ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
AIR PERMITS PROGRAM

TECHNICAL ANALYSIS REPORT

for

Air Quality Control Minor Source Permit AQ1227MSS03

Usibelli Coal Mine, Inc.
Wishbone Hill Coal Mining and Processing Operation

DEVELOPMENT OF COAL MINING OPERATIONS

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ABBREVIATIONS/ACRONYMS

AAC ..... Alaska Administrative Code
ACMP ..... Alaska Coastal Management Program
ADEC ..... Alaska Department of Environmental Conservation
AS ..... Alaska Statutes
ASTM ..... American Society of Testing and Materials
BAE ..... Baseline Actual Emissions
CEMS ..... Continuous Emission Monitoring System
C.F.R. ..... Code of Federal Regulations
EPA ..... Environmental Protection Agency
MACT ..... Maximum Achievable Control Technology
NA ..... Not Applicable
NAICS ..... North American Industry Classification System
NESHAPS ..... National Emission Standards for Hazardous Air Pollutants
NSPS ..... New Source Performance Standards
ORL ..... Owner Requested Limit
PAE ..... Projected Actual Emissions
PS ..... Performance Specification
PSD ..... Prevention of Significant Deterioration
PTE ..... Potential to Emit
RM ..... Reference Method
SIC ..... Standard Industrial Classification
SN ..... Serial Number
TBD ..... To Be Determined

Units and Measures

bhp ..... brake horsepower or boiler horsepower
gr./dscf ..... grains per dry standard cubic feet (1 pound = 7,000 grains)
dscf ..... dry standard cubic foot
gph ..... gallons per hour
kW ..... kiloWatts
kWe ..... kiloWatts electric[1]
lbs ..... pounds
mmBtu ..... million British thermal units
ppm ..... parts per million
ppmv ..... parts per million by volume
tph ..... tons per hour
tpy ..... tons per year
wt% ..... weight percent

Pollutants

CO ..... Carbon Monoxide
HAPS ..... Hazardous Air Pollutants
H_2S ..... Hydrogen Sulfide
NO_X ..... Oxides of Nitrogen
NO_2 ..... Nitrogen Dioxide
NO ..... Nitric Oxide
PM-10 ..... Particulate Matter with an aerodynamic diameter less than 10 microns
SO_2 ..... Sulfur Dioxide
VOC ..... Volatile Organic Compound

Permit Specific

VMT ..... Vehicle Miles Travelled

[1] kWe refers to rated generator electrical output rather than engine output.

1.0 Introduction

This Technical Analysis Report (TAR) provides Alaska Department of Environmental Conservation's basis for issuing Air Quality Control Minor Permit AQ1227MSS02 to Usibelli Coal Mine, Inc. (Permittee) for the Wishbone Hill Coal Mining and Processing Operation, Development of Mining Operations, under 18 AAC 50.502(b)(5) and 18 AAC 50.502(c)(1).

The Permittee submitted an application for a minor air quality permit dated August 5, 2011. The Department of Environmental Conservation (Department) sent an email follow-up for the Permittee to provide a revised dust control plan, to which the Permittee responded to, within the specified timeframe requested.

1.1 Stationary Source Description

The Permittee is planning to operate a coal mining and processing facility at Wishbone Hill located northeast of Palmer, Alaska. Exploration and development work on the Wishbone Hill Project has been in progress since 1983. Exploration drilling discovered a reserve of high quality bituminous coal yielding as much as 1.0 million metric tons per year (Approximately 1,102,311 short tons per year).

This permit will establish the site as a Stationary Source under 18 AAC 50.502(c)(1) and 18 AAC 50.502(b)(5). The permit will also have a dust control plan to help minimize the impact of fugitive dust on ambient air.

1.2 Permit History

The Permittee does not currently have an active Air Quality Permit for construction or operations at the Wishbone Hill Coal Mine. The Department issued two Permits to Operate (9022-AA002 and 9022-AA004) to the Permittee for the Wishbone Hill site on October 12, 1990 for operations to process coal. The Permittee allowed these permits to expire without renewal. On May 26, 2009, the Permittee submitted a permit application to the Department for developing operations and processing coal at the Wishbone Hill coalmine. The project ID was AQ1227MSS01, and the Department during its review determined that the application was incomplete and requested additional information. The Permittee never submitted the requested data and, the Department deemed the application as withdrawn. The Permittee submitted a new application, dated May 7, 2010, to establish mining and processing operations at the Wishbone Hill coalmine, the project ID was AQ1227MSS02. The Department was unable to issue this permit, as during public comment it was determined that the Permittee had not made a sufficient compliance demonstration with the PM-10 AAAQS. Subsequently, the Permittee submitted a new application, Project ID AQ1227MSS03, dated August 5, 2011, with a revised PM-10 demonstration along with other changes to address issues raised by the public to the preliminary permit AQ1227MSS02.

1.3 Project Description

The mine lies at the western end of the Wishbone Hill coal district on the southwestern extent of Wishbone Hill. The Permittee provided a location map as Figure A-1 in the permit application. Wishbone Hill is a synclinal structure bisected by several major transverse and low angle thrust faults. The Permittee has proposed four main coal seam groups for mining during the life of the project. These groups, in descending order are, the Jonesville, Premier, Eska, and Burning Bed groups, with the majority of the recoverable coal located in the Premier group. The Permittee

also is planning to mine another individual coal seam not associated with the other coal groups, the Midway seam, which lies between the Premier and Eska groups. The Permittee provided a more detailed map of the planned mine in Figure A-2 of their permit application.

The Permittee stated that the selected mining plan required careful consideration of the geologic conditions, climatic conditions, and mine plan for the project. The Permittee designed the mining method to allow for optimal equipment utilization and coal recovery to accomplish a continuous pattern from topsoil removal through reclamation while ensuring environmental protection.

The Permittee will remove topsoil with dozers and/or scrapers and the Permittee either will use the topsoil immediately for reclamation or stockpiled for later use. The Permittee will be removing the overburden and coal, with a hydraulic excavator, and the Permittee will place it into 150-ton capacity haul trucks. Due to steeply dipping seams and the depth of the mining pit, direct haul back of overburden and inter-burden material is not always possible, and so the Permittee will temporarily stockpile these materials in designated areas.

The Permittee will wash or clean the coal using simple washing and separation techniques without the use of chemicals. The Permittee will haul the coarse coal refuse generated at the wash plant, back to the mine area for backfill in the pit. The Permittee will deposit the fine coal refuse in a storage pond. The clean coal will be hauled offsite using road-legal trucks.

The main elements of the coal processing plant are a run-of-mine stockpile, a run-of-mine hopper, the crushing and screening plant, the preparation plant, and the clean coal stockpile. The Permittee provided a plot plan of the coal processing plant facilities in Figure A-3. The Permittee also provided a process flow diagram of the coal treatment process in Figure A-4.

The Permittee will transport the coal to the wash plant from the pit area in 150-ton capacity haul trucks.

At the wash plant, the coal will be either stockpiled or direct loaded into the run-of-mine hopper for processing through the wash plant. The run-of-mine stockpile has a capacity of 100,000 tons to enable continued plant operation during any unexpected lapses in haulage from the pit area. The Permittee will use a front-end loader to load the stockpiled coal into the hopper for processing.

The hopper will feed coal to a grizzly for sizing, and then if required, will send it to a feed breaker, to get the material size to a maximum of 8 inches. This feed will proceed to the crushing and screening circuit for sizing at 3-inch and 3/8-inch. The material falling between 3-inch and 3/8-inch will be the feed to the preparation circuit. In addition, The Permittee will crush 3-inch material in a grizzly, to a maximum 3-inch size. The Permittee will combine these two streams before entering the preparation circuit. The minus 3/8-inch material will be separated and will either be blended into the feed stream for the washing circuit or blend with the clean coal being shipped from the facility. The Permittee will process the 3-inch to 3/8-inch material through the wash plant, which will consist of heavy media cyclones and spirals to separate the coal from the parting material. The Permittee will use as a final step to centrifuge the fine clean coal to reduce the moisture content. The Permittee plans to operate the plant under maximum production of seven days per week, three 8-hour shifts per day. No chemicals, other than inert flocculent used to settle the fine coal waste, will be used in the washing process. The Permittee will accomplish the drying using a centrifuge. Therefore, the Permittee is not planning to use thermal drying of washed coal.

Coarse coal refuse will be loaded from the coarse coal refuse bin into the same trucks hauling coal to the plant for transport back to the pit area. The refuse will be directly placed in areas of current backfilling and will be buried a minimum of four feet below the regarded surface of the overburden material.

Onsite coal storage will be located adjacent to the processing plant. The Permittee will use a truck load-out bin to load the stockpiled coal into highway-legal, covered trucks for delivery.

1.4 Application Description

In this application, The Permittee proposed to establish the Wishbone Hill Stationary Source with the main purpose of coal extraction and processing. The Permittee requested the following:

1. Install a new 900 hp backup diesel electric generator – listed as Emission Unit 1;
2. Install space heaters up to, and including, a maximum of 10 MMBtu/hr total– listed as Emission Unit 2;
3. Maintain adherence to the Dust Control Plan;
4. Use centrifugal centrifuge for drying the coal and not use thermal dryers in the preparation of the coal. Not using thermal dryers in preparation of the coal allows the source to avoid being classified as one of the 100 tpy special category sources under 40 CFR 52.21(b)(1)(iii) and bringing fugitive emissions into the PTE for initial stationary source classification; and
5. Characterize the fugitive emissions and their impact on ambient air quality.

The Permittee provided an emissions unit inventory in the application as shown in Table 1 – Emission Unit Inventory of Minor Permit AQ01227MSS03.

The majority of the emissions identified in the permit application, are fugitive dust emissions. However, these emissions do not count towards permit applicability under 18 AAC 50. The Permittee evaluated the mine emissions to ensure that they do not cause or contribute to a violation of the annual average nitrogen dioxide (NO_2) and the 24-hour PM-10 Alaska Ambient Air Quality Standards (AAAQS).

1.5 Project Emissions Summary

In their application dated August 5, 2011, the Permittee provided emissions calculations for the engines, heaters and fugitive dust sources. The Permittee used the following assumptions in their calculations.

1. Highline power will be the primary electrical power source for the mine, and Emission Unit 1 (Diesel Engine) will provide emergency backup electric power for the operations at the Wishbone Hill mine site, when there is a loss of highline power. The emissions estimates and the AAAQS demonstration used the manufacturer not-to-exceed (NTE) emission factors at 8760 hours operations, to show compliance at the maximum practical operations.
2. Unit 2 (Heaters) will provide space heating to the structures at the mine site. The emission factors are from AP-42, Table 1.3-1.
3. Fugitive Sources –Usibelli based the fugitive emissions estimates for these sources on the maximum expected operation associated with the activities that generate fugitive dust.

4. Usibelli based their emissions estimates on unlimited operation of the sources non-fugitive emissions units. The sources unrestricted emissions show that the stationary source is a true minor source. Based on this, and that there is no threat to any permit thresholds, the Department is not requiring either any restrictions or monitoring on any of the emissions units for permit threshold protection.

Table 1 shows the stationary source's potential emissions with this project, from Emission Units 1 through 36. Emissions from the primary diesel generator (EU ID 1) were calculated using emission factors provided by the manufacturer. Emissions from EU ID(s) 2 through 36 were calculated using emission factors from AP-42. The emissions summary uses 100% load for all the fuel burning equipment.

Table 1 shows the Potential to Emit and Assessable Emissions associated with this stationary source.

Table 1 – Emissions Summary[a] for Permit Applicability and Assessable Emissions Review

Parameter	NO_x (TPY)	CO (TPY)	SO_2 (TPY)	PM-10 (TPY)	PM - 2.5 [b] (TPY)	VOC (TPY)	Total (TPY)
900 hp diesel fired engine	61.3	7.8	0.04	0.8	0.8	0.6	
10 MMBtu/hr diesel fired heater	6.5	1.6	0.1	0.6	0.6	0.1	
PTE for Permit Applicability	67.8	N/A	0.14	1.4	1.4	0.7	
Minor Permit 18 AAC 50.502(c)(1) threshold (tpy)	40	N/A	40	15	N/A	N/A	
Minor Permit Triggered?	Yes	N/A	No	No	N/A	No	
PSD Permit Thresholds (tpy)	250	250	250	250	250	250	
PSD Permit Triggered?	No	No	No	No	No	No	
Operating Permit Threshold (tpy)	100	100	100	100	100	100	
Operating Permit Triggered?	No	No	No	No	No	No	
Assessable Emissions	68	0	0	0	0	0	68

Table 1 Notes:
[a] See Appendix for calculations. Fugitive emissions that are not emitted from a source category listed in 40 CFR 52.21(b)(1)(iii) are not counted towards PSD or minor permit applicability determination.
[b] Usibelli for purposes of PM2.5 PSD review for this permit is assuming that 100% of the applicable PM-10 as PM2.5

The uncontrolled emissions (applicable to determining permitting thresholds[2]) from this stationary source are less than 100 tpy and the stationary source does not trigger Title V permitting requirements.

The application used AP-42 emission factors to calculate fugitive emissions (associated with EU ID(s) 29 – 35). These emission factors account for wet suppression or other control techniques that will reduce the emissions by 50%. The Department has thus imposed a permit condition requiring that the Permittee employ wet suppression techniques that the Department believes will result in well over 50% reduction when the Permittee is operating in those areas (identified, as EU's 29-35).

[2] Emissions characterized as fugitive emissions are not used in determining the stationary sources classification, unless the stationary source is one of the special catagories under 40 CFR 52.21(b)(1), which this is not, unless they begin to use thermal dryers in the preparation of the coal.

1.6 Emission Factor Summary

The Permittee used emission factors from a variety of sections of AP-42 and manufacturer data. Therefore, the Department has included a Table in Exhibit A a list of Emissions Factors as a single concise reference for the origin of each factor.

1.7 Department Findings

Based on the review of the application, the Department finds that:

1. The Permittee stated that they will not be using thermal dryers to dry the coal. If the Permittee does use thermal dryers at some point in the future, the stationary source would then require review under 40 CFR 52.21 as a PSD major source.
2. This project is classified under 18 AAC 50.502(c)(1) because The Permittee is establishing a new stationary source with the potential to emit NO_X emissions by greater than 40 tpy.
3. The Stationary Source Identification Form provided in the application indicates that the stationary source is classified under 18 AAC 50.502(b)(5) for a coal preparation plant.
4. The Permittee is not proposing to burn coal at the stationary source. Therefore, there was no need to evaluate Hazardous Air Pollutant emissions.
5. The Permit application for Wishbone Hill contains all the elements required by 18 AAC 50.540.
6. The emissions from the fuel burning equipment has sufficient margin from the applicable AAAQS and the Permitting trigger thresholds such as the 100 tpy Operation Permit threshold and the 250 tpy PSD thresholds.

2.0 Permit Requirements

State regulations in 18 AAC 50.544 describe the elements that the Department must include in minor permits. This section of the TAR provides the technical and regulatory basis for the permit requirements in Minor Permit AQ1227MSS03, which is, classified under 18 AAC 50.502(b)(5) and 18 AAC 50.502(c)(1).

2.1 General Requirements for all Minor Permits

This permit includes the following requirements necessary for all minor permits as described in 18 AAC 50.544(a)(1) through (4):

1. The cover page identifies the stationary source, the project, the Permittee, and contact information.
2. Emission fee requirements are required for each minor permit issued under 18 AAC 50.542, as described in 18 AAC 50.544(a). The Department is establishing the fee requirements in Permit AQ1227MSS03, and Table 1 shows the assessable emissions are 68 tpy. The fee requirements are included in Section 4 of the permit.
3. There are no specific requirements established under 18 AAC 50.201 for this Stationary Source.

4. The Department included an ORL to operate the stationary source without the use of thermal dryers to avoid PSD classification. The Department specified the reporting requirement for compliance with this condition.
5. Conditions necessary to protect the ambient air quality are included in Section 2 of the permit. Additional discussion of these requirements is contained in Section 2.5 of this TAR.
6. The permit includes the standard permit condition in 18 AAC 50.345. These conditions are included in Sections 6 through 9 of the permit.

2.2 Requirements for a Permit Classified under 18 AAC 50.502(b)(5) and 18 AAC 50.502(c)(1)

This permit includes the following requirements necessary for all minor permits under 18 AAC 50.502(b) as described in 18 AAC 50.544(b)(1) through (2) and 18 AAC 50.544(c) for a Minor permit under 18 AAC 50.502(c):

1. Sections 6 through 8 of the Permit contain the applicable requirements for:
    a. Sampling emissions according to the methods prescribed by the Department and at locations and intervals, and by the procedures specified by the Department;
    b. Providing source test reports, monitoring data, emissions data, and information on analyses of any test samples;
    c. Keeping records; and
    d. Making periodic reports on process operations and emissions;
    e. Perform regular maintenance considering the manufacturer's or the operator's maintenance procedures;
    f. Keep records of any maintenance that would have a significant effect on emissions; the records may be kept in an electronic format; and
    g. Keep a copy of either the manufacturer's or the operator's maintenance procedures.
2. Terms and conditions requiring performance tests for emission limits under 18 AAC 50.050 – 18 AAC 50.090. Since Wishbone Hill will not have Title V operating permit after issuance of AQ1227MSS02, the Department included the periodic monitoring, recordkeeping, and reporting (MR&R) that would be necessary to ensure continued compliance with the state emissions standards for fuel burning equipment and industrial processes. These requirements are in Section 4 of the permit and are discussed in detail in Section 2.4 of this TAR; and
3. Terms and conditions requiring maintenance of equipment according to the manufacturer's or operator's maintenance procedures, including requirements to keep a copy of either the manufacturer's or the operator's maintenance procedures. These requirements are in Section 8 of the permit.

2.3 Requirements for a Stationary Sources not Subject to Title V Permitting:

As required by 18 AAC 50.544(d), each stationary source that is not subject to Title V permitting under 18 AAC 50.326 must periodically affirm that the stationary source is still accurately described by the application and minor permit and whether the owner or operator has made changes that would trigger the requirement for a new permit under this chapter. This provision is included in Section 6 of the minor permit.

For this project, the requirement pertains to an annual affirmation that there have not been any changes to the source described in the application. This requirement will preclude the additions of new emissions units, addition of thermal dryers or other like changes to the source that could affect Air Quality.

2.4 State Emissions Standards

2.4.1 Visible Emission Standard

The diesel fired engine and the diesel heaters (Emission Unit 1 and Emission Unit 2) are *fuel-burning equipment* subject to the state standards for visible emissions in 18 AAC 50.055(a)(1).

Sources such as transfer points, conveyors, Piles, etc… are not *industrial processes* and not subject to the state standard for visible emissions in 18 AAC 50.055(a) (1).

Oil fired heaters, have historically complied with visible emission standards of 18 AAC 50.055(a)(1) when properly operated and maintained. The Department has reviewed its compliance database and found no recorded violations of the Visible Emissions standards for this type of equipment. Therefore, the Department is requiring only an initial compliance demonstration for the heater, within 30 days of startup.

Diesel-fired engines have the potential to exceed the visible emission standard. Therefore, the Department is requiring the Permittee to verify compliance by conducting an initial visible emission surveillance within 30-days after startup and periodic monitoring for continued compliance with the standard.

2.4.2 Particulate Matter Standard

Emission Unit 1 (diesel engine) and Emission Unit 2 (heaters) are *fuel-burning equipment* subject to the state standards for PM emissions of 0.05 grains per dry standard cubic foot of exhaust gas (gr./dscf) in 18 AAC 50.055(b)(1).

Sources such as transfer points, conveyors, Piles, etc… are not *industrial processes* and not subject to the state standard for PM in 18 AAC 50.055(b)(1).

Usibelli included a compliance demonstration in the application for the diesel engine, Emission Unit 1 and Emission Unit 2. The PM emissions for these diesel engines is derived from manufacturer supplied emission data. The Department concurs with these demonstrations. The permit does not include requirements of an initial source test for these units, as the Department concurs with the submitted compliance demonstration.

2.4.3 Sulfur Dioxide Standard

Emission Unit 1 and Emission Unit 2 are fuel-burning equipment subject to the state standards for SO_2 emissions in 18 AAC 50.055(c). Sources such as transfer points, conveyors, Piles, etc…

are not industrial processes and not subject to the state standard for SO_2 emissions in 18 AAC 50.055(c).

To comply with the state standards, a Permittee must combust a fuel with a sulfur content less that 0.75% Sulfur (which is 7,500 ppm), which conservatively ensures that the emission unit will comply with the state standard of 500 ppm of SO_2 in the exhaust. Since ULSD is 15 ppm of sulfur, versus the maximum allowable, the resulting SO_2 emissions on a ppm basis are many orders of magnitude below the state standard for SO_2, resulting in an SO_2 concentration in the exhaust of approximately 1 ppm. The Department is not requiring any compliance demonstration for the heaters, generators, or engines. The Permittee may show compliance with the state sulfur standard for distillate fuel burning equipment by using only ULSD and showing compliance with this by keeping records of fuel grade and amount, and reporting this in the operating report.

2.5 Ambient Air Quality Protection Requirements

Section 2 of the permit contains Conditions to protect the ambient air quality standards for the annual NO_2 and for the 24-hour PM-10 AAAQS.

Because this stationary source has the potential to create fugitive dust, the Department included Conditions in Section 2 for adherence to the fugitive dust plan proposed by the Permittee. The Permittee committed to reducing emissions associated with the vehicle movements inside the mine and on the access roads. Therefore, the Department has included permit conditions to adhere to these reduction techniques in the Dust Control Plan. The Department also added additional monitoring requirement to ensure that the Permittee perform visual surveys at regular intervals, initiate corrective actions of discovering dust leaving the boundary, keep records of visual surveys, record any complaints and if necessary to revise the Dust Control Plant with Department approval.

Based on the Department's review of the ambient analysis, the Department has included ambient monitoring for PM-10 and for meteorological data to ensure the mine does not cause or contribute to a violation of the AAAQS for PM-10. Justification for this is contained in the modeling memo attached to this TAR.

3.0 Permit Administration

Usibelli may construct and operate the stationary source upon issuance.

New Source Performance Standards (NSPS) and National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements are not part of the State of Alaska's minor permit program, and are not included in Minor Permits. The stationary source based on its emissions level is not subject to Title V permitting (18 AAC 50.326), where the NSPS or NESHAP requirements would reside in a State issued permit, therefore the Permittee is obligated to coordinate all associated NSPS and NESHAP requirements with EPA, and courtesy copy the state on all submittals to the EPA. The Department has determined that at a minimum, the stationary source is subject to one NSPS, specifically 40 CFR 60 Subpart Y, as a Coal Preparation and Processing Plant.

Based on the manufacturer date of the diesel engine being selected, and that the stationary source is an Area Source in regards to NESHAP, the Department believes that Unit 1 will be subject to

provisions of NESHAP Subpart ZZZZ, the actual portions that it is subject to will not be included in this permit.

Exhibit A: Emissions Calculations

ID	Unit ID/ Description	Expected Operation	NO_X		CO		SO_2		VOC		PM-10	
			Emission factor	PTE TPY	Emission actor	PTE TPY	Emission factor	PTE TPY	Emission factor	PTE TPY	Emission Factor (In lb/ton unless otherwise noted)	PTE TPY
1	Power Generation	8760 hrs/yr	14.0 lb/hr	61.3	1.77 lb/hr	7.8	15 ppmw	0.04	0.14 lb/hr	0.6	0.18 lb/hr	0.8
2	Heaters	8760 hrs/yr	20 lb/10^3 gal	6.5	0.036 lb/MMBtu	1.6	15 ppmw	0.1	0.002 lb/MMBtu	0.1	2 lb/10^3 gal	0.6
3	Topsoil removal and storage	2,660 hrs/yr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	32.0 lb/hr	42.5
4	Overburden blasting	240 blast/yr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8.27 lb/blast	0.99
5	Coal blasting	120 blasts/yr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8.27 lb/blast	0.50
6	Overburden truck loading	10,306,000 tpy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.00103266	5.3
7	Overburden dumping	10,306,000 tpy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.00103266	5.3
8	Coal removal	1,815,000 tpy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0178	16.1
9	Coal dumping –Crusher feeder	1,815,000 tpy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0178	16.1
10	Coal dumping from run of mine pile	605,000 tpy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0178	5.4
11	Coal Reclaim from run of mine pile	605,000 tpy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0178	5.4
12	Crusher	1,815,000 tpy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0024	2.2
13	Transfer-Crusher to conveyor	1,815,000 tpy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0024	2.2
14	Transfer-Conveyor 1 to raw stockpile	1,815,000 tpy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.00058537	0.5
15	Transfer-Raw stockpile to conveyor 2	1,815,000 tpy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.00058537	0.5
16	Transfer-Conveyor 2 to Jig Plant	1,815,000 tpy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.00058537	0.5
17	Transfer-Jig Plant to Conveyor 3	815,000 tpy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.00058537	0.2
18	Transfer-Conveyor 3 to reject stockpile	815,000 tpy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.00039131	0.2
19	Transfer- Jig plant to conveyor 4	1,000,000 tpy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.00039131	0.2
20	Transfer-Conveyor 4 to clean stockpile	1,000,000 tpy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.00039131	0.2
21	Transfer-Clean stockpile to conveyor 5	1,000,000 tpy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.00039131	0.2
22	Transfer-Conveyor 5 to loadout bin	1,000,000 tpy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.00039131	0.2
23	Transfer- loadout bin to truck	1,000,000 tpy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.00039131	0.2
24	Wind erosion- mine area	168 Acres	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.38 ton/acre/yr	63.8
25	Wind erosion - run-of-mine coal stockpile	4 Acres	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	36.6 g/m^2/yr	0.7
26	Wind erosion- raw coal stockpile	1.5 Acres	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	36.6 g/m^2/yr	0.2
27	Wind Erosion – clean coal stockpile	1.5 Acres	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	36.6 g/m^2/yr	0.2

28	Wind Erosion –reject stockpile	0.1 Acres	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	36.6 g/m^2/yr	0.02
29	Mobile Equipment – grader operations	13,122 VMT[3]/yr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.765 lb/VMT	5.0
30	Mobile Equipment – overburden hauling - backfill	19,340 VMT/yr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4.52 lb/VMT	21.8
31	Mobile Equipment – overburden hauling - stockpile	204,517 VMT/yr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4.52 lb/VMT	230.8
32	Mobile Equipment – coal hauling within mine	14,103 VMT/yr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.874 lb/VMT	65.7
33	Mobile Equipment – miscellaneous mine traffic	50,000 VMT/yr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
34	Mobile Equipment – other vehicle traffic	236,520 VMT/yr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
35	Mobile Equipment – coal truck haul – loop road	4,410 VMT/yr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.42 lb/VMT	2.7
36	Off Source – coal truck haul – access road	101, 430 VMT/yr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.42 lb/VMT	61.4
	Total (Not Fugitive)			**67.8**		**9.3**		**0.1**		**0.7**		**1.4**
	Total Fugitive											**557.2**

Emission factors used in emissions calculations

EU ID	NO_X	CO	SO_2	VOC	PM-10
1	Vendor	Vendor	Mass Balance ULSD	Vendor	Vendor
2	AP-42 Table 1.3-1	AP-42 Table 1.3-1	AP-42 Table 1.3-1	AP-42 Table 1.3-1	AP-42 Table 1.3-1
3,4, 5	N/A	N/A	N/A	N/A	AP-42, Table 11-9.1
6, 7	N/A	N/A	N/A	N/A	AP-42 Section 13.2.4 Equation 1
8, 9, 10, 11	N/A	N/A	N/A	N/A	AP-42, Table 11-9.1
12	N/A	N/A	N/A	N/A	AP-42, Table 11.19.2-2
13 through 23	N/A	N/A	N/A	N/A	AP-42 Section 13.2.4 Equation 1
24 through 28	N/A	N/A	N/A	N/A	AP-42 Section 13.2.5, Equation 3
29	N/A	N/A	N/A	N/A	AP-42, Table 11.9.1
30 through 36	N/A	N/A	N/A	N/A	AP-42 Section 13.2.2, Equation 1a

[3] VMT = Vehicle Miles Travelled

Exhibit B: Modeling Memo

MEMORANDUM

State of Alaska
Department of Environmental Conservation
Division of Air Quality

TO: File
DATE: August 9, 2011

THRU: Alan Schuler, P.E.
Environmental Engineer
Air Permits Program
FILE NO: AQ1227MSS03
PHONE: 269-7577
FAX: 269-7508

FROM: Krystin Bablinskas
Environmental Engineering Assoc. I
Air Permits Program
SUBJECT: Review of Usibelli's Ambient Assessment - *REVISED*

This memorandum summarizes the Department's findings regarding the ambient analysis submitted by Usibelli Coal Mine, Inc. (Usibelli) for the Wishbone Hill Coal Mining and Processing Operation (Wishbone Hill). Usibelli submitted this analysis in support of their May 7, 2010 minor permit application (AQ1227MSS03), as amended through July 28, 2011. As described in this memorandum, Usibelli's analysis adequately shows that operating their emission units within the requested constraints will not cause or contribute to a violation of the annual average nitrogen dioxide (NO_2) and 24-hour particulate matter with an aerodynamic diameter of less than 10 microns (PM-10) Alaska Ambient Air Quality Standards (AAAQS) provided in 18 AAC 50.010.

This memorandum supersedes the Department's previous findings regarding the Wishbone Hill Coal and Processing Operation, as reported in my March 10, 2011 memorandum, *Review of Usibelli's Ambient Assessment*.

BACKGROUND

Usibelli is planning to develop the coal reserves at Wishbone Hill through topsoil removal and reclamation. The project includes installation of a coal preparation plant to grind and wash the coal before hauling away from the site.

Usibelli submitted the application on May 7, 2010. The application was used in support of a previous preliminary permit decision (Minor Permit AQ1227MSS02) and the current preliminary permit decision (AQ1227MSS03). The Department is unable to proceed with the previous permit but has incorporated additional information provided by Usibelli into the current preliminary decision. Hoefler Consulting Group (now SLR) prepared the minor permit application, including the ambient assessment, on behalf of Usibelli. SLR submitted additional information on January 17, 2011, February 8, 2011, February 18, 2011, July 5, 2011, July 12, 2011, and July 28, 2011 in response to Department comments.

Usibelli's application triggers minor permit review under 18 AAC 50.502(c)(1) for oxides of nitrogen (NO_X). Per 18 AAC 50.540(c)(2)(A), applicants subject to 18 AAC 50.502(c)(1) must provide an ambient AAAQS analysis for each pollutant for which a permit is required under 18 AAC 50.502(c)(1). Therefore, Usibelli submitted an AAAQS analysis for NO_2 under 18 AAC 50.540(c)(2)(A).

Usibelli's application also triggers minor permit review under 18 AAC 50.502(b) for a coal preparation plant (18 AAC 50.502(b)(5)). Per 18 AAC 50.540(c)(2)(D), applicants subject to 18 AAC 50.502(b) must provide an ambient AAAQS analysis for each pollutant for which the Department requests an analysis. The Department requested an analysis for PM-10 in order to assess the potential fugitive dust impacts associated with this project. Therefore, Usibelli submitted an AAAQS analysis for PM-10 under 18 AAC 50.540(c)(2)(D).

APPROACH

Usibelli used computer analysis (modeling) to predict the ambient air quality impacts. Usibelli did not conduct a significant impact level (SIL) analysis on either pollutant.

Model Selection

There are a number of air dispersion models available to applicants and regulators. The U.S. Environmental Protection Agency (EPA) lists these models in their *Guideline on Air Quality Models* (Guideline), which the Department has adopted by reference in 18 AAC 50.040(f). Usibelli used EPA's AERMOD Modeling System (AERMOD) for the ambient analysis. AERMOD is an appropriate modeling system for this application.

The AERMOD Modeling System consists of three components: AERMAP (which is used to process terrain data and develop elevations for the receptor grid/emission units), AERMET (which is used to process the meteorological data), and the AERMOD dispersion model (which is used to estimate the ambient concentrations). Usibelli used the following version of each component in their July revisions: version 11103 for AERMOD, version 09040 for AERMAP and version 11059 for AERMET. Except for AERMAP, these are the current versions of these components. The current AERMAP version is 11103. However, the only changes regard options not applicable to the Usibelli project. Therefore, the Department did not require Usibelli to rerun AERMAP.

Meteorological Data

AERMOD requires hourly meteorological data to estimate plume dispersion. The required surface parameters are wind direction, wind speed, ambient temperature, and either cloud cover or solar radiation and delta-temperature (SRDT) data. AERMOD will also accept a wide-range of additional surface parameters. According to the Guideline, a *minimum* of one-year of site-specific data, or five years of representative National Weather Service (NWS) data should be used. Per section 8.3.1.2b of the Guideline, site specific data is preferred when available.

When modeling with site-specific data, the Guideline states that additional years (up to five) are preferred when available to account for year-to-year variation in meteorological conditions. In

all cases the data must be representative of the meteorological transport conditions at the source. Section 8.3 of the Guideline states that "[t]he representativeness of the data is dependent on: (1) The proximity of the meteorological monitoring site to the area under consideration; (2) the complexity of the terrain; (3) the exposure of the meteorological monitoring site; and (4) the period of time during which data are collected." The data must also meet EPA's quality assurance requirements.

Usibelli used one year of site-specific surface data, with Palmer NWS cloud cover data and concurrent NWS upper air (sounding) data from the Ted Stevens Anchorage International Airport. This is an acceptable data set for new source review modeling purposes. Additional information regarding this data set, and the Department's basis for accepting it, are provided below.

Uisbelli's Site-Specific Surface Data

Usibelli's predecessor, McKinley Mining Consultants, Inc. (MMCI), collected surface meteorological data at Wishbone in circa-1990 to support anticipated air quality permit applications. MMCI submitted a monitoring plan for Department review in July 1988. Meteorological monitoring started October 23, 1988. The Department approved MMCI's monitoring plan on March 1, 1989. The meteorological parameters measured by MMCI were: wind speed and direction, wind direction standard deviation (sigma theta), ambient temperature, and precipitation. Except for the precipitation data, these were the typical parameters used to support air quality modeling at that time. Precipitation data was not required and was likely collected for non-modeling reasons.

MMCI operated their meteorological monitoring station for three years (October 1988 through October 1991). However, they only submitted the October 1988 through December 1990 data for Department review and approval. The initial year of meteorological monitoring was plagued with large periods of data loss due to high wind events or power loss. MMCI meet a 90-percent annual data capture requirement the following year (1990).

The meteorological inputs required for modeling have changed slightly from what was applicable at the time MMCI collected their data. AERMOD still requires wind speed, wind direction, and ambient temperature data, such as those collected by MMCI, but it also requires either SRDT or cloud cover data, instead of sigma-theta data.

Usibelli desired to use their meteorological data since it was site-specific. To meet the additional data need, Usibelli proposed using Palmer NWS cloud cover data for their modeling analysis. The Department had previously ruled out the use of Palmer NWS wind data since the wind speed and direction are non-representative of the meteorological conditions at Wishbone Hills due to terrain differences. However, this limitation does not necessarily apply to cloud cover data. The Department therefore asked Usibelli to conduct an analysis to determine whether the modeled impacts are sensitive to variations in cloud cover. Usibelli conducted a sensitivity analysis, as described in detail under the *Cloud Cover* section of this memorandum, which showed that variations in cloud cover do not substantively alter the modeling results.

Meteorological data must be spatially and temporally representative. The spatial requirement was addressed during the monitoring plan development/review stage. In regards to temporal representativeness, the Guideline states that newer data is preferred to older data, but there is no maximum age provision. Section 8.3a of the Guideline instead states that the data must "…be viewed in terms of the appropriateness of the data for constructing realistic boundary layer profiles and three dimensional meteorological fields…" This approach is consistent with the general understanding that seasonal variations can be a larger factor in air quality assessments than the climatic variations that may occur over time. The Guideline therefore established minimum requirements for meteorological data periods (one year of site-specific data or five years of NWS data), rather than "sunset" timelines for meteorological data. Usibelli complied with this requirement by using one year of site-specific data.

Usibelli used all of the measured parameters in their modeling analysis, including the optional sigma-theta and precipitation data. While AERMOD requires either SRDT or cloud cover data, it will also accept sigma-theta data to refine its atmospheric stability calculations. It will also accept precipitation data for use in the optional particle deposition algorithm (see *Particle Deposition* discussion).

Cloud Cover

Usibelli used the following approach to justify their use of Palmer NWS cloud cover data for their ambient assessment. Usibelli conducted a cloud cover sensitivity analysis to determine the effect of cloud cover on the high second-high (h2h) 24-hr PM-10 impact. Usibelli modeled PM-10 impacts under clear and fully overcast skies. Table F-5 of Usibelli's ambient assessment shows the variation in PM-10 concentration based on cloud cover. The table shows that there is some variation with cloud cover, but the difference is inconsequential. Therefore, the Department agrees with Usibelli that the use of Palmer Airport's cloud cover data is an acceptable.[4]

The Palmer Airport cloud cover data from 1990 only includes observations taken during daytime hours. The night-time hours are therefore missing in the dataset, meaning a substitute or assumed night-time cloud cover value is required in order for AERMOD to estimate the air quality impacts during night-time hours.

Usibelli did not fill in the missing night-time cloud cover values in their original analysis. However, since cloud cover (or SRDT) data is a required parameter for AERMOD, this approach meant that AERMOD was unable to process almost 40-percent of the site-specific meteorological data. Usibelli has since filled in the missing cloud cover values with assumed values.

The Guideline does not offer a method for filling in gaps in cloud cover data, so Usibelli used best scientific judgment to find an acceptable method. Usibelli examined the available cloud cover data for Palmer from 1986 through 1995. For each night-time hour over the 10 year period,

[4] The Department's determination is case-specific and may not be applicable for other projects. Usibelli adequately demonstrated that their modeling results are insensitive to changes in cloud cover. However, projects with tall stacks and extremely buoyant plumes could be sensitive to changes in cloud cover, and therefore may warrant other data/solutions.

Usibelli determined the minimum cloud cover value. Usibelli then substituted this minimum value for the given Julian day and hour into the corresponding hour in their 1990 dataset. This method allowed Usibelli to fill in approximately 1900 missing hours of cloud cover data.

For the remaining missing cloud cover values, no historic data was available for gap filling. Instead, Usibelli calculated the weighted average of the existing cloud cover data over the 10-year period to use as a gap-filling value. Usibelli's final value to fill in the missing parameters is a value of 7 (on a 0 to 10, or clear to cloudy, scale).

The Department reviewed Usibelli's method and conducted its own sensitivity analysis to verify Usibelli's findings. Based on Usibelli's cloud cover sensitivity analysis submitted with the application, clear sky values produce slightly larger impacts. The Department therefore investigated the effect of filling in the missing cloud cover with clear sky values instead of Usibelli's approach. The Department found that both approaches produced nearly identical modeling results. The Department therefore accepts Usibelli's method for filling in the missing cloud cover values.

Surface Characteristics

AERMET requires the area surrounding the meteorological tower to be characterized in regards to the following three surface characteristics: noon-time albedo, Bowen ratio, and surface roughness length. EPA has provided additional guidance regarding the selection and processing of these values in their *AERMOD Implementation Guide*.

Usibelli segregated the surrounding area into a single sector to reflect the main type of surface condition: deciduous and coniferous forest. Usibelli assigned the values by month in order to adjust the surface characteristics according to each season. The Department agrees with Usibelli's approach. The accepted values are repeated below in Table 1.

Table 1 – Approved AERMET Surface Characteristics for Wishbone Hill

Month	Season	Albedo	Bowen Ratio	Surface Roughness
January	Winter	0.43	2	0.9
February		0.43	2	0.9
March		0.43	2	0.9
April		0.43	2	0.9
May	Spring	0.12	1.5	1.15
June		0.12	1.5	1.15
July	Summer	0.12	0.6	1.3
August		0.12	0.6	1.3
September	Autumn	0.12	1.8	1.05
October	Winter	0.43	2	0.9
November		0.43	2	0.9
December		0.43	2	0.9

Upper Air Data

The AERMET meteorological processor requires full upper air soundings (radiosonde data) representing the vertical potential temperature profile near sunrise in order to calculate convective mixing heights. Data from the nearest NWS upper air station is used to meet this requirement. The nearest upper air station to Wishbone is at the Ted Stevens Anchorage International Airport.

Design Concentrations

EPA allows applicants to compare the high second-high (h2h) modeled concentration to the short-term air quality standards if at least one year of temporally representative site-specific, or five years of representative NWS data, are used. When these criteria are not met, then applicants must use the high first-high (h1h) concentration. In all cases, applicants must compare the highest modeled concentration to the annual average standards. The Department allowed Usibelli to compare the h2h concentration to the short-term AAAQS since they used a complete year of site-specific data.

Summary

Usibelli's 1990 surface data, with Palmer NWS cloud-cover data and Anchorage upper air data complies with the Guideline requirements. The Department accepts the use of Usibelli's 1990 meteorological data, with Palmer NWS cloud-cover data, because

- the surface data is site-specific, which is the preferred approach under the Guideline;
- MMCI met the 90-percent data capture requirement for the measured parameters (wind speed and direction, ambient temperature, and precipitation); and
- Usibelli adequately showed that the cloud cover data does not need to be accurate for purposes of modeling their stationary source.

Emission Unit Inventory

Wishbone Hills has a large emission unit inventory covering a variety of activities occurring at the mine. Usibelli's emission unit inventory includes:

- Diesel-fired generator and comfort heaters,
- Topsoil Operations,
- Blasting Operations,
- Overburden,
- Coal Mining,
- Coal Processing,
- Wind Erosion,
- Mobile Equipment (such as coal hauling); and
- Off-source access roads.

Usibelli used AERMOD's open pit algorithm to characterize the open pit mine. They characterized all dust emitting activities as volume sources. They used a line of volume sources to characterize the road from the mine to the highway. Usibelli characterized the diesel fired generator and heater as point sources. These are appropriate methods for characterizing each of these sources.

Only two of the emission units (the diesel-fired generator and the diesel-fired comfort heaters) emit NO_X. Usibelli therefore limited the annual average NO_2 assessment to just those two units.

All of the emission units listed in Usibelli's permit application emit PM-10 (either directly or as fugitive dust). Many of the units operate sequentially, rather than concurrently. The large number of emission units and wide range of combinations/duration that could occur within a 24-hour period could easily lead to an unmanageable matrix of modeling scenarios. Usibelli therefore grouped emission units with similar operating schedules, emission characteristics and location in their modeling analysis. Table F-3 of Usibelli's ambient assessment details the individual units in each group. The resulting PM-10 analysis consisted of two point sources, an open pit source, and several volume sources, as discussed below in detail under *Emission Rates and Stack Parameters*. Usibelli also assumed that all operations occur on a daily basis. Their approach provides a worst-case estimate of the 24-hour PM-10 impacts.

Emission Rates and Stack Parameters

The assumed emission rates and stack parameters have significant roles in an ambient demonstration. Therefore, the Department checks these parameters very carefully.

Usibelli used vendor data to estimate the NO_X emissions from the diesel-fired generator and EPA's *Compilation of Air Pollutant Emission Factors* (AP-42) to estimate the NO_X emissions from the comfort heaters. Usibelli assumed these emission units operate continuously. Usibelli used reasonable stack parameters.

For modeling the 24-hr PM-10 impacts, Usibelli primarily used AP-42 to estimate their PM-10 emissions. As previously noted, Usibelli assumed that all operations occur within a 24-hour period. However, they tempered this assumption by assuming the highly intermittent operations do not continuously run throughout the entire 24-hour period. These assumptions, along with several other aspects of Usibelli's 24-hour PM-10 analysis, are discussed below in detail.

Topsoil Operations and Overburden

Usibelli's application states the following sequence will be used to mine the coal. Topsoil must first be removed and stored. Overburden is then removed through blasting and then hauled away before mining can commence. For safety reasons, topsoil removal, blasting, overburden hauling, and coal mining cannot occur within the same 24-hour period.

Usibelli characterized this sequential operation by making the following assumptions in their 24-hour PM-10 ambient assessment.

- Topsoil removal, blasting, overburden hauling, and coal mining occur concurrently. This assumption makes the analysis conservative since it overestimates the amount of PM-10 emissions that could really occur within a 24-hour period.
- Topsoil removal occurs 2,660 hours per year (hr/yr) and was modeled using the annual average, rather than maximum short-term, emission rate to reflect this intermittent activity.
- Overburden loading and dumping occurs no more than 30 days per year, and therefore, is not part of the typical daily emission profile. Instead of specifically including this limited activity in the analysis, Usibelli assumed the emissions are represented through their

assumption that overburden hauling occurs continuously throughout the 24-hour averaging period.

- While Usibelli intends to blast no more than 240 times per year for overburden removal and 120 times per year for coal removal, they conservatively assumed both types occurs continuously during the 24-hour averaging period.
- All other emission units operate continuously within a 24-hour period.

As part of its review of both the initial and July 2011 submittals, the Department conducted sensitivity analyses to determine if the modeled results are highly sensitive to Usibelli's use of an annual, rather than maximum, emission rate for characterizing topsoil removal. The Department assessed whether Usibelli could still comply with the 24-hr PM-10 standard when using the maximum emission rate for topsoil removal, but without *concurrent* emissions from the overburden operations.

The Department conducted two runs each time it conducted this sensitivity analysis. In Run 1, the Department included the full emissions from the overburden operations, but no emissions from the top soil operations (i.e., the overburden operations were modified to include the additional dumping and loading emission rates that were previously excluded). Because Usibelli did not specifically model these operations, their emission contribution was added to the overburden hauling. In Run 2, the Department assessed the opposite scenario: no overburden operations (except overburden blasting), while assuming full topsoil operations (i.e., the Department used the short-term emission rate, not the annual emission rate, to represent the topsoil removal operations). In both runs, the Department included all other operations, such as coal operations and blasting.

The maximum 24-hour impacts for the analysis conducted while reviewing the July submittals are listed below in Table 2. The impacts are reported in micrograms per cubic meter ($\mu g/m^3$). The results listed in Table 2 do not include background data. Both runs result in values lower than Usibelli's non-cumulative impact of 80.1$\mu g/m^3$. Thus, this shows that Usibelli's assumed daily profile is conservative and operational restrictions regarding the Topsoil and Overburden Operations are not required.

Table 2 – Results of Topsoil/Overburden Sensitivity Analysis

Run	24-hr PM-10 results ($\mu g/m^3$)
1	78.7
2	79.7

Particle Deposition

Usibelli continued to utilize the particle deposition option within AERMOD to refine their 24-hr PM-10 estimates. However, they changed their approach for utilizing this feature from the approach used in support of the AQ1227MSS02 preliminary decision.

Deposition refers to the natural settling of particles that occurs as the plume travels downwind. AERMOD has two algorithms for estimating this occurrence: "Method 1" and "Method 2". The Method 1 approach may be applied under the "regulatory default" option of AERMOD. The

Method 2 approach is considered a "non-Guideline" method and therefore, requires case-by-case approval from the Department and EPA under the alternative modeling procedures of the Guideline.

Usibelli used only Method 1 for estimating the deposition effects in their revised submittal. They previously used a combination of Method 1 and Method 2, with Method 2 being the method used for most emission activities. Usibelli's previous approach provided a more conservative analysis, but their current use of just Method 1 is allowed under the Guideline and is therefore acceptable.

The particle size distribution must be reasonably well known in order to use Method 1. The user must provide the particle diameter, mass fraction, and particle density for each emission activity. Usibelli conducted additional research to support the Method 1 deposition parameters used in their July 2011 submittals. Their findings are outlined in their outlined in their July 5, 2011 submittal.

Usibelli classified the particles as having an aerodynamic diameter of 1 micron, 10 microns and 30 microns. The percentage of each size class is shown below in Table 3 for each type of emission unit.

Table 3 – Particle Mass Fraction for Each Size Class for Emission Units

Activity	Associated Emission Units	1 micron	10 microns	30 microns
overburden operations, topsoil removal, open-pit mining	EUs 3 – 11, 30, and 31	10%	10%	80%
coal processing	EUs 12 - 23	20%	50%	30%
Mobile operations and road hauling	EUs 29 and 32 – 36	10%	30%	60%
diesel-fired generator and heater	EUs 1 and 2	50%	30%	20%

For particle density, Usibelli used a particle density of 2 grams per cubic centimeter (g/cm^3) for mine, overburden, and topsoil related activities, a density of 1 g/cm^3 for combustion activities, and a density of 1.2 g/cm^3 for the coal processing activities.

The Department also researched typical particle distributions for activities similar to those proposed by Usibelli. The Department notes the following:

- Both coal and dust can have a particle diameter size of anywhere between 1 and 100 microns. Pulverized coal can vary between 5 and 500 microns.[5]
- Extraction usually results in larger particles which are then refined to smaller particles through crushing operations. A survey of mines throughout the US showed that in bituminous coal seams on average, only 30% of the dust measured has an aerodynamic diameter of less than 75 microns with an average particle size of 147 microns.[6]

[5] Wark, K. and Warner, F. *Air Pollution: Its Origin and Control*, 1981, p. 145
[6] Sapko, M. J. et al. *Coal Dust Particle Size Survey of U.S. Mines*

- Densities of coal and gravel can vary between 1 and 2 g/cm^3 depending on the type and water content. One source sites bituminous coal having a density closer to 1.2 g/cm^3 and gravel between 1.5 and 2 g/cm^3. [7]

The Department also conducted two sensitivity analyses to determine the sensitivity of the modeled results to the assumed deposition parameter inputs. In the first analysis, the Department continued to use the same speciation of particles and same particle densities, but modified the percentage of particles in each class. In the second analysis, the Department used the same modifications as for the first analysis, but also modified the particle densities. Table 4 shows the modifications to the mass fraction. For the densities, the Department used 1.2 g/cm^3 for the mine, and 1.5 g/cm^3 for the topsoil, overburden, and road operations. The particle densities for the diesel-fired emission units and coal processing remain unchanged. This approach is roughly based on the figure supplied in Usibelli's July 5, 2011 submittal.

Table 4 – Department's Particle Mass Fraction for Each Size Class for Emission Units

Activity	Associated Emission Units	1 micron	10 microns	30 microns
overburden operations, topsoil removal, open-pit mining, and coal processing	EUs 3 – 23, 30, and 31	5%	30%	65%
Mobile operations and road hauling	EUs 29 and 32 – 36	5%	45%	50%
diesel-fired generator and heater	EUs 1 and 2	90%	5%	5%

With just modifying the mass fraction, the resulting concentrations (without background) increase from 80.1µg/m^3 to 85.1µg/m^3. With the modified mass fraction and reduced particle densities, the concentration (without background) increases to 89.3 µg/m^3. This shows that the deposition algorithm is sensitive to changes in the mass fraction and particle density.

The deposition values used by the Department for the sensitivity analyses are conservative compared to Usibelli's values. As stated above, the Department's research shows that for extractive processes such as mining, most particles are in the coarse category because of the presence of raw materials versus fine, crushed materials. Therefore, the Department agrees that Usibelli's inputs for the deposition algorithm are adequate for Wishbone Hills.

Wind Erosion

Usibelli did not include the impacts of wind erosion on material piles and mining operations, such as digging and hauling. Wind erosion requires high velocity winds to exceed the threshold friction velocity of the materials, such as overburden and coal. The threshold friction velocity is dependent on the surface roughness of the material. Based on AP-42, Table 13.2.5-2 Threshold Friction Velocities, the threshold wind velocity for overburden is approximately 20 meters per second (m/s) for overburden and 15 m/s for coal. Usibelli assessed the meteorology at Wishbone Hills and concluded that most of the days do not have high enough wind speeds to cause erosion.

[7] *Mass, Weight, Density, or Specific Gravity of Bulk Materials*, http://www.simetric.co.uk/si_materials.htm

High winds that did occur were most likely to coincide with the winter months where snow cover should diminish erosion.

The Department finds this assumption acceptable. The maximum modeled concentration (without the wind erosion emissions) occurs during low wind speeds (due to poor dispersion). Therefore, even if there is an increase in fugitive emissions during high wind events, the increase in wind speed would also lead to greater dispersion, which would decrease the ambient impact. The Department, nevertheless, investigated whether the increased emissions would violate the 24-hour PM-10 standard under the impossible scenario of no increase in dispersion. Wind erosion accounts for 14 percent of fugitive emissions at Wishbone Hills. Assuming a direct relationship between fugitive emissions and modeled concentration, a 14 percent increase in the modeled concentration would still not result in a violation of the 24-hr PM-10 standard. For example, even if the Department calculated 89.3 $\mu g/m^3$ value obtained with the revised deposition parameters is increased by 14 percent (i.e., 101.8 $\mu g/m^3$) the total impact (130.3 $\mu g/m^3$) still complies with the 150 $\mu g/m^3$ 24-hr PM-10 standard. The Department is nevertheless requiring Usibelli to adhere to the "Active Controls for Fugitive Emission Sources" section in their August 10, 2010 Fugitive Dust Control Plan in order to further reduce the likelihood for erosion.

Ambient NO_2 Modeling

The modeling of ambient NO_2 concentrations can sometimes be refined through the use of ambient air data assumptions. Applicants generally use the national default ambient NO_2-to-NOx ratio of 0.75, as provided in the Guideline, to refine the estimated ambient NO_2 concentrations. Usibelli's assessment mentions the use of this method, but they did not apply it to their modeled impacts. Therefore, the Department included the 0.75 ratio in the results shown below in Table 3.

Ambient Air Boundary

For purposes of air quality modeling, "ambient air" means outside air to which the public has access. Ambient air typically excludes that portion of the atmosphere within a stationary source's boundary. Usibelli used the boundary of Wishbone Hills as the ambient air boundary. The boundary encompasses land owned by Usibelli as well as land leased from the State of Alaska and the Matanuska-Susitna Borough. Usibelli can legally preclude access to the facility due to public safety concerns.

The land includes an existing public trail that Usibelli intends to relocate to the outer edge of the proposed mining area and Moose Creek, which is popular with recreational enthusiasts. Usibelli does not plan to preclude access to Moose Creek and treated the creek as ambient air by including receptors along the creek in their modeling analysis. For the surrounding trails, Usibelli plans to close off the old trail by installing a berm at the junction. Due to the surrounding terrain, the relocated trail will still transect sections of the mine. Usibelli correctly treated these transects as ambient air. They will also install barriers along the transects to prevent access to the rest of the mine. One transect crosses the access road into the mine site. Usibelli plans to put gates on both sides of the trail at the road crossings. The other section runs along the southwestern portion of the mine boundary. Usibelli plans to preclude public access by

installing a fence between the trail and mining area, as illustrated in Page A-4 of Usibelli's May 2010 application.

Because of the extent of Usibelli's boundary and the existence of natural barriers, Usibelli does not plan to install a fence around the entire perimeter of the mine. Usibelli does plan to gate the entrance onto the access road at the Glenn Highway in addition to the gates enclosing the public trail. Usibelli plans additional fencing around the coal processing plant and slurry pond for additional safety reasons. Usibelli also developed a Public Access Control Plan to preclude public access within the mine boundary (except for the previously noted public trails and nearby creek).

The Department visited the proposed Wishbone Hills site and concluded the following:

- The northwestern edge of the mine has a dirt road that travels along Moose Creek. The general public can easily access this road and the creek, which Usibelli included in the modeling. However, on the mine side of the creek, the terrain is very steep which creates a natural barrier that exceeds that of a fence.
- The western and southern edges of the mine likewise have natural barriers in the form of steep terrain. While there is an established trail in the general area, the trail does not traverse the bluff. The bluff is visible across Moose Creek from the nearby Moose Creek Soapstone/Buffalo Soapstone community.
- The eastern edge of the proposed site cannot be easily accessed. While there are several trails in the general area, none of the trails go near the mine.

Because of the natural barriers surrounding most of the mine, the Department finds Usibelli's May 25, 2011 Public Access Control Plan adequate for establishing an ambient air boundary around most parts of the mine. Usibelli's proposed areas for fencing are warranted for the remaining portions of their ambient air boundary. The Department is therefore imposing Usibelli's proposed fencing as a permit condition. A map showing the location of the required fences is included in Page A-4 of Usibelli's May 2010 application.

Receptor Grid

Usibelli used a 50 meter (m) spacing around the boundary of Wishbone Hills and along the public trails and creek that transect the ambient boundary. Usibelli extended the receptor grid outward about 200 m at 100 m spacing from the Wishbone Hills boundary.

Usibelli used a typical receptor spacing for modeling geographically large sources, such as mines. The tighter spacing suggested in the Department's *Modeling Review Procedures Manual* presumes the more common modeling scenario: a downwash dominated source located near their ambient air boundary.[8] While the Department would typically accept at face value the spacing used by Usibelli for modeling a mining operation, the Department conducted an analysis to assess the adequacy of Usibelli's grid. The Department used a 25 meter grid spacing (i.e., doubled the receptor density) around the location of maximum impact and reran the 24-hour PM-

[8] Downwash can create extremely steep concentration gradients (i.e., the impacts rapidly change with distance). Therefore, a denser receptor grid is typically warranted when modeling a downwash dominated source located near their ambient boundary.

10 analysis. The location and concentration of the maximum impact did not change. Therefore, Usibelli used an adequate receptor grid for their analysis.

Downwash

The facilities within Wishbone Hills do not contain any large structures near emission units that would warrant a downwash analysis. Therefore, Usibelli did not include any of the planned buildings in the modeling. The Department verified the building locations with the emission points and finds this assumption acceptable for this analysis.

Off-Site Impacts

The impact from neighboring (off-site) sources must be accounted for in a cumulative impact assessment. Per Section 8.2.3 of the Guideline, "all sources expected to cause a significant concentration gradient in the vicinity of the [applicant's source] should be explicitly modeled." The impact from other sources can be accounted for through ambient monitoring data.

Usibelli checked to see if there are any off-site sources within 50 km of Wishbone Hills. Usibelli noted that there were no stationary sources within 50 km that would warrant an off-site impact analysis. The Department agrees with Usibelli's conclusion that there are no off-site sources that are expected to cause a significant concentration gradient near Wishbone Hill. Therefore, there are no off-site sources that should be explicitly modeled.

Background Concentrations

The background concentration represents impacts from sources not included in the modeling analysis. Typical examples include natural, area-wide, and long-range transport sources. The background concentration must be evaluated on a case-by-case basis for each ambient analysis. Once the background concentration is determined, it is added to the modeled concentration to estimate the total ambient concentration.

There is no current ambient pollutant data from the Wishbone Hill area. Since pre-construction monitoring is *not* required or expected under the minor permit program, surrogate values must be used to estimate the expected background concentrations.

Usibelli presented North Slope data in their application to represent the NO_2 and PM-10 background concentrations at Wishbone Hills. The Department disagrees with this approach. The large distance and regional differences between the Matanuska-Susitna (Mat-Su) Valley and the North Slope make Usibelli's approach untenable.

For NO_2, the Department instead used data from the Swanson River Field (northern Kenai Peninsula). Union Oil Company of California (UOCC) collected this data between May 2008 and April 2009 to support future ambient assessments of their oil and gas production activities. The data likely includes impacts from the existing oil and gas infrastructure. It should therefore be a conservative estimate of the expected background concentration at Wishbone Hills.

The Department discussed its concerns with using North Slope PM-10 data with Usibelli. The Department proposed that Usibelli should instead use the maximum concentration measured at Eagle River. Eagle River is the nearest monitoring site to Wishbone Hills with a readily available

data set. Like Wishbone Hills, Eagle River is subject to the wind-blown dust events prevalent in the Mat-Su Valley. The station would also include impacts from anthropogenic sources, such as dust from the Glenn highway and local streets. The maximum 24-hr PM-10 Federal Reference Method (FRM) concentration is 50 $\mu g/m^3$ – which is a third of the ambient standard.

Usibelli felt the Eagle River data would be overly conservative since the Eagle River traffic is much greater than what occurs in the Wishbone Hill area. They also felt the use of a maximum impact was overly conservative. They therefore elected to average the dataset based on the meteorological period(s) of concern, per Section 8.2.2 of the Guideline. The goal of this methodology is to identify under which meteorological conditions high impacts occur, and then average the concentrations with similar meteorology, to develop a representative background concentration. Depending on the data, there may be more than one meteorological condition of concern. The Guideline is silent on how these periods are identified. However, Phillips Alaska, Inc. developed an approach in March 2002 for processing PM-10 data measured at Nuiqsut[9]. Their approach was reviewed and approved by the Department and EPA Region 10.

In a February 9, 2011 response to Department questions, Usibelli agreed to replace their North Slope PM-10 value with Eagle River data processed in a manner similar to the method used for the Nuiqsut dataset. In summary, Usibelli examined the data as follows:

1. Usibelli first calculated the 95th percentile of the Eagle River hourly concentrations to create a subset of the highest concentrations. Hourly concentrations were used over the FRM values so that wind speed and direction can be correlated to each hourly value. This value, which they referred as the significant monitoring concentration, was determined to be 56 $\mu g/m^3$.
2. Usibelli then sorted the high values by wind direction to determine if there were specific directions of concern. Spikes in concentration level were attributed to wind directions between 010 – 050 degrees and 340 – 360 degrees. For the rest of the sectors, the data was primarily below the significant monitoring concentration.
3. Usibelli then investigated the wind speed for each sector of concern:
    a. For the 010 – 050 sector, the wind speeds were as high as 45 mph, with a significant cluster of high concentrations between 15 mph and 45 mph. This suggests the high values may be due to wind-driven dust events from the Matanuska Glacier.
    b. For the 340 – 360 sector, the wind speeds were primarily between 5 mph and 15 mph. Usibelli stated these values are likely dust impacts due to vehicular traffic on the nearby Glenn highway. Usibelli provided a figure showing spikes in PM-10 concentration during rush hour in April (the time of year when gravel is most prevalent on roads).

Usibelli then averaged the data for each sector, and the remaining 060 – 330 sector. The highest average concentration was 28.5 $\mu g/m^3$. This was the value Usibelli proposed as the background concentration for Wishbone Hills.

[9] *Short-Term PM-10 Background Concentration Determination for the Proposed Alpine CDN & CDS Satellite Drilling Pads Colville River Unit, Alaska*, March 2002, Prepared by SECOR International Incorporated on behalf of Phillips Alaska, Inc.

The Department conducted a lengthy review of Usibelli's method for averaging the Eagle River PM-10 data. In general, the Department agrees with Usibelli's method and final results. The Department independently averaged the background data using a slightly different and simpler method. The Department's cursory approach provided a higher value than Usibelli's, but the higher value did *not* result in a modeled violation of the 24-hr PM-10 AAAQS. Therefore, the Department accepts Usibelli's averaged background concentration for the 24-hr PM-10.

RESULTS AND DISCUSSION

The maximum annual average NO_2 and 24-hour PM-10 AAAQS impacts, along with the background concentrations, total impacts, and AAAQS are shown in Table 5. All of the total impacts are less than the AAAQS. Therefore, Usibelli has demonstrated compliance with the AAAQS.

Table 5 – Maximum AAAQS Impacts

Air Pollutant	Avg. Period	Maximum Modeled Conc ($\mu g/m^3$)	Bkgd Conc ($\mu g/m^3$)	TOTAL IMPACT: Max conc plus bkgd ($\mu g/m^3$)	Ambient Standard ($\mu g/m^3$)
NO_2	Annual	2.47	13.2	**15.7**	100
PM-10	24-hr	80.1	28.5	**108.6**	150

It is important to note that since ambient concentrations vary with distance and direction from each emission unit, the maximum values shown represent the highest annual and high second high short-term values that may occur within the area. The maximum 24-hour PM-10 impact occurs along the access road. While there are several other locations with relatively high modeled impacts, the total impact at most locations is less than half of the PM-10 AAAQS.

Regardless of what the impacts are at most receptors, the maximum 24-hour PM-10 impact is still fairly high. It is also unknown how this impact would compare to the modeled impacts from other meteorological data years – if additional meteorological years were available. The Department is therefore proposing that Usibelli install and operate a PM-10 ambient air quality monitoring station to confirm their modeling analysis. Additional details regarding this requirement are provided below.

Ambient PM-10 Monitoring

The Department is proposing that Usibelli install and operate an ambient PM-10 monitoring station as described below.

- Within 60 days of permit issuance, Usibelli will need to propose for Department approval a PM-10 monitoring location that best measures the ambient impacts from their mine emissions.

- Usibelli will need to also install a meteorological tower of *at least* 3 meters in height, in order to measure wind speed, wind direction and ambient temperature. The purpose for

the meteorological data is to ascertain the possible source of any elevated PM-10 concentrations. While not required, Usibelli may want to install a fully instrumented 10-meter tower to support future modeling assessments (if needed).[10] Since there are different criteria for siting ambient air and meteorological monitoring stations, the meteorological tower and PM-10 station need not be collocated. Usibelli will need to submit their proposed location for meteorological monitoring with their proposed location for PM-10 monitoring.

- Within 30 days of the Department's approval of the PM-10 and meteorological monitoring locations, Usibelli will need to submit for Department approval a Quality Assurance Project Plan (QAPP) for their PM-10 and meteorological monitoring effort. The purpose of the QAPP is to describe the equipment and techniques that Usibelli intends to use in order to obtain data that complies with 18 AAC 50.215(a). The PM-10 data will need to meet the quality assurance and data capture requirements (75 percent) of the national State/Local Ambient Monitoring (SLAM) program. The meteorological data will need to meet the quality assurance and data capture requirements (90 percent) of the Prevention of Significant Deterioration (PSD) program.

- Usibelli will need to initiate their monitoring program within 60 days of the QAPP approval date, or a subsequent data approved in writing by the Department in advance of the 60 day deadline.

- Usibelli will need to collect continuous PM-10 data using a federal equivalent method (FEM). Monitoring will need to occur year-round, unless otherwise approved by the Department. The Department may allow Usibelli to suspend monitoring during extended periods of inactivity, or in other situations that would lead to near-background conditions.

- Usibelli will need post their hourly and 24-hour PM-10 monitoring data on a publicly accessible web-site on a near real-time basis.

- Usibelli will also need to make quarterly summaries publicly available. The quarterly summaries will need to report the maximum and second high 24-hour PM-10 concentrations, and any exceedances of the AAAQS, measured during the quarter and the previous 12-month period. The summaries will also need to note whether an audit or calibration occurred during the quarter, and whether Usibelli is complying with their QAPP. The quarterly summaries must be posted on a publicly assessable web-site within 30 days of the quarter and maintained on the web-site for at least one year.

- Usibelli will need to submit annual monitoring reports of their PM-10 and meteorological monitoring effort for Department review and approval. The monitoring reports must be

[10] Usibelli will need to assess the potential uses of the data and whether they would like to use the data for additional reasons than just complying with this permit condition. If so, they may want to expand this monitoring effort so that the data meets the requirements of these additional uses. For example, if Usibelli desires to use their meteorological data for future modeling efforts, then they will need to collect meteorological data that meets EPA's *Meteorological Monitoring Guidance for Regulatory Modeling Applications*, adopted by reference in 18 AAC 50.035(a).

submitted no later than 60-days after a 12-month monitoring period ends. The annual monitoring reports will also need to be posted on a publicly assessable web-site.

- Usibelli will need to collect at least three years of PM-10 and meteorological data. After this period is met, Usibelli may seek Department approval to stop monitoring if the measured impacts during the previous year is less than two-thirds of the 24-hour PM-10 AAAQS. The Department will have the right to refuse Usibelli's request if the impacts are unusually low (compared to the previous years of monitoring data) or if Usibelli is planning to increase their level of activity. For purposes of this condition, Usibelli need not compare impacts approved by the Department as an exceptional event (e.g., wildfire impacts) to the two-third threshold.

CONCLUSION

The Department reviewed Usibelli's modeling analysis for Wishbone Hills and concluded the following:

1. The NO_2 and PM-10 emissions associated with operating the proposed emission units will not cause or contribute to a violation of the AAAQS listed in 18 AAC 50.010.
2. Usibelli's modeling analysis fully complies with the showing requirements of 18 AAC 50.540(c)(2).
3. Usibelli conducted their modeling analysis in a manner consistent with EPA's *Guideline on Air Quality Models*, as required under 18 AAC 50.215(b)(1).

The Department developed conditions in Minor Permit AQ1227MSS03 to ensure Usibelli complies with the AAAQS. These conditions are summarized below.

To protect the 24-hr PM-10 standard:

1. Ambient Boundary.
    a. Install a fence or other physical barrier along the locations shown in Page A-4 of Usibelli's May 2010 application.
    b. For all other boundaries not specified in Attachment 1, comply with the May 25, 2011 Public Access Control Plan.
2. Comply with the Fugitive Dust Control Plan provided to the Department on August 10, 2010.
3. PM-10 monitoring: Conduct PM-10 and meteorological monitoring as described in the Results and Discussion section of this memorandum.

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