Comments on the Air Quality Impact Analysis of the Minor Permit Application for the Usibelli Wishbone Hill Coal Mining and Processing Project

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Prepared for:

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I. INTRODUCTION

Usibelli Coal Mine, Inc. (Usibelli) has submitted to the Alaska Department of Environmental Conservation (ADEC) an application for a minor air permit for the planned Wishbone Hill Coal Mining and Processing Operation. AMI Environmental (AMI) has been retained by Trustees for Alaska to review and comment on the air quality impact analysis of the proposed coal mining and processing project. Qualifications of Mr. Khanh Tran, Principal of AMI, to perform the review are shown in Appendix A.

II. PROJECT DESCRIPTION

The proposed project will be located eight miles northeast of Palmer, Alaska. The project's surrounding area is classified as Prevention of Significant Deterioration (PSD) Class II and is currently designated as attainment or unclassified for all regulated pollutants including nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), particulate matter less than 10 microns in aerodynamic diameter (PM_{10}), fine PM ($PM_{2.5}$), lead, and ozone.

According to the Appendix A of the ADEC Technical Analysis Report (TAR), the proposed project will emit oxides of nitrogen (NO_x) (94.8 tons per year (tpy)), PM_{10} (260.47 tpy) and SO_2 (0.1 tpy). NO_x point source emissions of 67.8 tpy are emitted by a 900-hp diesel IC engine and two diesel heaters rated at 10 MMBtu/hr. Blasting operations emit 27 tpy of NO_x. PM_{10} emissions are primarily from coal mining fugitive (225.1 tpy), coal preparation plant fugitive (33.97 tpy) and point sources (1.4 tpy).

III. REVIEW METHODOLOGIES

AMI's review has focused on the documents prepared by ADEC and the applicant Usibelli. Below is a list of the documents and modeling data that have been reviewed:

ADEC Preliminary Air Permit AQ1227MSS04 (March 4, 2014)
ADEC Technical Analysis Report for Air Permit AQ1227MSS04 (March 4, 2014)
Usibelli Wishbone Hill Minor Air Permit Application (June 2013)
AERMOD Modeling Input and Output Files (dated June 2013)
AERMOD rerun by Enviroplan for 1-hr NO_x (dated March 2014)

IV. COMMENTS ON AIR QUALITY MODELING

Comment #1: Total project PM_{10} emissions exceed the PSD permit threshold of 250 tpy

The ADEC TAR shows in Appendix A that total PM_{10} emissions from the Usibelli coal mining and processing operation are 260.47 tpy (225.1 tpy from coal mining fugitive sources, 33.97 tpy from coal preparation and processing plant, and 1.4 tpy from the diesel engine and diesel heaters). Thus, total project PM_{10} emissions exceed the PSD permit threshold of 250 tpy. If all project emissions are included in the calculation of the project's potential to emit, then a major PSD permit application should be submitted instead of the current minor permit application.

Comment #2: Total project NO_x emissions exceed the operating permit threshold of 100 tpy

The ADEC TAR shows in Appendix A that NO_x emissions from the diesel engine and diesel heaters (67.8 tpy) and coal blasting (27 tpy). The sum of NO_x emissions from these project sources is 94.8 tpy. But the ADEC TAR and the Usibelli permit application do not show the NO_x emissions from mobile equipment (Sources 29-36) including overburden hauling, coal truck haul onsite and on access roads. NO_x emissions from these mobile sources are expected to exceed 6 tpy based on the vehicle-mile-travelled (VMT) data (576,338 VMT) shown in Appendix A. Thus, total project NO_x emissions exceed the operating permit threshold of 100 tpy and, if all project emissions are included in the calculation of the project's potential to emit, then a major operating permit application should be submitted instead of the current minor permit application.

Comment #3: Project PM_{10} impacts are underestimated by using particle deposition

Particle deposition (Method 1) has been used in the AERMOD modeling to model PM_{10} impacts. Since project emissions are already calculated as PM_{10}, it is customary to model PM_{10} emissions without particle deposition. Particle deposition is important for large particles and frequently modeled for particles with diameter larger than 10 microns. Thus, it is not necessary to model particle deposition, and doing so only underestimates project impacts. The AERMOD model should be rerun with the particle deposition turned off to provide accurate PM_{10} impacts.

Comment #4: Receptor grid is too coarse to capture maximum impacts

As stated in the Permit Application, the AERMOD modeling used a 50 meter (m) spacing around the ambient air boundary and along the public trails that transect the ambient air boundary. The receptor grid is also extended outward about 200 m at 100 m spacing from the Wishbone Hill boundary. In its Modeling Review Procedures Manual, ADEC has recommended that a 25 meter spaced grid be placed around the receptor with the maximum impact predicted by the AERMOD model to ensure that the maximum has truly been defined (ADEC, 2006). Thus, the AERMOD model should be rerun with additional receptors with a 25-m spacing placed around the maximum receptors that have been predicted for NO_2 and PM_{10}.

Comment #5: Project PM_{10} impacts are severely underestimated by the large number of calm hours in the onsite meteorological data

The 1990 onsite meteorological data used in the AERMOD modeling has 664 hours with missing data. Further, it has 2,401 hours of calm hours (27.4% of possible 8,760 hours). The AERMOD model does not calculate PM_{10} concentrations for the calm or missing hours. Project PM_{10} impacts are primarily from surface emission sources such as open pit, topsoil removal and vehicular traffic. Thus, maximum impacts are expected to occur near the project site under calm conditions with low wind (less than 1 m/s) and stable conditions. However, the AERMOD model ignores these calm hours since it does not calculate concentrations for these hours and, hence, project impacts have been severely underpredicted. Attempts should be made to fill in the calm and missing hours with linearly interpolated data or reset wind speed to a minimum of 1 m/s. The AERMOD model should then be rerun with the revised meteorological data.

Comment #6: Project PM_{10} impacts have been underestimated by using the second highest concentration

The ADEC TAR shows in Table 5 of Appendix B that the 24-hour PM_{10} predicted impact of 97.5 $\mu g/m^3$ (69.0 ug/m^3 from project + 28.5 $\mu g/m^3$ from background) is below the 24-hour national ambient air quality standard (NAAQS) and Alaska ambient air quality standard (AAAQS) of 150 $\mu g/m^3$. The modeled project concentration of 69.0 $\mu g/m^3$ is the second highest predicted by the AERMOD model. In a March 2010 memo from the Director of the Office of Air Quality Planning and Standards regarding *Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS,* US EPA has recommended the use of the maximum highest 24-hour concentration predicted in modeling with one year of onsite meteorological data (US EPA, 2010a). According to US EPA, the use of the maximum concentration is designed to avoid the underestimation of impact.

The maximum project-only concentration predicted by AERMOD is 85.5 $\mu g/m^3$. With this project-only maximum concentration and a background of 28.5 $\mu g/m^3$, the project impact is 114.0 $\mu g/m^3$ (85.5 $\mu g/m^3$ from project + 28.5 $\mu g/m^3$ from background). This is still below the NAAQS and AAAQS of 150 $\mu g/m^3$ but Table 5 of Appendix B should be revised to reflect this new, higher PM_{10} impact.

Comment #7: Modeled NO_x emissions and impacts are underestimated by omitting mobile emissions

The AERMOD modeling has omitted NO_x emissions from mobile equipment (emission units 29-36) including overburden hauling, coal truck haul onsite, and on access roads. These mobile sources emit large amounts of PM_{10} and have been included in the AERMOD modeling for PM_{10}. However, they have been omitted in the AERMOD modeling for NO_x and, hence, the modeled NO_2 impacts are underestimated. NO_x emissions from mobile equipment (emission units 29-36) should be quantified and included in the AERMOD modeling.

Comment #8: Modeled NO_x impacts are underestimated by using low NO_2/NO_x in-stack ratios

The AERMOD modeling has used in-stack ratios (ISR) of 0.1 for point sources (diesel generator and heaters) and 0.036 for blasting. These ratios are not based on source testing performed with sources that are identical to those proposed by the Usibelli project. In the absence of source-specific ratios, US EPA has recommended a default ratio of 0.5 (US EPA, 2011). Use of this default ratio should result in higher calculated NO_2 impacts. Because modeled NO_2 impacts are underestimated, a higher ISR should be used in the AERMOD modeling to provide a more accurate assessment of potential project impacts.

Comment #9: NO_2 impacts predicted by the OLM method may be underestimated and NO_2 impacts should be modeled by both OLM and PVMRM options

Two Tier-3 techniques have been recommended for NO_x modeling by the US EPA: Ozone Limiting Method (OLM) and Plume Volume Molar Ratio Method (PVMRM) (US EPA, 2010b). The Usibelli Permit Application and the ADEC TAR have used OLM in the AERMOD modeling. ADEC has sponsored a sensitivity study of both OLM and PVMRM techniques using emission sources and meteorological inputs that are appropriate for Alaska (ADEC, 2004). For multiple sources, Table 3.3 of this ADEC study (page 16 of ADEC, 2004) has shown that the 1-hour NO_2 impacts are predicted to be 1,822.2 $\mu g/m^3$ by OLM and 3,196.6 $\mu g/m^3$ by PVMRM. The annual NO_2 impacts are quite similar for both options. Compared to PVMRM, this sensitivity study has shown that OLM can substantially underestimate the NO_2 1-hour impacts for multiple sources. Further, the ADEC study has concluded that "Overall the PVMRM option appears to provide a more realistic treatment of the conversion of NO_x to NO_2 as a function of distance downwind from the source than OLM" (page 55 of ADEC, 2004). Thus, NO_2 impacts predicted by OLM for multiple sources in the Usibelli Permit Application may be underestimated. It is recommended that the NO_2 impacts be also analyzed with the PVMRM option.

Comment #10: Maximum 1-hour NO_2 impacts from project-only emissions exceed the 1-hour NAAQS and AAAQS

Results of the AERMOD modeling with OLM performed by ADEC and Enviroplan show a maximum 1-hour NO_2 concentration of 210.9 µg/m^3. This concentration is solely caused by project NO_x emissions and it largely exceeds the 1-hour NAAQS and AAAQS of 188 µg/m^3. With a background of 37.6 µg/m^3, maximum total concentration is 249 µg/m^3 (210.9 µg/m^3 from project + 37.6 µg/m^3 from background). Both maximum 1-hour NO_2 impacts (project-only and total) exceed the NAAQS and AAAQS of 100 ppb (or 188 µg/m^3).

Comment #11: Project 1-hour NO_2 impacts in revised modeling will exceed the 1-hour NAAQS and AAAQS

ADEC has identified and corrected some errors in the original AERMOD modeling submitted by Usibelli. Results of the revised AERMOD/OLM modeling in Table 5 of Appendix B of the ADEC TAR show an 1-hour NO_2 impact of 181 µg/m^3 (143.2 µg/m^3 from project + 37.6 µg/m^3 from background). This 1-hour NO_2 impact of 181 µg/m^3 is based on the maximum 8th concentration and is close to the NAAQS and AAAQS of 100 ppb (or 188 µg/m^3). The modeled impact has been underestimated as shown in the above comments (i.e., omission of NO_x emissions from mobile sources in Comment #7, low ISR in Comment #8, and use of OLM instead of PVMRM in Comment #9). Thus, a new modeling analysis that includes these corrections should be performed and modeling results likely will show an exceedance of the 1-hour NO_2 standard.

Comment #12: Project $PM_{2.5}$ emissions have not been completely quantified

Table 1 of the ADEC TAR only shows $PM_{2.5}$ emissions for the 900 hp diesel engine, the 10 MMBtu/hr diesel heaters, and the coal preparation and processing plant. $PM_{2.5}$ emissions from all other sources (e.g., coal mining fugitive and mobile equipment) have not been quantified and documented—nor has ADEC addressed secondary $PM_{2.5}$ formation that may be associated with the project's NO_x and volatile organic compound (VOC) emissions. The US EPA has promulgated $PM_{2.5}$ NAAQS for 24-hour average (35 µg/m^3) and annual average (12 µg/m^3). Likewise, ADEC has adopted AAAQS of 35 µg/m^3 and 15 µg/m^3 for 24-hour and annual concentrations, respectively. Thus, the Permit Application should quantify and present $PM_{2.5}$ emissions from all project sources.

Comment #13: Project $PM_{2.5}$ impacts have not been modeled

The Usibelli Permit Application and the ADEC TAR do not show any modeling analysis of $PM_{2.5}$ impacts. The Permit Application should present a modeling analysis of the $PM_{2.5}$ 24-hour and annual impacts from all project sources. The AERMOD model can be used in this analysis and the predicted impacts can be compared against the applicable NAAQS and AAAQS.

Comment #14: Project ozone impacts have not been addressed

The proposed project will emit a large amount of NO_x (94.8 tpy from diesel engine, diesel heaters and blasting operations) and some VOC (0.7 tpy). With the additional NO_x emissions from mobile equipment (emission units 29-36), total project NO_x emissions exceed 100 tpy. Known as ozone precursors, these NO_x and VOC emissions will react under sunlight to form ozone. The Permit Application has not addressed the project ozone impacts. The proposed project will add to ozone levels in the region and may interfere with the attainment or maintenance of ozone standard. It should be noted maximum 8-hour concentrations exceeding the current 8-hour ozone standard of 0.075 ppm have been recorded in Denali National Park (e.g., maximum 8-hour ozone of 0.076 ppm in 2008) (US EPA, 2008).

Comment #15: Plume blight from project sources has not been modeled

Project sources emit significant amounts of NO_x (94.8 tpy from diesel engine, diesel heaters and blasting) and PM_{10} (260.47 tpy) that are known to reduce visibility. The VISCREEN model developed by the EPA should be used to analyze local visibility effects of project sources.

V. REFERENCES

Alaska DEC, 2006. ADEC Modeling Review Procedures Manual Available at http://www.dec.state.ak.us/AIR/ap/docs/mpm_10-03-06.pdf

ADEC, 2004. Sensitivity Analysis of PVMRM and OLM in AERMOD. Final Report prepared by MACTEC under contract No. 18-8018-04. Available at: http://www.epa.gov/scram001/7thconf/aermod/pvmrm_sens.pdf

US EPA, 2011. Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 NAAQS. Memo dated March 1, 2011 from Tyler Fox to Regional Air Directors. Available at: http://www.epa.gov/ttn/scram/guidance/clarification/Additional_Clarifications_AppendixW_Hourly-NO2-NAAQS_FINAL_03-01-2011.pdf

US EPA, 2010a. *Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS*. Memo dated March 23, 2010 from Stephen D. Page, Director of Office of Air Quality Planning and Standards. Available at http://www.epa.gov/ttn/scram/Official%20Signed%20Modeling%20Proc%20for%20Demo%20Compli%20w%20PM2.5.pdf

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US EPA, 2008. Alaska Ozone Data. Available at: http://iaspub.epa.gov/airsdata/adaqs.monvals?geotype=st&geocode=AK&geoinfo=st~AK~Alaska&pol=O3&year=2008&fld=monid&fld=siteid&fld=address&fld=city&fld=county&fld=stabbr&fld=regn&rpp=25

APPENDIX A

Qualifications of Khanh T. Tran

Mr. Khanh Tran is the owner and Principal Scientist of AMI Environmental since its establishment in 1980. He has over 30 years of experience in project management, meteorological modeling, air quality modeling, emissions inventory and visibility analysis. He has successfully managed over 200 air quality studies conducted by AMI on behalf of government agencies (including US Department of Energy, Bureau of Land Management, Minerals Management Service, Arizona Department of Environmental Quality, California Energy Commission and California South Coast Air Quality Management District) as well as large utilities (including Duke Power, Los Angeles Department of Water and Power and Southern California Edison) and oil companies (including Arco, Occidental Petroleum and Texaco).

Mr. Tran received his B.S. (1973) and M.S. (1974) degrees in Mechanical Engineering from the University of California, Santa Barbara. From 1978-1980, he completed graduate courses in Atmospheric Sciences, Computer Sciences and Environmental Fluid Dynamics at UCLA. In 1978, he also developed a predictive atmospheric modeling system for real-time emergencies as part of his Ph.D. research at UCLA. Mr. Tran is a former member of the National Committee on Meteorological Aspects of Air Pollution of the American Meteorological Society.

Mr. Tran has extensive experience in the development, evaluation and application of air quality simulation models, from simple Gaussian dispersion models (AERMOD, CALPUFF, ISCST3) to complex photochemical grid models (UAM, CAMx, Models3/CMAQ). He has also developed air quality models that have received approval from regulatory agencies. He has performed a wide variety of air quality modeling studies, including:

- He has recently reviewed the air quality and visibility impact analyses that have been performed as part of PSD permit applications of proposed coal-fired power plants in Georgia (Longleaf and Washington), Idaho (Power County), Kentucky (Trimble), Montana (Highwood), Nevada (Ely), New Mexico (Desert Rock), Ohio (AMP), Michigan (Consumers and Wolverine), South Dakota (Hyperion), Virginia (Virginia City Hybrid) and Wyoming (Dry Fork and Medicine Bow). He has performed AERMOD, ISCST3 and CALPUFF modeling to verify the results documented in the PSD permit applications and predict air quality and visibility impacts from alternative emissions scenarios.

- He has applied the photochemical model CAMx to predict ozone impacts in Houston from the proposed White Stallion coal-fired power plant. He has also used the CAMx model to assess cumulative ozone impacts of Texas existing and new coal-fired plants in neighboring states such as Arkansas and Oklahoma.

- He has performed a comparative study of short-range dispersion models (ISCST3, ISC-PRIME and AERMOD). He has extensive experience in applying these models to air quality impact analyses for power plants, oil refineries and other facilities. He had applied Gaussian-based models to proposed coal leases by the Bureau of Land Management in New Mexico. He had used the ISCST3 model to assess potential impacts of several proposed gas-fired power plants in California.
- He modified and applied the long-range transport MESOPUFF (a predecessor of CALPUFF) to coal development projects in Utah and North Dakota. As part of these project EIS, he had performed visibility modeling to assess potential impacts of end-use facilities (e.g. power plants) at nearby PSD Class I areas.
- He developed the diagnostic wind module that has been included in the preprocessor CALMET of the CALPUFF model.
- He developed PC-based versions of the MM5 model, and applied the model to air quality modeling studies, e.g. the 1997 Southern California Ozone Study (SCOZ). He also modified the MM5 model to provide Web-based real-time weather forecasts for wind energy plants in California and Texas as well as tropical storms in Southeast Asia.
- He had developed the photochemical trajectory model TRACE and applied to power plant siting (e.g. the Lucerne Valley generating station for Southern California Edison) and offshore oil and gas development in California. He also applied other photochemical grid models to the development of ozone air quality attainment plans (AQAP) for Santa Barbara County, San Diego County and Kern County in California, and the Phoenix metropolitan area of Arizona. He recently applied the Urban Airshed Model to predict ozone impacts from proposed power plants in southern California and Phoenix.
- He developed the multipathway risk assessment model ACE2588 that has become widely used in over 1000 facilities under California's air toxics regulations (AB 2588). The ACE2588 model has also been used in other states and foreign countries. He improved the ACE2588 model to include a Monte Carlo uncertainty analysis to provide more realistic risk estimates.
- He developed the ACEHWCF model that implements the U.S. EPA health risk assessment guidelines for hazardous waste combustion facilities.
- He was in charge of prioritizing over 800 air toxics facilities in the Los Angeles air basin, reviewing and modifying their risk assessments submitted under the California Air Toxics Hot Spots AB 2588.
- He completed the development of a comprehensive emission inventory of over 10,000 point sources, including power plants, for regional exposure modeling of air toxics in the Los Angeles area.
- He has also used several dispersion models ranging from simple Gaussian puff to multiphase, dense gas models (e.g., DEGADIS and SLAB) to simulate accidental releases of hazardous chemicals.