**1.19E-02**		**1.44E-03**	

Table title (printed above the table): ***Combustion Source Hazardous Air Pollutant Potential to Emit Emissions Summary, Rasmussen Valley Mine Proposed Action***

Notes:

1. Emissions are based on 8760 hours/year.

₂e
tons/yr
124
124
124
124
124
124
124
124
124
567
330
537
2,548
--
--
--
0.0
2,548

halene
tons/yr
6.42E-05
6.42E-05
6.42E-05
6.42E-05
6.42E-05
6.42E-05
6.42E-05
6.42E-05
6.42E-05
2.94E-04
1.71E-04
2.78E-04
1.32E-03

Agrium - Rasmussen Valley Mine Fugitive PM Metal TAPs

		Aluminum	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Cobalt[3]	Copper	Iron	Manganese	Mercury[3]	Molybdenum	Nickel	Selenium
Source Description	Material	**Annual PM10 (lb/hr)**	**Annual PM10 (lb/hr)**	**Annual PM10 (lb/hr)**	**Annual PM10 (lb/hr)**	**Annual PM10 (lb/hr)**	**Annual PM10 (lb/hr)**	**Annual PM10 (lb/hr)**	**Annual PM10 (lb/hr)**	**Annual PM10 (lb/hr)**	**Annual PM10 (lb/hr)**	**Annual PM10 (lb/hr)**	**Annual PM10 (lb/hr)**	**Annual PM10 (lb/hr)**	**Annual PM10 (lb/hr)**
Pit Drilling	ROM	6.4E-04	3.0E-07	1.5E-06	8.0E-08	2.1E-06	3.8E-05	1.4E-06	4.3E-06	9.0E-04	9.6E-06	8.3E-11	1.8E-06	1.5E-05	6.0E-06
Pit Blasting	ROM	1.8E-04	8.5E-08	4.1E-07	2.2E-08	5.8E-07	1.1E-05	3.9E-07	1.2E-06	2.5E-04	2.7E-06	2.3E-11	5.0E-07	4.1E-06	1.7E-06
Screening	ore	2.4E-05	1.4E-08	3.4E-08	4.1E-09	3.2E-07	2.0E-06	5.1E-08	2.0E-07	1.6E-05	1.1E-07	3.0E-12	5.6E-08	3.4E-07	1.6E-07
Haul Road - Pit to Overburden Pile	low Se OB	3.1E-02	2.2E-06	2.0E-05	2.2E-06	3.5E-05	3.4E-04	8.2E-05	8.7E-05	3.7E-02	9.0E-04	4.9E-09	1.1E-05	1.9E-04	1.6E-05
Haul Road - Pit to Ore Stockpile/Lease Boundry	low Se OB	3.1E-02	2.2E-06	2.0E-05	2.2E-06	3.5E-05	3.4E-04	8.2E-05	8.7E-05	3.7E-02	9.0E-04	4.9E-09	1.1E-05	1.9E-04	1.6E-05
Ore Loading at Pit	ore	1.9E-04	1.1E-07	2.7E-07	3.3E-08	2.5E-06	1.6E-05	4.0E-07	1.6E-06	1.3E-04	8.7E-07	2.4E-11	4.5E-07	2.7E-06	1.3E-06
Ore Unloading at Pile	ore	1.9E-04	1.1E-07	2.7E-07	3.3E-08	2.5E-06	1.6E-05	4.0E-07	1.6E-06	1.3E-04	8.7E-07	2.4E-11	4.5E-07	2.7E-06	1.3E-06
Ore Loading at Pile	ore	1.9E-04	1.1E-07	2.7E-07	3.3E-08	2.5E-06	1.6E-05	4.0E-07	1.6E-06	1.3E-04	8.7E-07	2.4E-11	4.5E-07	2.7E-06	1.3E-06
Overburden Loading at Pit	low Se OB	5.6E-04	4.0E-08	3.7E-07	4.0E-08	6.3E-07	6.2E-06	1.5E-06	1.6E-06	6.8E-04	1.6E-05	8.9E-11	2.0E-07	3.5E-06	3.0E-07
Overburden Unloading at Pile	low Se OB	5.6E-04	4.0E-08	3.7E-07	4.0E-08	6.3E-07	6.2E-06	1.5E-06	1.6E-06	6.8E-04	1.6E-05	8.9E-11	2.0E-07	3.5E-06	3.0E-07
Overburden Loading at Pile	low Se OB	4.6E-04	3.2E-08	3.0E-07	3.3E-08	5.2E-07	5.0E-06	1.2E-06	1.3E-06	5.5E-04	1.3E-05	7.3E-11	1.6E-07	2.9E-06	2.4E-07
Overburdent Unloading Pit Refill	low Se OB	4.6E-04	3.2E-08	3.0E-07	3.3E-08	5.2E-07	5.0E-06	1.2E-06	1.3E-06	5.5E-04	1.3E-05	7.3E-11	1.6E-07	2.9E-06	2.4E-07
Wind Erosion- Growth Media & Overburden Piles	low Se OB	1.6E-05	1.1E-09	1.0E-08	1.2E-09	1.8E-08	1.8E-07	4.3E-08	4.5E-08	1.9E-05	4.7E-07	2.6E-12	5.7E-09	1.0E-07	8.4E-09
Wind Erosion- Ore Stock Pile	ore	1.8E-06	9.8E-10	2.5E-09	3.0E-10	2.3E-08	1.4E-07	3.7E-09	1.5E-08	1.2E-06	7.9E-09	2.2E-13	4.1E-09	2.5E-08	1.2E-08
	Toal, lb/hr	6.6E-02	5.2E-06	4.5E-05	4.8E-06	8.3E-05	8.0E-04	1.7E-04	1.9E-04	7.9E-02	1.9E-03	1.0E-08	2.7E-05	4.3E-04	4.5E-05
	EL, lb/hr	1.3E-01	3.3E-02	1.5E-06	2.8E-05	3.7E-06	3.3E-02	3.3E-03	6.7E-02	6.7E-02	3.3E-01	2.9E-03	3.3E-01	2.7E-05	1.3E-02
	over EL	NO	NO	YES	NO	YES	NO	NO	NO	YES	NO	NO	NO	YES	NO
Emission Fraction	low Se OB [1]	7.6E-03	5.3E-07	4.9E-06	5.4E-07	8.5E-06	8.2E-05	2.0E-05	2.1E-05	9.1E-03	2.2E-04	1.2E-09	2.7E-06	4.7E-05	4.0E-06
Emission Fraction	ROM [1]	9.2E-03	4.4E-06	2.1E-05	1.1E-06	3.0E-05	5.6E-04	2.0E-05	6.2E-05	1.3E-02	1.4E-04	1.2E-09	2.6E-05	2.1E-04	8.7E-05
Emission Fraction	ORE [1]	9.5E-03	5.3E-06	1.3E-05	1.6E-06	1.2E-04	7.7E-04	2.0E-05	8.0E-05	6.3E-03	4.3E-05	1.2E-09	2.2E-05	1.3E-04	6.3E-05

Notes ►

1 Whetstone Associates, Inc., 2012, Final Baseline Geochemical Characterization Study Plan, Rasmussen Valley Mine Project, U.S. Department of Interior, Bureau of Land Management, Idaho Falls District, Pocatello Field

3 Herring, J.R., and R.I. Grauch. 2004. Lithogeochemistry of the Meade Peak Phosphatic Shale Member of the

4 Rader, L.F., and Grimaldi, F.S., 1961, Chemical Analyses for Selected Minor Elements in Pierre Shale, Geological Survey Professional Paper 391-A, U.S. Govt. Printing Office, Washington, 1961, 51 pp.

Silver	Tungsten[4]	Uranium	Zirconium[3]	Zinc
Annual PM10 (lb/hr)	**Annual PM10 (lb/hr)**	**Annual PM10 (lb/hr)**	**Annual PM10 (lb/hr)**	**Annual PM10 (lb/hr)**
3.2E-07	6.9E-08	2.0E-06	1.2E-05	8.4E-05
9.0E-08	1.9E-08	5.5E-07	3.2E-06	2.3E-05
2.2E-08	2.5E-09	2.6E-07	4.2E-07	3.4E-06
1.3E-06	4.1E-06	3.0E-05	6.9E-04	1.0E-03
1.3E-06	4.1E-06	3.0E-05	6.9E-04	1.0E-03
1.7E-07	2.0E-08	2.1E-06	3.4E-06	2.7E-05
1.7E-07	2.0E-08	2.1E-06	3.4E-06	2.7E-05
1.7E-07	2.0E-08	2.1E-06	3.4E-06	2.7E-05
2.4E-08	7.5E-08	5.5E-07	1.2E-05	1.9E-05
2.4E-08	7.5E-08	5.5E-07	1.2E-05	1.9E-05
2.0E-08	6.1E-08	4.5E-07	1.0E-05	1.5E-05
2.0E-08	6.1E-08	4.5E-07	1.0E-05	1.5E-05
6.9E-10	2.1E-09	1.6E-08	3.6E-07	5.4E-07
1.6E-09	1.8E-10	1.9E-08	3.1E-08	2.5E-07
3.7E-06	8.7E-06	7.1E-05	1.4E-03	2.3E-03
1.0E-03	1.0E-03	1.3E-02	3.3E-01	6.7E-01
NO	NO	NO	NO	NO
3.2E-07	1.0E-06	7.3E-06	1.7E-04	2.5E-04
4.6E-06	1.0E-06	2.8E-05	1.7E-04	1.2E-03
8.6E-06	1.0E-06	1.0E-04	1.7E-04	1.3E-03

Pollutant	Threshold	Units	Emissions	Model?
585.TOXIC AIR POLLUTANTS NON-CARCINOGENIC INCREMENTS.				
Aluminum	6.67E-01	lb/hr	6.58E-02	No
Antimony	3.30E-02	lb/hr	5.29E-06	No
Chromium	3.30E-02	lb/hr	8.06E-04	No
Cobalt	3.30E-03	lb/hr	1.73E-04	No
Copper	6.70E-02	lb/hr	1.91E-04	No
Iron	6.70E-02	lb/hr	7.87E-02	**Yes**
Manganese	3.33E-01	lb/hr	1.88E-03	No
Molybdenum	3.30E-01	lb/hr	2.68E-05	No
Selenium	1.30E-02	lb/hr	4.58E-05	No
Silver	7.00E-03	lb/hr	3.79E-06	No
Tungsten	6.70E-02	lb/hr	8.67E-06	No
Uranium	1.30E-02	lb/hr	7.22E-05	No
Zirconium	3.33E-01	lb/hr	1.45E-03	No
Zinc	6.67E-01	lb/hr	2.35E-03	No
586.TOXIC AIR POLLUTANTS CARCINOGENIC INCREMENTS				
Arsenic	1.50E-06	lb/hr	4.47E-05	**Yes**
Beryllium	2.80E-05	lb/hr	4.83E-06	No
Cadmium	3.70E-06	lb/hr	8.38E-05	**Yes**
Nickel	2.70E-05	lb/hr	4.29E-04	**Yes**
215.MERCURY EMISSION STANDARD FOR NEW OR MODIFIED SOURCES				
Mercury	2.50E+01	lb/yr	9.11E-05	No
LEVEL I THRESHOLDS				
CO	15	lb/hr	7.7	No
NOx	1.2	tons/yr	21	**Yes**
	0.2	lb/hr	4.8	**Yes**
SO2	1.2	tons/yr	0.4	No
	0.21	lb/hr	0.09	No
PM10	0.22	lb/hr	8.9	**Yes**
PM2.5	0.35	tons/yr	5.0	**Yes**
	0.054	lb/hr	1.2	**Yes**
Pb	14	lb/month	0.0	No
LEVEL II THRESHOLDS				
CO	175	lb/hr	8	No
NOx	14	tons/yr	21	**Yes**
	2.4	lb/hr	5	**Yes**
SO2	14	tons/yr	0.4	No
	2.5	lb/hr	0.1	No
PM10	2.6	lb/hr	9	**Yes**
PM2.5	4.1	tons/yr	5	**Yes**
	0.63	lb/hr	1	**Yes**

Pb	14 lb/month	0.0	No

AAC (mg/m3)		AACC (ug/m3)	
0.5	24-hr		
0.025	24-hr		
0.025	24-hr		
0.0025	24-hr		
0.05	24-hr		
0.05	24-hr		
0.25	24-hr		
0.25	24-hr		
0.01	24-hr		
0.005	24-hr		
0.05	24-hr		
0.01	24-hr		
0.25	24-hr		
0.5	24-hr		
		2.30E-04	ann
		4.20E-03	ann
		5.60E-04	ann
		4.20E-03	ann

Diesel Light Plant Emission Calculations

unit size	24.7	HP	18.4 kW [1]	HP reference: file GH3XL1.49FTV.pdf
Operation	8760	hours/yr		

Pollutant	EF/units		Source	Emissions (lb/HR)	(T/yr)	(lb/hp-hr)	Emissions (lb/HR)	(T/yr)
Total NOx (NMHC+NOx)	7.5	g/kW-hr	TIER 4 2008	0.30	1.33			
PM	0.4	g/kW-hr	TIER 4 2008	0.0162	0.07			
CO	6.6	g/kW-hr	TIER 4 2008	0.27	1.17			
SOx [2]	1.09E-05	lb/hp-hr	15 ppmw S			1.09E-05	2.69E-04	1.18E-03
VOC (TOC)	2.51E-03	lb/hp-hr	AP-42 Table 3.3-1			2.51E-03	6.21E-02	2.72E-01
	1.09E-05							

[1] Hp x 0.7457

[2] Assumptions: SO_s Emissions Factor: 7,000 Btu/hp*hr X lb fuel/19,300 Btu X 15 lb S/1,000,000lb fuel X 2 lb SO2/lb **S= 1.09 E-05 lb SO2/hp-hr**

1 gram = 0.0022 lb

1 HP= 0.7457 kW

Stack Parameters

		Reference
exhaust flow rate (cfm)	127.1	per email 2▶
exhaust temperature (oF)	869	per email 1▶
exhaust release height (ft)	6.17	per email 1▶
exhaust direction (vertical or horizontal).	vertical	per email 1▶
exhaust stack diameter (ft).	0.125	per email 2▶
calculated exit velocity (ft/sec)	172.7	

Liters per cylinder

Displacement (liters)	1.496
Number of cylinders	3
Liters per cylinder	0.50

Fuel Rate

lb/hr	10.3	GH3XL1.49FTV.pdf
gal/hr	1.48	Diesel fuel - Wikipedia

EMAIL 1

From: Grasz, Andrew < grasz.andrew@allmand.com>
Date: Wed, Mar 2, 2016 at 12:14 PM
Subject: Re: FW: Attached Image
To: "Newman, John" < newman.dave@allmand.com>
Cc: Jeff Nantkes < nantkes.jeff@allmand.com>, Raymond Solano < solano.raymond@allmand.com>, Dave Jones < jones.dave@allmand.com>

Dave -

We no longer offer the downward exit exhaust but the C1.5 has two different options and the C1.5T only has one option, here is breakdown for you.

The CAT C1.5 two different exhaust exit options:

Horizontal exit which is 46" off the ground. This is standard for the Maxi II
Vertical exit which is 67" off the ground. This is standard for the Mine and Rig Spec machines

The CAT C1.5T has one exhaust option and it is a vertical outlet out the top of the machine. This is due to the orientation of the turbo.
The height of this outlet is 74" off the ground.
As for exhaust gas temperatures, CAT publishes the exhaust gas temperature measured at the outlet of the exhaust manifold (at the turbo outlet for the C1.5T) while running at full load. They are:

C1.5 - 824°F
C1.5T - 869°F

I attached some pictures of the exhaust systems so you can get a better idea as to what they look like since the C1.5T has a much different exhaust system.
One thing to note from the pictures, the C1.5 vertical system has a rain cap and that rain cap is in the process of being replaced by a curved stack. Similar to what the C1.5T stack looks like (minus the ring).
I know the change has been made but I do not know if all the old rain caps have been used up yet. If there is anything else I can help with, give me a shout!

Thank you,

Andy Grasz | New Product Development

Allmand Bros., Inc.

308.995.4495 | 800.562.1373

EMAIL 2

From: Grasz, Andrew <grasz.andy@allmand.com>
Date: Wednesday, March 16, 2016
Subject: Rob Sweeney info
To: "Newman, John" <newman.dave@allmand.com>
Cc: Dave Jones <jones.dave@allmand.com>

Dave -

C1.5 HP: 18.8
C1.5T HP: 24.7
C1.5 Certificate Sheet #: FH3XL1.49F2C
C1.5T Certificate Sheet #: FH3XL 1.49FTV
C1.5 & C1.5T Stack Diameter: 1.500"
C1.5 Exhaust CFM: 99.6
C1.5T Exhaust CFM: 127.1
C1.5 & C1.5T Total Displacement: 1.496L
C1.5 & C1.5T Number of Cylinders: 3

Thank you,

Andy Grasz | Project Engineer

Allmand Bros., Inc.

308.995.4495 | 800.562.1373

Existing Dust Suppression Well Emission Calculations

Unit size	113	HP	84.3	kW [1]
Operation	8760	hours/yr		

Pollutant	EF/units		Source	Emissions (lb/HR)	(T/yr)	(lb/hp-hr)	Emissions (lb/HR)	(T/yr)
Total NOx (NMHC+NOx)	4.0	g/kW-hr	TIER 3	0.74	3.25			
PM	0.3	g/kW-hr	TIER 3	0.06	0.24			
CO	5.0	g/kW-hr	TIER 3	0.93	4.06			
SOx [2]	1.09E-05	lb/hp-hr	15 ppmw S			1.09E-05	1.23E-03	5.39E-03
VOC (TOC)	2.51E-03	lb/hp-hr	AP-42 Table 3.3-1			2.51E-03	2.84E-01	1.24E+00

[1] Hp x 0.7457

[2] Assumptions: SO_x Emissions Factor: 7,000 Btu/hp*hr X lb fuel/19,300 Btu X 15 lb S/1,000,000lb fuel X 2 lb SO2/lb **S= 1.09 E-05 lb SO2/hp-hr**

1 gram = 0.0022 lb

1 HP= 0.7457 kW

Stack Parameters

Parameter	Value	Reference
exhaust flow rate (cfm)	674	DCA85USJ Data Sheet
exhaust temperature (oF)	1094	DCA85USJ Data Sheet
exhaust release height (ft)	9.05	DCA85USJ Data Sheet & per email ▶
exhaust direction (vertical o	vertical	per email ▶
exhaust stack diameter (ft).	0.375	per email ▶
calculated exit velocity (ft/se	101.8	

Liters per cylinder

Displacement (cubic inches	274.6	DCA85USJ Data Sheet
Number of cylinders	4	DCA85USJ Data Sheet
Cubic inches to cylinder	68.65	
Liters per cylinder	1.13	

From: Thielman, Joannie [mailto:Joannie.Thielman@agrium.com]
Sent: Wednesday, February 10, 2016 10:37 AM
To: JoAnne Mooney; Skinner, Justin; Guedes, Chris; Goode, Jon
Cc: Thomas Emmel; David Keen
Subject: RE: RVMP Info Needs for Air Quality Modeling

Morning,

This is what I could come up with, understand that they are measurements off of the equipment that we have on site, and is not exact. The hope is that equivalent equipment can be utilized as it is hard to determine rental availability. Meeting the federal requirements as to model year and having certified engines should be the driving factor. See 40CFR 60.4208- Deadline for Installing Previous Model Years Stationary CI ICE (excluding fire pump engines)

Description	Model Number	Diesel Engine Hp	Model Year	Stack Height (ft)	Stack Diameter (ft)	Exhaust oF	Exhaust acfm	Flow Direction*
Dust Suppression Well	DCA85USJ or equivalent	113	2012*	22"***	4.5"OD	1094	674	Vertical
Dust Suppression Well	DCA45SSIU4F or equivalent	65.7	2013*	3/4"	2.4"OD	1078	237	Vertical
Ready Line	DCA70SSJU4i or equivalent	107	2012*	23"	3.0"OD	835	399	Vertical
Light Plants (9)	**Wanco-WLTC or equivalent	13.6 (15.4)	2013	6"	1.5"OD	?	?	Horizontal

* Horizontal or vertical

*** Stack height was measured from the bend after the muffler and catalytic converter if one was present.

If you wanted the stack height after it leaves the housing it is flush with the housing in all cases except on the light plants, there is a distance of 3.5".

If you are using the Wanco information I do not have access to those, the information supplied is for the Wacker Neuson rentals, I sent you over all of the data on the Neuson's that I could find in the last e-mail dated February 2nd.

New Dust Suppression Well Emission Calculations

unit size	65.7	HP	49.0	kW [1]
Operation	8760	hours/yr		

Pollutant	EF	units	Source	Emissions (lb/HR)	(T/yr)	(lb/hp-hr)	Emissions (lb/HR)	(T/yr)
Total NOx (NMHC+NOx)	4.7	g/kW-hr	TIER 4 2013	0.51	2.22			
PM	0.03	g/kW-hr	TIER 4 2013	0.00	0.01			
CO	5.0	g/kW-hr	TIER 4 2013	0.54	2.36			
SOx [2]	1.09E-05	lb/hp-hr	15 ppmw S			1.09E-05	7.15E-04	3.13E-03
VOC (TOC)	2.51E-03	lb/hp-hr	AP-42 Table 3.3-1			2.51E-03	1.65E-01	7.23E-01

[1] Hp x 0.7457

[2] Assumptions: SOs Emissions Factor: 7,000 Btu/hp*hr X lb fuel/19,300 Btu X 15 lb S/1,000,000lb fuel X 2 lb SO2/lb   S= 1.09 E-05 lb SO2/hp-hr

1 gram = 0.0022 lb

1 HP= 0.7457 kW

Stack Parameters

		Reference
• exhaust flow rate (cfm)	237	DCA45SSIU4F Data Sheet
• exhaust temperature (oF)	1078	DCA45SSIU4F Data Sheet
• exhaust release height (ft)	5.15	DCA45SSIU4F Data Sheet & per email ▶
• exhaust direction (vertical o	vertical	per email ▶
· exhaust stack diameter (ft).	0.2	per email ▶
• calculated exit velocity (ft/se	125.8	

Liters per cylinder

Displacement (cubic inches	133	DCA45SSIU4F Data Sheet
Number of cylinders	4	DCA45SSIU4F Data Sheet
Cubic inches to cylinder	33.25	
Liters per cylinder	0.54	

From: Thielman, Joannie [mailto:Joannie.Thielman@agrium.com]
Sent: Wednesday, February 10, 2016 10:37 AM
To: JoAnne Mooney; Skinner, Justin; Guedes, Chris; Goode, Jon
Cc: Thomas Emmel; David Keen
Subject: RE: RVMP Info Needs for Air Quality Modeling

Morning,

This is what I could come up with, understand that they are measurements off of the equipment that we have on site, and is not exact. The hope is that equivalent equipment can be utilized as it is hard to determine rental availability. Meeting the federal requirements as to model year and having certified engines should be the driving factor. See 40CFR 60.4208- Deadline for Installing Previous Model Years Stationary CI ICE (excluding fire pump engines)

Description	Model Number	Diesel Engine Hp	Model Year	Stack Height (ft)	Stack Diameter (ft)	Exhaust oF	Exhaust acfm	Flow Direction*
Dust Suppression Well	DCA85USJ or equivalent	113	2012*	22"***	4.5"OD	1094	674	Vertical
Dust Suppression Well	DCA45SSIU4F or equivalent	65.7	2013*	.75"	2.4"OD	1078	237	Vertical
Ready Line	DCA70SSJU4i or equivalent	107	2012*	23"	3.0"OD	835	399	Vertical
Light Plants (9)	**Wanco-WLTC or equivalent	13.6 (15.4)	2013	6"	1.5"OD	?	?	Horizontal

* Horizontal or vertical

*** Stack height was measured from the bend after the muffler and catalytic converter if one was present.

If you wanted the stack height after it leaves the housing it is flush with the housing in all cases except on the light plants, there is a distance of 3.5".

If you are using the Wanco information I do not have access to those, the information supplied is for the Wacker Neuson rentals. I sent you over all of the data on the Neuson's that I could find in the last e-mail dated February 2nd.

Ready Line Generator Emission Calculations

unit size	107	HP	79.8	kW [1]
Operation	8760	hours/yr		

Pollutant	EF/units		Source	Emissions (lb/HR)	(T/yr)	(lb/hp-hr)	Emissions (lb/HR)	(T/yr)
Total NOx	0.4	g/kW-hr	TIER 4 2012-2014	0.07	0.31			
PM	0.02	g/kW-hr	TIER 4 2012-2014	0.004	0.015			
CO	5	g/kW-hr	TIER 4 2012-2014	0.88	3.84			
NMHC (VOC)	0.19	g/kW-hr	TIER 4 2012-2014	0.03	0.15			
SOx [2]	1.09E-05	lb/hp-hr	15 ppmw S			1.09E-05	1.16E-03	5.10E-03

[1] Hp x 0.7457

[2] Assumptions: SO_s Emissions Factor: 7,000 Btu/hp*hr X lb fuel/19,300 Btu X 15 lb S/1,000,000lb fuel X 2 lb SO2/lb **S= 1.09 E-05 lb SO2/hp-hr**

1 gram = 0.0022 lb

1 HP= 0.7457 kW

Stack Parameters

		Reference
• exhaust flow rate (cfm)	399	DCA70SSJU4i Data Sheet
• exhaust temperature (oF)	835	DCA70SSJU4i Data Sheet
• exhaust release height (ft)	7.61	DCA70SSJU4i Data Sheet & per email ▶
• exhaust direction (vertical o	vertical	per email ▶
· exhaust stack diameter (ft).	0.25	per email ▶
• calculated exit velocity (ft/s	135.5	

Liters per cylinder

Displacement (cubic inches	275	DCA70SSJU4i Data Sheet
Number of cylinders	4	DCA70SSJU4i Data Sheet
Cubic inches to cylinder	68.75	
Liters per cylinder	1.13	

From: Thielman, Joannie [mailto:Joannie.Thielman@agrium.com]
Sent: Wednesday, February 10, 2016 10:37 AM
To: JoAnne Mooney; Skinner, Justin; Guedes, Chris; Goode, Jon
Cc: Thomas Emmel; David Keen
Subject: RE: RVMP Info Needs for Air Quality Modeling

Morning,

This is what I could come up with, understand that they are measurements off of the equipment that we have on site, and is not exact. The hope is that equivalent equipment can be utilized as it is hard to determine rental availability. Meeting the federal requirements as to model year and having certified engines should be the driving factor. See 40CFR 60.4208- Deadline for Installing Previous Model Years Stationary CI ICE (excluding fire pump engines)

Description	Model Number	Diesel Engine Hp	Model Year	Stack Height (ft)	Stack Diameter (ft)	Exhaust oF	Exhaust acfm	Flow Direction*
Dust Suppression Well	DCA85USJ or equivalent	113	2012*	22"***	4.5"OD	1094	674	Vertical
Dust Suppression Well	DCA45SSIU4F or equivalent	65.7	2013*	3/4"	2.4"OD	1078	237	Vertical
Ready Line	DCA70SSJU4i or equivalent	107	2012*	23"	3.0"OD	835	399	Vertical
Light Plants (9)	**Wanco-WLTC or equivalent	13.6 (15.4)	2013	6"	1.5"OD	?	?	Horizontal

* Horizontal or vertical

*** Stack height was measured from the bend after the muffler and catalytic converter if one was present.

If you wanted the stack height after it leaves the housing it is flush with the housing in all cases except on the light plants, there is a distance of 3.5".

If you are using the Wanco information I do not have access to those, the information supplied is for the Wacker Neuson rentals, I sent you over all of the data on the Neuson's that I could find in the last e-mail dated February 2nd.

Combustion Sources - Small Diesel Fuel Stationary Engine

Assumptions:		**Units**
BSFC (brake specific fuel consumption) =	7,000	Btu/hp-hr

HAPs [1]	**EF / Units**	
Benzene	9.33E-04	lb/mmBtu
Toluene	4.09E-04	lb/mmBtu
Xylenes	2.85E-04	lb/mmBtu
Formaldehyde	1.18E-03	lb/mmBtu
Acetaldehyde	7.67E-04	lb/mmBtu
Acrolein	9.25E-05	lb/mmBtu
Naphthalene	8.48E-05	lb/mmBtu
1.3-Butadiene	3.91E-05	lb/mmBtu
PAHs	**EF / Units**	
Acenaphthylene	5.06E-06	lb/mmBtu
Acenaphthene	1.42E-06	lb/mmBtu
Fluorene	2.92E-05	lb/mmBtu
Phenanthrene	2.94E-05	lb/mmBtu
Anthracene	1.87E-06	lb/mmBtu
Fluoranthene	7.61E-06	lb/mmBtu
Pyrene	4.78E-06	lb/mmBtu
Benzo(a)anthracene	1.68E-06	lb/mmBtu
Chrysene	3.53E-07	lb/mmBtu
Benzo(b)fluoranthene	9.91E-08	lb/mmBtu
Benzo(k)fluoranthene	1.55E-07	lb/mmBtu
Benzo(a)pyrene	1.88E-07	lb/mmBtu
Indeno(1,2,3-cd)pyrene	3.75E-07	lb/mmBtu
Dibenzo(a,h)anthracene	5.83E-07	lb/mmBtu
Benzo(g,h,l)perylene	4.89E-07	lb/mmBtu
Total Organic Speciated Compounds		

[1] Hazardous air pollutant listed in the Clean Air Act.

[2] For emissions of the 7-PAH group, the following PAHs shall be considered togeth

s (<600hp)

Reference "a" AP-42 Table 3.3-1

		Diesel Light Plant		Existing Dust Suppression Well	
	Unit Size	24.7	HP	113.0	HP
		0.17	MMBtu/hr	0.79	MMBtu/hr
	Operation	8,760	hours/year	8,760	hours/year
		Emissions		Emissions	
Reference	**CAS**	lb/hr	TPY	lb/hr	TPY
AP-42 Table 3.3-2	**71-43-2**	1.61E-04	7.07E-04	7.38E-04	3.23E-03
AP-42 Table 3.3-2	**108-88-3**	7.07E-05	3.10E-04	3.24E-04	1.42E-03
AP-42 Table 3.3-2	**1330-20-7**	4.93E-05	2.16E-04	2.25E-04	9.87E-04
AP-42 Table 3.3-2	**50-00-0**	2.04E-04	8.94E-04	9.33E-04	4.09E-03
AP-42 Table 3.3-2	**75-07-0**	1.33E-04	5.81E-04	6.07E-04	2.66E-03
AP-42 Table 3.3-2	**107-02-8**	1.60E-05	7.01E-05	7.32E-05	3.20E-04
AP-42 Table 3.3-2	**91-20-3**	1.47E-05	6.42E-05	6.71E-05	2.94E-04
AP-42 Table 3.3-2	**106-99-0**	6.76E-06	2.96E-05	3.09E-05	1.35E-04
	N/A				
			6.31E-05		**2.88E-04**
AP-42 Table 3.3-2	**203-96-8**	8.75E-07	3.83E-06	4.00E-06	1.75E-05
AP-42 Table 3.3-2	**83-32-9**	2.46E-07	1.08E-06	1.12E-06	4.92E-06
AP-42 Table 3.3-2	**86-73-7**	5.05E-06	2.21E-05	2.31E-05	1.01E-04
AP-42 Table 3.3-2	**85-01-8**	5.08E-06	2.23E-05	2.33E-05	1.02E-04
AP-42 Table 3.3-2	**120-12-7**	3.23E-07	1.42E-06	1.48E-06	6.48E-06
AP-42 Table 3.3-2	**206-44-0**	1.32E-06	5.76E-06	6.02E-06	2.64E-05
AP-42 Table 3.3-2	**129-00-0**	8.26E-07	3.62E-06	3.78E-06	1.66E-05
AP-42 Table 3.3-2	**56-55-3**	2.90E-07	1.27E-06	1.33E-06	5.82E-06
AP-42 Table 3.3-2	**218-01-9**	6.10E-08	2.67E-07	2.79E-07	1.22E-06
AP-42 Table 3.3-2	**205-99-2**	1.71E-08	7.50E-08	7.84E-08	3.43E-07
AP-42 Table 3.3-2	**205-82-3**	2.68E-08	1.17E-07	1.23E-07	5.37E-07
AP-42 Table 3.3-2	**50-32-8**	3.25E-08	1.42E-07	1.49E-07	6.51E-07
AP-42 Table 3.3-2	**193-39-5**	6.48E-08	2.84E-07	2.97E-07	1.30E-06
AP-42 Table 3.3-2	**53-70-3**	1.01E-07	4.42E-07	4.61E-07	2.02E-06
AP-42 Table 3.3-2	**191-24-2**	8.45E-08	3.70E-07	3.87E-07	1.69E-06
			0.0029		**0.0134**

ıer as one TAP, equivalent in potency to benzo(a)pyrene: benzo(a)anthracene, benzo(b)fluoranthene, benzc

New Dust Suppression Well		Ready Line		
65.7	HP	107.0	HP	
0.46	MMBtu/hr	0.75	MMBtu/hr	
8,760	hours/year	8,760	hours/year	
Emissions		Emissions		
lb/hr	TPY	lb/hr	TPY	**TAPs ?**
4.29E-04	1.88E-03	6.99E-04	3.06E-03	CTAP
1.88E-04	8.24E-04	3.06E-04	1.34E-03	TAP
1.31E-04	5.74E-04	2.13E-04	9.35E-04	TAP
5.43E-04	2.38E-03	8.84E-04	3.87E-03	CTAP
3.53E-04	1.55E-03	5.74E-04	2.52E-03	CTAP
4.25E-05	1.86E-04	6.93E-05	3.03E-04	TAP
3.90E-05	1.71E-04	6.35E-05	2.78E-04	TAP
1.80E-05	7.88E-05	2.93E-05	1.28E-04	CTAP
	1.68E-04		**2.73E-04**	
2.33E-06	1.02E-05	3.79E-06	1.66E-05	NOT
6.53E-07	2.86E-06	1.06E-06	4.66E-06	NOT
1.34E-05	5.88E-05	2.19E-05	9.58E-05	NOT
1.35E-05	5.92E-05	2.20E-05	9.65E-05	NOT
8.60E-07	3.77E-06	1.40E-06	6.13E-06	NOT
3.50E-06	1.53E-05	5.70E-06	2.50E-05	NOT
2.20E-06	9.63E-06	3.58E-06	1.57E-05	NOT
7.73E-07	3.38E-06	1.26E-06	5.51E-06	PAH [2]
1.62E-07	7.11E-07	2.64E-07	1.16E-06	PAH [2]
4.56E-08	2.00E-07	7.42E-08	3.25E-07	PAH [2]
7.13E-08	3.12E-07	1.16E-07	5.08E-07	PAH [2]
8.65E-08	3.79E-07	1.41E-07	6.17E-07	CTAP/PAH
1.72E-07	7.55E-07	2.81E-07	1.23E-06	PAH [2]
2.68E-07	1.17E-06	4.37E-07	1.91E-06	PAH [2]
2.25E-07	9.85E-07	3.66E-07	1.60E-06	NOT
	0.0078		**0.0127**	
			0.0603	

ɔ(k)fluoranthene, dibenzo(a,h)anthracene, chrysene, indenol(1,2,3,-cd)pyrene, benzo(a)pyrene.

GHG Emission Calculations for Stationary Fuel Combustion Sources

						Emission Factors per MMBtu[2]			Emission Factors per CO2e/MMBtu[3]				
Emission Source	Power Output Rating (hp)1	Fuel Input Rating (MMBTU/Hr)	Fuel Type1	Number of Units	Hours of Operations (hr/yr)	CO2-lb/MMBtu	CH4-lb/MMBtu	N2O-lb/MMBtu	CO2-CO2e EF	CH4-CO2e EF	N2O-CO2e EF	CO2e-EF	CO2e Units
Light Plants	24.7	0.173	Diesel	9	8760	1.6E+02	6.6E-03	1.3E-03	1.6E+02	1.7E-01	3.9E-01	1.15	lb/hp-hr
Existing Dust Suppression Well	113	0.791	Diesel	1	8760	1.6E+02	6.6E-03	1.3E-03	1.6E+02	1.7E-01	3.9E-01	1.15	lb/hp-hr
New Dust Suppression Well	65.7	0.460	Diesel	1	8760	1.6E+02	6.6E-03	1.3E-03	1.6E+02	1.7E-01	3.9E-01	1.15	lb/hp-hr
Ready Line	107	0.749	Diesel	1	8760	1.6E+02	6.6E-03	1.3E-03	1.6E+02	1.7E-01	3.9E-01	1.15	lb/hp-hr
Total													

	Emission (lb/hr)			Emission (lb/yr)			Emission (ton/yr)			CO2e - Conversion[3]			CO2e -
Emission Source	CO2-lb/hr	CH4-lb/hr	N2O-lb/hr	CO2-lb/yr	CH4-lb/yr	N2O-lb/yr	CO2-ton/yr	CH4-ton/yr	N2O-ton/yr	CO2-CO2e	CH4-CO2e	N2O-CO2e	CO2e-tons/yr
Light Plants	2.8E+01	1.1E-03	2.3E-04	2.2E+06	9.0E+01	1.8E+01	1.1E+03	4.5E-02	9.0E-03	1.1E+03	1.1E+00	2.8E+00	1,115
Existing Dust Suppression Well	1.3E+02	5.2E-03	1.0E-03	1.1E+06	4.6E+01	9.2E+00	5.6E+02	2.3E-02	4.6E-03	5.6E+02	5.7E-01	1.4E+00	567
New Dust Suppression Well	7.5E+01	3.0E-03	6.1E-04	6.6E+05	2.7E+01	5.3E+00	3.3E+02	1.3E-02	2.7E-03	3.3E+02	3.3E-01	8.3E-01	330
Ready Line	1.2E+02	5.0E-03	9.9E-04	1.1E+06	4.3E+01	8.7E+00	5.3E+02	2.2E-02	4.3E-03	5.3E+02	5.4E-01	1.3E+00	537
Total													**2,548**

Notes:

1. Data are from manufacturer specification sheets.
2. Source: Table 1 for Stationary Combustion Emission Factors from the EPA Emission Factors for Greenhouse Gas Inventories.
3. Source: Table 9 for Global Warming Potentials (GWPs) for conversion of gasses to CO2 equivalent, from the EPA Emission Factors for Greenhouse Gas Inventories.

Totals
CO2e-lb/hr
255
129
75
123
582

$PM_{2.5}$-EF[4] #REF!

Appendix F - Summary Emission Calculations, NRRM Air Permit Application September 23rd, 2013.

Drilling Emissions

Pollutant	Blast Holes Drilled Per Day[1,2]	Estimated Holes Drilled for Additional Operations Per Day[1,3]	Total Holes Drilled Per Year (hole/yr)	Emissions Factor (lb/hole)[4,5]	Uncontrolled Annual Emissions (lb/hr)	Uncontrolled Annual Emissions (tons/yr)	Control Efficiency[6]	Controlled Annual Emissions (lb/hr)	Controlled Annual Emissions (tons/yr)
TSP	4	4	2920	1.3	0.43	1.9	84%	0.069	0.30368
PM_{10}	4	4	2920	1.3	0.43	1.9	84%	0.069	0.30368
$PM_{2.5}$	4	4	2920	1.3	0.43	1.9	84%	0.069	0.30368

Notes:

1. Data are based on Brown and Caldwell, April 7, 2014, Data Request for Desktop Air Resources Analysis by ARCADIS for Environmental Impact Statement.
2. Based on Section 1.3 of the Brown and Caldwell document in Note 1 above, in which it is estimated that each blast will consist of 4, 40ft holes drilled in a 20' x 20' spacing.
3. Based on Section 1.2 of the Brown and Caldwell document in Note 1 above, in which it is estimated that drilling operations for overburden holes will commence 24 hours a day for 365 days a year. Additionally Section 4.5 of the Rasmussen Valley Mine Plan describes that additional drilling will continue during mining for material grade modelling and classification. No defined number of holes drilled was provided for these drilling operations, therefore an estimated 4 holes per day are included in this emission summary.
4. AP-42 Section 11.9-4 (7/98) for Overburden drilling emission factor for TSP.
5. Barring no particle size distribution data available in AP-42 Chapter 11.9, calculations conservatively assume PM10 and PM2.5 emission will be equal to TSP.
6. Watering and applying dust suppressant to unpaved areas during construction/demolition will provide up to 84% control efficiency. Control efficiency based on the WRAP Fugitive Dust Handbook, September 2006. Table 3-7. Control Efficiencies for Control Measures for Construction/Demolition

Blasting Emissions

Potential Particulate Emissions from Blasting

Pollutant	Blasts per Year[1] (blast/yr)	Particulate Emission Factor[2] (lb/blast)	Potential Uncontrolled Emissions[3] (lb/hr)	Potential Uncontrolled Emissions (tons/yr)	check
TSP	365	0.8960	0.0373	0.164	0.16352
PM_{10}	365	0.4659	0.0194	0.085	0.08503
$PM_{2.5}$	365	0.0269	0.0011	0.00491	0.00491

Potential Gaseous Emissions from Blasting

Pollutant	Blasts per Year[1] (blast/yr)	Fuel Mass Per Blast (lb)[4]	Annual Explosive Material Usage (tons/yr)	Emission Factor (lb/ton)[5]	Potential Uncontrolled Emissions[3] (lb/hr)	Potential Uncontrolled Emissions (tons/yr)
CO	365	2,128	388	67	3.0	13.0
NOx	365	2,128	388	17	0.75	3.3
SO2	365	2,128	388	2	0.089	0.39

Notes:

1. Blasting data are based on Brown and Caldwell, April 7, 2014, Data Request for Desktop Air Resources Analysis by ARCADIS for Environmental Impact Statement.
2. Uncontrolled TSP and PM_{10} emission factors are from AP-42, Section 11.9, Table 11.9-1 (July 1998), with a horizontal blasting area of 20 ft x 20 ft.
3. Based on Section 1.3 of the Brown and Caldwell document in Note 1 above in which it is estimated that blast hole spacing is 20' x 20' with 4 blast holes each filled with 532lb of ANFO Prill per blast.
4. Assuming 8760 hours per year of blasting operations for emission estimate.
5. Based on AP-42, Table 13.3-1 Detonation of Explosives for ANFO.

Screening Activities

Pollutant	Annual Material Throughput (tons/yr)[1]	Uncontrolled Emission Factor (lb/ton)[2, 3]	Controlled Emissions Factor (lb/ton)[2, 4]	Uncontrolled Emissions (tons/yr)[4]	Controlled Emissions (tons/yr)	Controlled Emissiojns (lb/hr) [5]
TSP	30,000	0.025	0.0022	0.38	0.033	0.0301
PM_{10}	30,000	0.0087	0.00074	0.13	0.011	0.0101
$PM_{2.5}$	30,000	0.00059	0.000050	0.0088	0.0008	0.0007

Notes: 0.00068493

1. Data are based on Brown and Caldwell, April 7, 2014, Data Request for Desktop Air Resources Analysis by ARCADIS for Environmen Statement section 1.13.
2. AP-42 Table 11.19.2-2, screening emission factors are applied to estimate particulate emissions for uncontrolled and controlled proces operations.
3. Particulate emissions may be controlled by wet suppression using water sprays during the screening stages. Sufficient water spaying emission rates as defined in Table AP-42 11.19.2-2.
4. No data was provided for the uncontrolled PM2.5 emission factor for screening, therefore this factor was interpolated using the rate of the controlled emissions factor from PM10 to PM2.5 and the relationship was applied to the uncontrolled emission factor.
5. Based on Section 1.13 of the Brown and Caldwell document in Note 1 above, which states that the screening operations will occur onl summer months (2190 hr/yr) for a total of 30,000 tons per year of throughput.

Sample Calculations:

PM2.5 Emission factor (lb/ton) = (PM10,uncontrolled EF) * (PM2.5, controlled EF) / (PM10, controlled EF)

Uncontrolled emissions (tons/yr) = emission factor (lb/ton) * material throughput rate (tons/yr) * 1 ton / 2,000 lb tal Impact

ssing

can result in

change from

y during the

Haul Truck Fugitive Dust Emissions on Unpaved Roads - RCA

Potential Emissions from Truck Hauling, unpaved roads, from Pit to Overburden Pile

Pollutant	s[2]	k[3]	a[3]	b[3]	Average Weight of Haul Trucks[4] (tons)	Number of Days With >= 0.01 inch Precipitation[5] (days)	Particulate Emission Factor (lb/VMT)[6]	Maximum Vehicle Trips per Day[7]	Roundtrip Vehicle Miles Traveled per trip[8]	Operating Days per Year[9]	Vehicle Miles Traveled per Year (VMT/yr)	Uncontrolled Particulate Emissions (lbs/hr)	Uncontrolled Particulate Emissions (tons/yr)	Control Efficiency[10]	Controlled Particulate Emissions[10] (lbs/hr)	Controlled Particulate Emissions[10] (tons/yr)
TSP	8.4	4.9	0.7	0.45	125	90	15.4	90	2.5	365	82,125	144	633	90%	14	63
PM_{10}	8.4	1.5	0.9	0.45	125	90	4.4	90	2.5	365	82,125	41	180	90%	4	18
$PM_{2.5}$	8.4	0.15	0.9	0.45	125	90	0.44	90	2.5	365	82,125	4	18	90%	0	2

Potential Emissions from Truck Hauling, unpaved roads, from Pit to Ore Stockpile/Lease Boundary

Pollutant	s[2]	k[3]	a[3]	b[3]	Average Weight of Haul Trucks[4] (tons)	Number of Days With >= 0.01 inch Precipitation[5] (days)	Particulate Emission Factor (lb/VMT)[6]	Maximum Vehicle Trips per Day[7]	Roundtrip Vehicle Miles Traveled per trip[8]	Operating Days per Year[9]	Vehicle Miles Traveled per Year (VMT/yr)	Uncontrolled Particulate Emissions (lbs/hr)	Uncontrolled Particulate Emissions (tons/yr)	Control Efficiency[10]	Controlled Particulate Emissions[10] (lbs/hr)	Controlled Particulate Emissions[10] (tons/yr)
TSP	8.4	4.9	0.7	0.45	125	90	15.4	45	5.0	365	82,125	144	633	90%	14	63
PM_{10}	8.4	1.5	0.9	0.45	125	90	4.4	45	5.0	365	82,125	41	180	90%	4	18
$PM_{2.5}$	8.4	0.15	0.9	0.45	125	90	0.44	45	5.0	365	82,125	4	18	90%	0	2

Notes:

1. Data are based on Brown and Caldwell, April 7, 2014, Data Request for Desktop Air Resources Analysis by ARCADIS for Environmental Impact Statement.
2. The mean surface material silt content applied here are from AP-42 Table 13.2.2-1 for Haul Road to/from pit for the western surface coal mining industry, November 2006 (8.4%).
3. Empirical constants for particle size range are based on AP-42 Table 13.2.2-2, for industrial roads for use with equation 1a from AP-42 Chapter 13.2.2.
4. The average vehicle weight is based on a Cat 777 haul truck that has an empty weight of 70 tons and a loaded weight of 180 tons. The haul truck will be empty 50% of the time it travels on the road and full 50% of the time it travels on the road.
5. Average number of days per year with precipitation >= 0.01 inches AP-42, Figure 13.2.2-1
6. Used AP-42 Section 13.2.2 Emission Estimates for Unpaved Roads. Uncontrolled emission factor includes natural mitigation from average precipitation days. lb/VMT = [k (s/12)^a (W/3)^b][(365-P)/365]
7. Based on Section 1.9 of the Brown and Caldwell document in Note 1 above in which the worst-case assumption of overburden transported is 90 truck loads of overburden and 30 truck loads of ore per day adjusted up for 3,000,000 tpy of ore (45 trucks/day).
8. Based on Figure 2.5-3 Facility Layout Map for the Rasmussen Collaborative Alternative the approximate worst-case distance: mine pit to overburden piles is approximately 1.25 miles (2*1.25=2.5 round trip), and mine pit to ore stockpile to lease boundary is approximately 2.5 miles (2*2.5=5 round trip).
9. Operating days per year includes approximately 365 days a year.
10. Haul roads and other areas requiring suppression of dust from mining operations will be sprayed with dust-suppression-water-supply-well water. Applying water to unpaved roads can result in control efficiency of 75 to 95% (see Figure 6-1. Watering Control Effectiveness for Unpaved Travel Surfaces; WRAP Air Handbook, September 2006). Used 90%.

Sample Calculation:

Particulate emission factor (lb/VMT) = $(k*(s/12)^a * (\text{Average Vehicle Weight}/3)^b) * (365 - \text{Number Precipitation Days})/365$

Loading and Unloading

Loading and Unloading of Overburden Material from Pit to Stockpile

Pollutant	Particle Size Multiplier, k (dimensionless)[2]	Mean Wind Speed, U (mph)[3]	Material Moisture Content, M (%)[4]	Particulate Emission Factor (lb/ton)[2]	Estimated Annual Material Handled (tons/yr)[5]	Potential Uncontrolled Emissions (lbs/hr)	Potential Uncontrolled Emissions (tons/yr)	Control Efficiency[8]	Potential Controlled Emissions (lbs/hr)
TSP	0.74	2.1	6.9	0.00014	10,197,000	0.16	0.7	0%	0.158
PM_{10}	0.35	2.1	6.9	0.00006	10,197,000	0.07	0.3	0%	0.075
$PM_{2.5}$	0.053	2.1	6.9	0.000010	10,197,000	0.011	0.05	0%	0.011

Loading and Unloading of Ore Material from Pit to Stockpile and Stockpile to Lease Boundry

Pollutant	Particle Size Multiplier, k (dimensionless)[2]	Mean Wind Speed, U (mph)[3]	Material Moisture Content, M (%)[4]	Particulate Emission Factor (lb/ton)[2]	Estimated Annual Material Handled (tons/yr)[6]	Potential Uncontrolled Emissions (lbs/hr)	Potential Uncontrolled Emissions (tons/yr)	Control Efficiency[8]	Potential Controlled Emissions (lbs/hr)
TSP	0.74	2.1	12	0.00006	6,000,000	0.043	0.19	0%	0.043
PM_{10}	0.35	2.1	12	0.00003	6,000,000	0.020	0.09	0%	0.020
$PM_{2.5}$	0.053	2.1	12	0.000004	6,000,000	0.0031	0.013	0%	0.0031

Loading and Unloading of Overburden Material from Stockpile to Pit Refill

Pollutant	Particle Size Multiplier, k (dimensionless)[2]	Mean Wind Speed, U (mph)[3]	Material Moisture Content, M (%)[4]	Particulate Emission Factor (lb/ton)[2]	Estimated Maximum Material Handled (tons/yr)[7]	Potential Uncontrolled Emissions (lbs/hr)	Potential Uncontrolled Emissions (tons/yr)	Control Efficiency[8]	Potential Controlled Emissions (lbs/hr)
TSP	0.74	2.1	6.9	0.00014	8,325,843	0.13	0.6	0%	0.129
PM_{10}	0.35	2.1	6.9	0.00006	8,325,843	0.06	0.3	0%	0.061
$PM_{2.5}$	0.053	2.1	6.9	0.000010	8,325,843	0.009	0.04	0%	0.009

Notes:

1. Data are based on Brown and Caldwell, April 7, 2014, Data Request for Desktop Air Resources Analysis by ARCADIS for Environmental Impact Statement.
2. AP-42 Section 13.2.4, Equation 1 (November 2006) is used to estimate particulate emissions generated by material transfer by means of loading and unloading of overburden and ((U/5)^1.3 / (M/2)^1.4
3. The mean wind speed of 2.1 mph is based on data obtained from the Diamond Flat meteorological station from 2010 to 2015.
4. Overburden mean moisture content of 6.9% is from AP-42 Table 13.2.4-1 for Western surface coal mining industry of coal material. Per Agrium ore moisture content is 12%.
5. Based on Section 1.5 of the Brown and Caldwell document in Note 1 above in which the worst-case scenario for loading overburden from pit to stockpile is 10,197,000 tons per yea the latter part of Phase 4 and 6.
6. Based on Section 1.10 of the Brown and Caldwell document in Note 1 above in which the worst-case assumption of ore per year is 2,000,000 tpy adjusted up for 3,000,000 tpy of o scenario would be loading ore twice, from pit to stockpiles then to tipple, and would total 6,000,000 wet tons per year (2 times 3,000,000 tpy).
7. Based on Section 1.6 of the Brown and Caldwell document in Note 1 above in which the worst case scenario for overburden replacement is 8,325,843 tons per year.
8. Calculated based on the WRAP Fugitive Dust Handbook, September 2006. Implementation of wet suppression for materials handling may provide 62 to 90% control efficiency. Fo 0% will be used.

Sample Calculations:

Emission factor (lb/ton) = particle size multiplier * 0.0032 * (wind speed (mph) / 5)$^{1.3}$ ÷ (moisture content (%) / 2)$^{1.4}$
Uncontrolled emissions (tons/yr) = emission factor (lb/ton) * ore throughput rate (tons/yr) * 1 ton/2,000 lb
Controlled emissions (tons/yr) = uncontrolled emissions (tons/yr) * (1 - control efficiency1)

Potential Controlled Emissions (tons/yr)
0.69
0.33
0.05

Potential Controlled Emissions (tons/yr)
0.19
0.089
0.013

Potential Controlled Emissions (tons/yr)
0.56
0.27
0.04

ore. lb/ton = k (0.0032)

ır which will only occurs in

ore. The worst-case

ır conservative calculations

Wind Erosion - Disturbed Areas

Wind Erosion of Growth Media & Overburdent Piles (AP-42 Table 11.9-4)[1]

Pollutant	Particle Size Multiplier, k [2]	Emission Factor (lb/acre-yr)[3]	Total Acreage of Disturbance[4]	Potential Uncontrolled Emissions (lbs/yr)
TSP	1	0.38	98.1	37.28
PM_{10}	0.5	0.19	98.1	18.64
$PM_{2.5}$	0.075	0.03	98.1	2.80

Wind Erosion of Ore Stockpile (AP-42 Table 11.9-4)1

Pollutant	Particle Size Multiplier, k [2]	Emission Factor (lb/acre-yr)[3]	Total Acreage of Disturbance[4]	Potential Uncontrolled Emissions (lbs/yr)
TSP	1	0.38	8.5	3.23
PM_{10}	0.5	0.19	8.5	1.62
$PM_{2.5}$	0.075	0.03	8.5	0.24

Notes:

1. Data are based on Brown and Caldwell, April 7, 2014, Data Request for Desktop Air Resourc
2. AP-42 Section 11.9 Table 11.9-4 (November 2006) is applied to estimate particulate emissior are not provied by Table 11.9-4. As such, the particle size multiplies found in AP-42 Section 1
3. Emissions factor calculated using AP-42 11.9-1 for Uncontrolled Open Dust Emissions for Ac
4. Based on Section 1.7 & 1.8 of the Brown and Caldwell document in Note 1 above, which state Overburden stock pile would total 98.1 acres.
5. Worst case emissions are calculated assuming no water control for surface disturbance area

Uncontrolled PM_{10} and $PM_{2.5}$ emissions generated from wind erosion of disturl from the TSP emission factor provided in AP-42 Section 11.9-4 (7/98). The TSI multiplied by the disturbed acreage and the PM_{10} and $PM_{2.5}$ aerodynamic partic Table 13.2.4. Emissions were calculated with no water control. This equation is

$$EF = 0.38 * A * k \text{ tons/acre-year*acre}$$

Where:
EF = is the emissions

A = is the acreage of the source

k = is the Aerodynamic Particle Size Multiplier (dimensionless), (0.35 for PM

Table 11.9-4 (English And Metric Units). UNCC
SOURCES AT

Source	
Wind erosion of exposed areas[d]	Seeded lar overburder

[a] Roman numerals I through V refer to specific mine location
Tables 11.9-4 and 11.9-5 present characteristics of each of t
other factors (from Reference 7, except for overburden drill

[b] Total suspended particulate (TSP) denotes what is measure

[c] Predictive emission factor equations, which generally provi

[d] To estimate wind erosion on a shorter time scale (e. g., wor

Potential Uncontrolled Emissions (tons/year)	Control Efficiency[5]	Potential Controlled Emissions (tons/year)
0.02	0%	0.019
0.01	0%	0.009
0.00	0%	0.0014

Potential Uncontrolled Emissions (tons/year)	Control Efficiency[5]	Potential Controlled Emissions (tons/year)
0.00	0%	0.002
0.00	0%	0.001
0.00	0%	0.0001

es Analysis by ARCADIS for Environmental Impact Statement.

ıs generated by wind erosion at the stock piles. Particle size multipliers
13.2.5 page 3 were used.

tive Storage Piles.

ɜs that the size of the Ore stock pile would total 8.5 acres and the

s.

bance acreage are calculated

P emission factor is then

:le size multiplier from AP-42

:

$_{10}$, 0.053 for PM $_{2.5}$)

)NTROLLED PARTICULATE EMISSION FACTORS FOR OPEN D
[WESTERN SURFACE COAL MINES

Material	Mine Location[a]	TSP Emission Factor[b]	Units	
ıd, stripped n, graded overburden	Any	0.38	T / (acre)(yr)	
		0.85	Mg / (hectare)(yr)	

ıs for which the corresponding emission factors were developed (Referer
these mines. See text for correct use of these "mine-specific" emission
.ing from Reference 1) can be applied to any western surface coal mine.
d by a standard high volume sampler (see Section 13.2).
de more accurate estimates of emissions, are presented in Chapter 13.
st-case day), see Section 13.2.5.

UST

EMISSION FACTOR RATING
C
C

nce 5).
factors. The

Agrium - Rasmussen Valley Mine Point Source Model Emission Inputs

Source Description	PM10 (lb/hr)
Diesel light plant - 1	1.62E-02
Diesel light plant - 2	1.62E-02
Diesel light plant - 3	1.62E-02
Diesel light plant - 4	1.62E-02
Diesel light plant - 5	1.62E-02
Diesel light plant - 6	1.62E-02
Diesel light plant - 7	1.62E-02
Diesel light plant - 8	1.62E-02
Diesel light plant - 9	1.62E-02
Existing Dust Suppression Well	5.56E-02
New Dust Suppression Well	3.23E-03
Ready Line	3.51E-03
Totals	**0.208**
chck	0.208

Agrium - Rasmussen Valley Mine Fugitive Source Model Emission Inputs

Source Description	PM10 (lb/hr)
Haul Road - Pit to Overburden Pile	4.1E+00
Haul Road - Pit to Ore Stockpile/Lease Boundry	4.1E+00
Wind Erosion- Growth Media & Overburden Piles	2.1E-03
Wind Erosion- Ore Stock Piles	1.8E-04
Ore Loading at Pit	2.0E-02
Ore Unloading at Pile	2.0E-02
Ore Loading at Pile	2.0E-02
Overburden Loading at Pit	7.5E-02
Overburden Unloading at Pile	7.5E-02
Overburden Loading at Pile	6.1E-02
Overburdent Unloading Pit Refill	6.1E-02
Pit - Screening	1.0E-02
Pit - Drilling	6.9E-02
Pit - Blasting	1.9E-02
Total Fugitive Source Emissions per Phase:	8.67E+00
chck	8.67E+00

Grand Total per Phase: 8.875

PM25 (lb/hr)	NO2 (lb/hr)	NOx (lb/hr)	SO2 (lb/hr)	SOx (lb/hr)	CO (lb/hr)	VOC (lb/hr)
1.62E-02	3.04E-01	3.04E-01	2.69E-04	2.69E-04	2.67E-01	6.21E-02
1.62E-02	3.04E-01	3.04E-01	2.69E-04	2.69E-04	2.67E-01	6.21E-02
1.62E-02	3.04E-01	3.04E-01	2.69E-04	2.69E-04	2.67E-01	6.21E-02
1.62E-02	3.04E-01	3.04E-01	2.69E-04	2.69E-04	2.67E-01	6.21E-02
1.62E-02	3.04E-01	3.04E-01	2.69E-04	2.69E-04	2.67E-01	6.21E-02
1.62E-02	3.04E-01	3.04E-01	2.69E-04	2.69E-04	2.67E-01	6.21E-02
1.62E-02	3.04E-01	3.04E-01	2.69E-04	2.69E-04	2.67E-01	6.21E-02
1.62E-02	3.04E-01	3.04E-01	2.69E-04	2.69E-04	2.67E-01	6.21E-02
1.62E-02	3.04E-01	3.04E-01	2.69E-04	2.69E-04	2.67E-01	6.21E-02
5.56E-02	7.42E-01	7.42E-01	1.23E-03	1.23E-03	9.27E-01	2.84E-01
3.23E-03	5.07E-01	5.07E-01	7.15E-04	7.15E-04	5.39E-01	1.65E-01
3.51E-03	7.02E-02	7.02E-02	1.16E-03	1.16E-03	8.78E-01	3.34E-02
0.208	**4.054**	**4.054**	**0.006**	**0.006**	**4.750**	**1.042**
0.208	4.054	4.054	0.006	0.006	4.750	1.042

PM25 (lb/hr)	NO2 (lb/hr)	NOx (lb/hr)	SO2 (lb/hr)	SOx (lb/hr)	CO (lb/hr)	VOC (lb/hr)	Al (lb/hr)
4.1E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.1E-02
4.1E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.1E-02
3.2E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.6E-05
2.8E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.8E-06
3.1E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.9E-04
3.1E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.9E-04
3.1E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.9E-04
1.1E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.6E-04
1.1E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.6E-04
9.2E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.6E-04
9.2E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.6E-04
6.8E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.7E-05
6.9E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.4E-04
1.1E-03	7.54E-01	7.54E-01	8.87E-02	8.87E-02	2.97E+00	0.00E+00	1.8E-04
9.45E-01	7.54E-01	7.54E-01	8.87E-02	8.87E-02	2.97E+00	0.00E+00	6.58E-02
9.45E-01	7.54E-01		8.87E-02		2.97E+00	0.00E+00	6.58E-02
1.153	4.807	4.807	0.094	0.094	7.721	1.042	0.066

Stack Height (ft)	Temp. (°F)	Exit Velocity (ft/sec)	Stack Diameter (ft)	Release Direction
6.17	869.00	172.70	0.125	vertical
6.17	869.00	172.70	0.125	vertical
6.17	869.00	172.70	0.125	vertical
6.17	869.00	172.70	0.125	vertical
6.17	869.00	172.70	0.125	vertical
6.17	869.00	172.70	0.125	vertical
6.17	869.00	172.70	0.125	vertical
6.17	869.00	172.70	0.125	vertical
6.17	869.00	172.70	0.125	vertical
9.05	1094.00	101.76	0.375	vertical
5.15	1078.00	125.80	0.200	vertical
7.61	835.00	135.54	0.250	vertical

As (lb/hr)	Cd (lb/hr)	Fe (lb/hr)	Ni (lb/hr)
2.0E-05	3.5E-05	3.7E-02	1.9E-04
2.0E-05	3.5E-05	3.7E-02	1.9E-04
1.0E-08	1.8E-08	1.9E-05	1.0E-07
2.5E-09	2.3E-08	1.2E-06	2.5E-08
2.7E-07	2.5E-06	1.3E-04	2.7E-06
2.7E-07	2.5E-06	1.3E-04	2.7E-06
2.7E-07	2.5E-06	1.3E-04	2.7E-06
3.7E-07	6.3E-07	6.8E-04	3.5E-06
3.7E-07	6.3E-07	6.8E-04	3.5E-06
3.0E-07	5.2E-07	5.5E-04	2.9E-06
3.0E-07	5.2E-07	5.5E-04	2.9E-06
1.4E-07	1.3E-06	6.4E-05	1.3E-06
1.5E-06	2.1E-06	9.0E-04	1.5E-05
4.1E-07	5.8E-07	2.5E-04	4.1E-06
4.47E-05	8.38E-05	7.87E-02	4.29E-04
4.47E-05	8.38E-05	7.87E-02	4.29E-04
0.000	0.000	0.079	0.000

Summary - Low-Se Waste ppmw

	Weighted average of geometric mean
Aluminum	7563.3
Antimony	0.5
Arsenic	4.9
Beryllium	0.5
Cadmium	8.5
Chromium	82.5
Copper	21.1
Iron	9061.4
Lead	4.9
Manganese	219.4
Molybdenum	2.7
Nickel	47.1
Selenium	4.0
Silver	0.3
Uranium	7.3
Zinc	251.9

Summary - Ore ppmw

Metal TAP	Average of geometric mean
Aluminum	9533.6
Antimony	5.3
Arsenic	13.5
Beryllium	1.6
Cadmium	124.5
Chromium	771.3
Copper	80.3
Iron	6330.5
Lead	11.0
Manganese	42.8
Molybdenum	22.3
Nickel	133.1
Selenium	62.6
Silver	8.6
Uranium	102.2
Zinc	1336.5

Summary - Run of Mine Waste ppmw

	Weighted average of geometric mean
Aluminum	9167.6
Antimony	4.4
Arsenic	21.0
Beryllium	1.1
Cadmium	30.0
Chromium	555.0
Copper	62.0
Iron	13046.3
Lead	7.8
Manganese	137.8
Molybdenum	25.9
Nickel	211.7
Selenium	86.7
Silver	4.6
Uranium	28.5
Zinc	1206.2

Emission Factors for Greenhouse Gas Inventories

Last Modified: 4 April 2014

Red text indicates an update from the 2011 version of this document.

Typically, greenhouse gas emissions are reported in units of carbon dioxide equivalent (CO_2e). Gases are converted to CO_2e by multiplying by their global warming potential (GWP). The emission factors listed in this document have not been converted to CO_2e. To do so, multiply the emissions by the corresponding GWP listed in the table below.

Gas	100-year GWP
CH_4	25
N_2O	298

Source: Intergovernmental Panel on Climate Change (IPCC), Fourth Assessment Report (AR4), 2007. See the source note to Table 9 for further explanation.

Table 1 Stationary Combustion Emission Factors

Fuel Type	Heating Value	CO_2 Factor	CH_4 Factor	N_2O Factor	CO_2 Factor	CH_4 Factor	N_2O Factor	Unit
	mmBtu per short ton	kg CO_2 per mmBtu	g CH_4 per mmBtu	g N_2O per mmBtu	kg CO_2 per short ton	g CH_4 per short ton	g N_2O per short ton	
Coal and Coke								
Anthracite Coal	25.09	103.69	11	1.6	2,602	276	40	short tons
Bituminous Coal	24.93	93.28	11	1.6	2,325	274	40	short tons
Sub-bituminous Coal	17.25	97.17	11	1.6	1,676	190	28	short tons
Lignite Coal	14.21	97.72	11	1.6	1,389	156	23	short tons
Mixed (Commercial Sector)	21.39	94.27	11	1.6	2,016	235	34	short tons
Mixed (Electric Power Sector)	19.73	95.52	11	1.6	1,885	217	32	short tons
Mixed (Industrial Coking)	26.28	93.90	11	1.6	2,468	289	42	short tons
Mixed (Industrial Sector)	22.35	94.67	11	1.6	2,116	246	36	short tons
Coal Coke	24.80	113.67	11	1.6	2,819	273	40	short tons
Fossil Fuel-derived Fuels (Solid)								
Municipal Solid Waste	9.95	90.70	32	4.2	902	318	42	short tons
Petroleum Coke (Solid)	30.00	102.41	32	4.2	3,072	960	126	short tons
Plastics	38.00	75.00	32	4.2	2,850	1,216	160	short tons
Tires	28.00	85.97	32	4.2	2,407	896	118	short tons
Biomass Fuels (Solid)								
Agricultural Byproducts	8.25	118.17	32	4.2	975	264	35	short tons
Peat	8.00	111.84	32	4.2	895	256	34	short tons
Solid Byproducts	10.39	105.51	32	4.2	1,096	332	44	short tons
Wood and Wood Residuals	17.48	93.80	7.2	3.6	1,640	126	63	short tons
	mmBtu per scf	kg CO_2 per mmBtu	g CH_4 per mmBtu	g N_2O per mmBtu	kg CO_2 per scf	g CH_4 per scf	g N_2O per scf	
Natural Gas								
Natural Gas (per scf)	0.001026	53.06	1.0	0.10	0.05444	0.00103	0.00010	scf
Fossil-derived Fuels (Gaseous)								
Blast Furnace Gas	0.000092	274.32	0.022	0.10	0.02524	0.000002	0.000009	scf
Coke Oven Gas	0.000599	46.85	0.48	0.10	0.02806	0.000288	0.000060	scf
Fuel Gas	0.001388	59.00	3.0	0.60	0.08189	0.004164	0.000833	scf
Propane Gas	0.002516	61.46	0.022	0.10	0.15463	0.000055	0.000252	scf
Biomass Fuels (Gaseous)								
Landfill Gas	0.000485	52.07	3.2	0.63	0.025254	0.001552	0.000306	scf
Other Biomass Gases	0.000655	52.07	3.2	0.63	0.034106	0.002096	0.000413	scf
	mmBtu per gallon	kg CO_2 per mmBtu	g CH_4 per mmBtu	g N_2O per mmBtu	kg CO_2 per gallon	g CH_4 per gallon	g N_2O per gallon	
Petroleum Products								
Asphalt and Road Oil	0.158	75.36	3.0	0.60	11.91	0.47	0.09	gallon
Aviation Gasoline	0.120	69.25	3.0	0.60	8.31	0.36	0.07	gallon
Butane	0.103	64.77	3.0	0.60	6.67	0.31	0.06	gallon
Butylene	0.105	68.72	3.0	0.60	7.22	0.32	0.06	gallon
Crude Oil	0.138	74.54	3.0	0.60	10.29	0.41	0.08	gallon
Distillate Fuel Oil No. 1	0.139	73.25	3.0	0.60	10.18	0.42	0.08	gallon
Distillate Fuel Oil No. 2	0.138	73.96	3.0	0.60	10.21	0.41	0.08	gallon
Distillate Fuel Oil No. 4	0.146	75.04	3.0	0.60	10.96	0.44	0.09	gallon
Ethane	0.068	59.60	3.0	0.60	4.05	0.20	0.04	gallon
Ethylene	0.058	65.96	3.0	0.60	3.83	0.17	0.03	gallon
Heavy Gas Oils	0.148	74.92	3.0	0.60	11.09	0.44	0.09	gallon
Isobutane	0.099	64.94	3.0	0.60	6.43	0.30	0.06	gallon
Isobutylene	0.103	68.86	3.0	0.60	7.09	0.31	0.06	gallon
Kerosene	0.135	75.20	3.0	0.60	10.15	0.41	0.08	gallon
Kerosene-type Jet Fuel	0.135	72.22	3.0	0.60	9.75	0.41	0.08	gallon
Liquefied Petroleum Gases (LPG)	0.092	61.71	3.0	0.60	5.68	0.28	0.06	gallon
Lubricants	0.144	74.27	3.0	0.60	10.69	0.43	0.09	gallon
Motor Gasoline	0.125	70.22	3.0	0.60	8.78	0.38	0.08	gallon
Naphtha (<401 deg F)	0.125	68.02	3.0	0.60	8.50	0.38	0.08	gallon
Natural Gasoline	0.110	66.88	3.0	0.60	7.36	0.33	0.07	gallon
Other Oil (>401 deg F)	0.139	76.22	3.0	0.60	10.59	0.42	0.08	gallon
Pentanes Plus	0.110	70.02	3.0	0.60	7.70	0.33	0.07	gallon
Petrochemical Feedstocks	0.125	71.02	3.0	0.60	8.88	0.38	0.08	gallon
Petroleum Coke	0.143	102.41	3.0	0.60	14.64	0.43	0.09	gallon
Propane	0.091	62.87	3.0	0.60	5.72	0.27	0.05	gallon
Propylene	0.091	65.95	3.0	0.60	6.00	0.27	0.05	gallon
Residual Fuel Oil No. 5	0.140	72.93	3.0	0.60	10.21	0.42	0.08	gallon
Residual Fuel Oil No. 6	0.150	75.10	3.0	0.60	11.27	0.45	0.09	gallon
Special Naphtha	0.125	72.34	3.0	0.60	9.04	0.38	0.08	gallon
Still Gas	0.143	66.72	3.0	0.60	9.54	0.43	0.09	gallon
Unfinished Oils	0.139	74.54	3.0	0.60	10.36	0.42	0.08	gallon
Used Oil	0.138	74.00	3.0	0.60	10.21	0.41	0.08	gallon
Biomass Fuels (Liquid)								
Biodiesel (100%)	0.128	73.84	1.1	0.11	9.45	0.14	0.01	gallon
Ethanol (100%)	0.084	68.44	1.1	0.11	5.75	0.09	0.01	gallon
Rendered Animal Fat	0.125	71.06	1.1	0.11	8.88	0.14	0.01	gallon
Vegetable Oil	0.120	81.55	1.1	0.11	9.79	0.13	0.01	gallon
	mmBtu per gallon	kg CO_2 per mmBtu	g CH_4 per mmBtu	g N_2O per mmBtu				
Steam and Hot Water								
Steam and Hot Water		66.33	1.250	0.125				mmBtu

Source:

Solid, gaseous, liquid and biomass fuels: Federal Register (2009) EPA*; 40 CFR Parts 86, 87, 89 et al; Mandatory Reporting of Greenhouse Gases; Final Rule*, 30Oct09, 261 pp. Tables C-1 and C-2 at FR pp. 56409-56410. Revised emission factors for selected fuels: Federal Register (2010) EPA; 40 CFR Part 98; Mandatory Reporting of Greenhouse Gases; Final Rule, 17Dec10, 81 pp. With Amendments from Memo: Table of Final 2013 Revisions to the Greenhouse Gas Reporting Rule (PDF) to 40 CFR part 98, subpart C: Table C–1 to Subpart C—Default CO2 Emission Factors and High Heat Values for Various Types of Fuel and Table C–2 to Subpart C—Default CH4 and N2O Emission Factors for Various Types of Fuel.

Steam and Hot Water: EPA (2008) *Climate Leaders Greenhouse Gas Inventory Protocol Core Module Guidance - Indirect Emissions from Purchases/Sales of Electricity and Steam*. Assumption: 80% boiler efficiency and fuel type assumed natural gas. Factors are per mmBtu of steam or hot water purchased.

http://www.epa.gov/ghgreporting/documents/pdf/2013/documents/memo-2013-technical-revisions.pdf
http://www.epa.gov/ghgreporting/reporters/subpart/c.html

Table 2 **Mobile Combustion CO_2 Emission Factors**

Fuel Type	kg CO_2 per unit	Unit
Aviation Gasoline	8.31	gallon
Biodiesel (100%)	9.45	gallon
Compressed Natural Gas (CNG)	0.0545	scf
Diesel Fuel	10.21	gallon
Ethane	4.05	gallon
Ethanol (100%)	5.75	gallon
Jet Fuel (kerosene type)	9.75	gallon
Liquefied Natural Gas (LNG)	4.46	gallon
Liquefied Petroleum Gases (LPG)	5.68	gallon
Methanol	4.10	gallon
Motor Gasoline	8.78	gallon
Propane	5.72	gallon
Residual Fuel Oil	11.27	gallon

Source:
Federal Register (2009) *EPA; 40 CFR Parts 86, 87, 89 et al; Mandatory Reporting of Greenhouse Gases; Final Rule* , 30Oct09, 261 pp. Tables C-1 and C-2. Table of Final 2013 Revisions to the Greenhouse Gas
LNG sourced from: EPA (2008) *Climate Leaders Greenhouse Gas Inventory Protocol Core Module Guidance - Direct Emissions from Mobile Combustion Sources,* Table B-5.
Methanol sourced from: The Climate Registry (2013); *General Reporting Protocol for the Voluntary Reporting Program Version 2.0* , Default Emission Factors, Table 13.1 US Default CO_2 Emission Factors for Transport Fuels.

Table 3 **Mobile Combustion CH_4 and N_2O Emission Factors for On-road Gasoline Vehicles**

Vehicle Type	Year	CH_4 Factor (g / mile)	N_2O Factor (g / mile)
Gasoline Passenger Cars	1973-74	0.1696	0.0197
	1975	0.1423	0.0443
	1976-77	0.1406	0.0458
	1978-79	0.1389	0.0473
	1980	0.1326	0.0499
	1981	0.0802	0.0626
	1982	0.0795	0.0627
	1983	0.0782	0.0630
	1984-93	0.0704	0.0647
	1994	0.0531	0.0560
	1995	0.0358	0.0473
	1996	0.0272	0.0426
	1997	0.0268	0.0422
	1998	0.0249	0.0393
	1999	0.0216	0.0337
	2000	0.0178	0.0273
	2001	0.0110	0.0158
	2002	0.0107	0.0153
	2003	0.0114	0.0135
	2004	0.0145	0.0083
	2005	0.0147	0.0079
	2006	0.0161	0.0057
	2007	0.0170	0.0041
	2008	0.0172	0.0038
	2009-present	0.0173	0.0036
Gasoline Light-duty Trucks (Vans, Pickup Trucks, SUVs)	1973-74	0.1908	0.0218
	1975	0.1634	0.0513
	1976	0.1594	0.0555
	1977-78	0.1614	0.0534
	1979-80	0.1594	0.0555
	1981	0.1479	0.0660
	1982	0.1442	0.0681
	1983	0.1368	0.0722
	1984	0.1294	0.0764
	1985	0.1220	0.0806
	1986	0.1146	0.0848
	1987-93	0.0813	0.1035
	1994	0.0646	0.0982
	1995	0.0517	0.0908
	1996	0.0452	0.0871
	1997	0.0452	0.0871
	1998	0.0391	0.0728
	1999	0.0321	0.0564
	2000	0.0346	0.0621
	2001	0.0151	0.0164
	2002	0.0178	0.0228
	2003	0.0155	0.0114
	2004	0.0152	0.0132
	2005	0.0157	0.0101
	2006	0.0159	0.0089
	2007	0.0161	0.0079
	2008-present	0.0163	0.0066
Gasoline Heavy-duty Vehicles	<1981	0.4604	0.0497
	1982-84	0.4492	0.0538
	1985-86	0.4090	0.0515
	1987	0.3675	0.0849
	1988-1989	0.3492	0.0933
	1990-1995	0.3246	0.1142
	1996	0.1278	0.1680
	1997	0.0924	0.1726
	1998	0.0641	0.1693
	1999	0.0578	0.1435
	2000	0.0493	0.1092
	2001	0.0528	0.1235
	2002	0.0546	0.1307
	2003	0.0533	0.1240
	2004	0.0341	0.0285
	2005	0.0326	0.0177
	2006	0.0327	0.0171
	2007	0.0330	0.0153
	2008-present	0.0333	0.0134

Source: EPA (2014) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2012. All values are calculated from Tables A-101 through A-105.

Table 4 Mobile Combustion CH_4 and N_2O Emission Factors for On-road Diesel and Alternative Fuel Vehicles

Vehicle Type	Vehicle Year	CH_4 Factor (g / mile)	N_2O Factor (g / mile)
Diesel Passenger Cars	1960-1982	0.0006	0.0012
	1983-1995	0.0005	0.0010
	1996-present	0.0005	0.0010
Diesel Light-duty Trucks	1960-1982	0.0011	0.0017
	1983-1995	0.0009	0.0014
	1996-present	0.0010	0.0015
Diesel Medium- and Heavy-duty Vehicles	1960-present	0.0051	0.0048
Gasoline Motorcycles	1960-1995	0.0899	0.0087
	1996-present	0.0672	0.0069
CNG Light-duty Vehicles		0.7370	0.0500
CNG Heavy-duty Vehicles		1.9660	0.1750
CNG Buses		1.9660	0.1750
LPG Light-duty Vehicles		0.0370	0.0670
LPG Heavy-duty Vehicles		0.0660	0.1750
LNG Heavy-duty Vehicles		1.9660	0.1750
Ethanol Light-duty Vehicles		0.0550	0.0670
Ethanol Heavy-duty Vehicles		0.1970	0.1750
Ethanol Buses		0.1970	0.1750

Source: EPA (2014) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2012. All values are calculated from Tables A-104 through A-106.

Table 5 Mobile Combustion CH_4 and N_2O Emission Factors for Non-road Vehicles

Vehicle Type	CH_4 Factor (g / gallon)	N_2O Factor (g / gallon)
LPG Non-Highway Vehicles	0.50	0.22
Residual Oil Ships and Boats	0.11	0.57
Diesel Ships and Boats	0.06	0.45
Gasoline Ships and Boats	0.64	0.22
Diesel Locomotives	0.80	0.26
Gasoline Agricultural Equip.	1.26	0.22
Diesel Agricultural Equip.	1.44	0.26
Gasoline Construction Equip.	0.50	0.22
Diesel Construction Equip.	0.57	0.26
Jet Fuel Aircraft	0.00	0.30
Aviation Gasoline Aircraft	7.06	0.11
Biodiesel Vehicles	0.57	0.26
Other Diesel Sources	0.57	0.26
Other Gasoline Sources	0.50	0.22

Source: EPA (2014) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2012. All values are calculated from Table A-107.
Note: LPG non-highway vehicles assumed equal to other gasoline sources. Biodiesel vehicles assumed equal to other diesel sources.

Table 6 Electricity Emission Factors

eGRID Subregion	Total output emission factors			Non-baseload emission factors		
	CO_2 Factor (lb CO_2 /MWh)	CH_4 Factor (lb CH_4 /MWh)	N_2O Factor (lb N_2O /MWh)	CO_2 Factor (lb CO_2/MWh)	CH_4 Factor (lb CH_4/MWh)	N_2O Factor (lb N_2O/MWh)
AKGD (ASCC Alaska Grid)	1,256.87	0.02608	0.00718	1,387.37	0.03405	0.00693
AKMS (ASCC Miscellaneous)	448.57	0.01874	0.00368	1,427.76	0.05997	0.01180
AZNM (WECC Southwest)	1,177.61	0.01921	0.01572	1,210.44	0.02188	0.00986
CAMX (WECC California)	610.82	0.02849	0.00603	932.82	0.03591	0.00455
ERCT (ERCOT All)	1,218.17	0.01685	0.01407	1,181.70	0.02012	0.00763
FRCC (FRCC All)	1,196.71	0.03891	0.01375	1,277.42	0.03873	0.01083
HIMS (HICC Miscellaneous)	1,330.16	0.07398	0.01388	1,690.72	0.10405	0.01912
HIOA (HICC Oahu)	1,621.86	0.09930	0.02241	1,588.23	0.11948	0.02010
MROE (MRO East)	1,610.80	0.02429	0.02752	1,755.66	0.03153	0.02799
MROW (MRO West)	1,536.36	0.02853	0.02629	2,054.55	0.05986	0.03553
NEWE (NPCC New England)	722.07	0.07176	0.01298	1,106.82	0.06155	0.01207
NWPP (WECC Northwest)	842.58	0.01605	0.01307	1,340.34	0.04138	0.01784
NYCW (NPCC NYC/Westchester)	622.42	0.02381	0.00280	1,131.63	0.02358	0.00244
NYLI (NPCC Long Island)	1,336.11	0.08149	0.01028	1,445.94	0.03403	0.00391
NYUP (NPCC Upstate NY)	545.79	0.01630	0.00724	1,253.77	0.03683	0.01367
RFCE (RFC East)	1,001.72	0.02707	0.01533	1,562.72	0.03593	0.02002
RFCM (RFC Michigan)	1,629.38	0.03046	0.02684	1,744.52	0.03231	0.02600
RFCW (RFC West)	1,503.47	0.01820	0.02475	1,982.87	0.02450	0.03107
RMPA (WECC Rockies)	1,896.74	0.02266	0.02921	1,808.03	0.02456	0.02289
SPNO (SPP North)	1,799.45	0.02081	0.02862	1,951.83	0.02515	0.02690
SPSO (SPP South)	1,580.60	0.02320	0.02085	1,436.29	0.02794	0.01210
SRMV (SERC Mississippi Valley)	1,029.82	0.02066	0.01076	1,222.40	0.02771	0.00663
SRMW (SERC Midwest)	1,810.83	0.02048	0.02957	1,964.98	0.02393	0.02965
SRSO (SERC South)	1,354.09	0.02282	0.02089	1,574.37	0.02652	0.02149
SRTV (SERC Tennessee Valley)	1,389.20	0.01770	0.02241	1,873.83	0.02499	0.02888
SRVC (SERC Virginia/Carolina)	1,073.65	0.02169	0.01764	1,624.71	0.03642	0.02306
US Average	1,232.35	0.02414	0.01826	1,520.20	0.03127	0.01834

Source: EPA Year 2010 eGRID 9th edition Version 1.0 February 2014.
Note: Total output emission factors are used for quantifying emissions from purchased electricity. Non-baseload emission factors are used for quantifying the emission reductions from purchased green power.

This is a representational map; many of the boundaries shown on this map are approximate because they are based on companies, not on strictly geographical boundaries.
Source: EPA Year 2010 eGRID 9th edition Version 1.0 February 2014.

Table 7 Business Travel Emission Factors

Vehicle Type	CO_2 Factor (kg / unit)	CH_4 Factor (g / unit)	N_2O Factor (g / unit)	Units

Passenger Car [A]	0.368	0.018	0.013	vehicle-mile
Light-duty Truck [B]	0.501	0.024	0.019	vehicle-mile
Motorcycle	0.197	0.070	0.007	vehicle-mile
Intercity Rail (i.e. Amtrak) [C]	0.144	0.0085	0.0032	passenger-mile
Commuter Rail [D]	0.174	0.0084	0.0035	passenger-mile
Transit Rail (i.e. Subway, Tram) [E]	0.133	0.0026	0.0020	passenger-mile
Bus	0.058	0.0007	0.0004	passenger-mile
Air Travel - Short Haul (< 300 miles)	0.275	0.0091	0.0087	passenger-mile
Air Travel - Medium Haul (>= 300 miles, < 2300 miles)	0.162	0.0008	0.0052	passenger-mile
Air Travel - Long Haul (>= 2300 miles)	0.191	0.0008	0.0060	passenger-mile

Source:

CO_2, CH_4, and N_2O emissions data for highway vehicles are from Table 2-15 of the Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2012. Vehicle-miles and passenger-miles data for highway vehicles are from Table VM-1 of the Federal Highway Administration Highway Statistics 2012.

Fuel consumption data and passenger-miles data for rail are from Tables A.14 to A.16 and 9.10 to 9.12 of the Transportation Energy Data Book: Edition 32. Fuel consumption was converted to emissions by using fuel and electricity emission factors presented in the tables above.

Notes:

[A] Passenger car: includes passenger cars, minivans, SUVs, and small pickup trucks (vehicles with wheelbase less than 121 inches).

[B] Light-duty truck: includes full-size pickup trucks, full-size vans, and extended-length SUVs (vehicles with wheelbase greater than 121 inches).

[C] Intercity rail: long-distance rail between major cities, such as Amtrak

[D] Commuter rail: rail service between a central city and adjacent suburbs (also called regional rail or suburban rail)

[E] Transit rail: rail typically within an urban center, such as subways, elevated railways, metropolitan railways (metro), streetcars, trolley cars, and tramways.

Table 8 Product Transport Emission Factors

Vehicle Type	CO_2 Factor (kg / unit)	CH_4 Factor (g / unit)	N_2O Factor (g / unit)	Units
Medium- and Heavy-duty Truck	1.456	0.018	0.011	vehicle-mile
Passenger Car [A]	0.368	0.018	0.013	vehicle-mile
Light-duty Truck [B]	0.501	0.024	0.019	vehicle-mile
Medium- and Heavy-duty Truck	0.296	0.0036	0.0022	ton-mile
Rail	0.026	0.0020	0.0007	ton-mile
Waterborne Craft	0.042	0.0004	0.0027	ton-mile
Aircraft	1.301	0.0000	0.0400	ton-mile

Source:

CO_2, CH_4, and N_2O emissions data for highway vehicles are from Table 2-15 of the Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2012. Vehicle-miles and passenger-miles data for highway vehicles are from Table VM-1 of the Federal Highway Administration Highway Statistics 2012.

CO_2e emissions data for non-highway vehicles are based on Table A-116 of the U.S. Greenhouse Gas Emissions and Sinks: 1990–2012, which are distributed into CO_2, CH_4, and N_2O emissions based on fuel/vehicle emission factors. Freight ton-mile data for non-highway vehicles are from Table 1-50 of the Bureau of Transportation Statistics, National Transportation Statistics for 2012.

Notes:

Vehicle-mile factors are appropriate to use when the entire vehicle is dedicated to transporting the reporting company's product. Ton-mile factors are appropriate when the vehicle is shared with products from other companies.

[A] Passenger car: includes passenger cars, minivans, SUVs, and small pickup trucks (vehicles with wheelbase less than 121 inches).

[B] Light-duty truck: includes full-size pickup trucks, full-size vans, and extended-length SUVs (vehicles with wheelbase greater than 121 inches).

Table 9 Global Warming Potentials (GWPs)

Gas	100-year GWP
CO_2	1
CH_4	25
N_2O	298
HFC-23	14,800
HFC-32	675
HFC-41	92
HFC-125	3,500
HFC-134	1,100
HFC-134a	1,430
HFC-143	353
HFC-143a	4,470
HFC-152	53
HFC-152a	124
HFC-161	12
HFC-227ea	3,220
HFC-236cb	1,340
HFC-236ea	1,370
HFC-236fa	9,810
HFC-245ca	693
HFC-245fa	1,030
HFC-365mfc	794
HFC-43-10mee	1,640
SF_6	22,800
NF_3	17,200
CF_4	7,390
C_2F_6	12,200
C_3F_8	8,830
$c\text{-}C_4F_8$	10,300
C_4F_{10}	8,860
C_5F_{12}	9,160
C_6F_{14}	9,300
$C_{10}F_{18}$	>7,500

Source:
100-year GWPs from IPCC Fourth Assessment Report (AR4), 2007. IPCC AR4 was published in 2007 and is among the most current and comprehensive peer-reviewed assessments of climate change. AR4 provides revised GWPs of several GHGs relative to the values provided in previous assessment reports, following advances in scientific knowledge on the radiative efficiencies and atmospheric lifetimes of these GHGs and of CO_2. Because the GWPs provided in AR4 reflect an improved scientific understanding of the radiative effects of these gases in the atmosphere, the values provided are more appropriate for supporting the overall goal of organizational GHG reporting than the Second Assessment Report (SAR) GWP values previously used in the Emission Factors Hub.
While EPA recognizes that Fifth Assessment Report (AR5) GWPs have been published, in an effort to ensure consistency and comparability of GHG data between EPA's voluntary and non-voluntary GHG reporting programs (e.g. GHG Reporting Program and National Inventory), EPA recommends the use of AR4 GWPs. The United States and other developed countries to the UNFCCC have agreed to submit annual inventories in 2015 and future years to the UNFCCC using GWP values from AR4, which will replace the current use of SAR GWP values. Utilizing AR4 GWPs improves EPA's ability to analyze corporate, national, and sub-national GHG data consistently, enhances communication of GHG information between programs, and gives outside stakeholders a consistent, predictable set of GWPs to avoid confusion and additional burden.

Table 9b GWPs for Blended Refrigerants

ASHRAE #	100-year GWP	Blend Composition
R-401A	16	53% HCFC-22 , 34% HCFC-124 , 13% HFC-152a
R-401B	14	61% HCFC-22 , 28% HCFC-124 , 11% HFC-152a
R-401C	19	33% HCFC-22 , 52% HCFC-124 , 15% HFC-152a
R-402A	2,100	38% HCFC-22 , 6% HFC-125 , 2% propane
R-402B	1,330	6% HCFC-22 , 38% HFC-125 , 2% propane
R-403B	3,444	56% HCFC-22 , 39% PFC-218 , 5% propane
R-404A	3,922	44% HFC-125 , 4% HFC-134a , 52% HFC 143a
R-406A	0	55% HCFC-22 , 41% HCFC-142b , 4% isobutane
R-407A	2,107	20% HFC-32 , 40% HFC-125 , 40% HFC-134a
R-407B	2,804	10% HFC-32 , 70% HFC-125 , 20% HFC-134a
R-407C	1,774	23% HFC-32 , 25% HFC-125 , 52% HFC-134a
R-407D	1,627	15% HFC-32 , 15% HFC-125 , 70% HFC-134a
R-407E	1,552	25% HFC-32 , 15% HFC-125 , 60% HFC-134a
R-408A	2,301	47% HCFC-22 , 7% HFC-125 , 46% HFC 143a
R-409A	0	60% HCFC-22 , 25% HCFC-124 , 15% HCFC-142b
R-410A	2,088	50% HFC-32 , 50% HFC-125
R-410B	2,229	45% HFC-32 , 55% HFC-125
R-411A	14	87.5% HCFC-22 , 11 HFC-152a , 1.5% propylene
R-411B	4	94% HCFC-22 , 3% HFC-152a , 3% propylene
R-413A	2,053	88% HFC-134a , 9% PFC-218 , 3% isobutane
R-414A	0	51% HCFC-22 , 28.5% HCFC-124 , 16.5% HCFC-142b
R-414B	0	5% HCFC-22 , 39% HCFC-124 , 9.5% HCFC-142b
R-417A	2,346	46.6% HFC-125 , 5% HFC-134a , 3.4% butane
R-422A	3,143	85.1% HFC-125 , 11.5% HFC-134a , 3.4% isobutane
R-422D	2,729	65.1% HFC-125 , 31.5% HFC-134a , 3.4% isobutane
R-423A	2,280	47.5% HFC-227ea , 52.5% HFC-134a ,
R-424A	2,440	50.5% HFC-125, 47% HFC-134a, 2.5% butane/pentane
R-426A	1,508	5.1% HFC-125, 93% HFC-134a, 1.9% butane/pentane
R-428A	3,607	77.5% HFC-125 , 2% HFC-143a , 1.9% isobutane
R-434A	3,245	63.2% HFC-125, 16% HFC-134a, 18% HFC-143a, 2.8% isobutane
R-500	32	73.8% CFC-12 , 26.2% HFC-152a , 48.8% HCFC-22
R-502	0	48.8% HCFC-22 , 51.2% CFC-115
R-504	325	48.2% HFC-32 , 51.8% CFC-115
R-507	3,985	5% HFC-125 , 5% HFC143a
R-508A	13,214	39% HFC-23 , 61% PFC-116
R-508B	13,396	46% HFC-23 , 54% PFC-116

Source:
100-year GWPs from IPCC Fourth Assessment Report (AR4), 2007. See the source note to Table 9 for further explanation. GWPs of blended refrigerants are based on their HFC and PFC constituents, which are based on data from http://www.epa.gov/ozone/snap/refrigerants/refblend.html.