

**CALPUFF MODELING PROTOCOL
FOR ROSEMONT COPPER PROJECT TO ASSESS
IMPACTS ON CLASS I AREAS**

October 30, 2009

Submitted to:

Pima County Department of Environmental Quality
Air Division
150 West Congress Street
Tucson, Arizona 85701-1333

Submitted by:

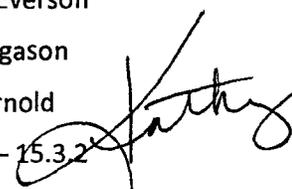
Rosemont Copper Company
3031 West Ina Road
Tucson, Arizona 80246

Prepared By:

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RECEIVED NOV 12 2009

Memorandum

To: Beverly Everson
Cc: Tom Furgason
From: Kathy Arnold 
Doc #: 053/09 - 15.3.2
Subject: Transmittal of Groundwater Flow Modeling Report
Date: November 9, 2009

Rosemont Copper is pleased to transmit the *Modeling Protocol to Assess Ambient Air Quality Impacts from the Rosemont Copper Project* and *CALPUFF Modeling Protocol for Rosemont Copper Project to Assess Impacts on Class I Areas* by Applied Environmental Consultants dated October 30, 2009. We are transmitting three hard copies (one contains a CD of the report) of each of the two reports directly to the Forest Service. We are also transmitting two hard copies of the report, one with a CD, to SWCA.

Deliver to:

3 copies – one containing a CD with electronic version of each report
Mindee Roth
Coronado National Forest
300 West Congress
Tucson, Arizona 85701

2 copies - one containing a CD with an electronic version of each report
Tom Furgason
SWCA
343 West Franklin St.
Tucson, Arizona 85701



ROSEMONT COPPER

Resourceful.

November 9, 2009

Mr. Mukonde Chama, P.E.
Air Permits Supervisor
PDEQ Air Program
150 West Congress St., Suite 109
Tucson, Arizona 85701

Re: Transmittal of Modeling Protocols for Rosemont Copper Project

Dear Mr. Chama:

Along with this a copy of the *Modeling Protocol to Assess Ambient Air Quality Impacts from the Rosemont Copper Project* as well as a copy of the *CALPUFF Modeling Protocol for Rosemont Copper Project to Assess Impacts on Class I Areas*. Both reports were produced by Applied Environmental Consultants, Inc. and dated October 30, 2009. These reports have been prepared as part of EIS process and are being provided as a courtesy to Pima County Department of Environmental Quality.

Please let me know if you require additional information associated with these protocols, I can be reached via email at karnold@rosemontcopper.com or via phone at 520-784-1972. We look forward to working with the department on our air permit process.

Regards,

Katherine Ann Arnold, PE
Director of Environmental and Regulatory Affairs

Cc: Louis Thanukos, Applied Environmental Consulting, Inc., w/o attachments
Bev Everson, Coronado National Forest, w/o attachment
File

Doc. No. 054/09-15.10.1.1

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1. INTRODUCTION

This document presents an air dispersion modeling protocol that will be followed to assess impacts of emissions from the proposed new Rosemont Copper Project (Rosemont Project) on Air Quality Related Values (AQRV) including Visibility in Class I areas. The Rosemont Project is a proposed new open pit copper mine that will be located in the Santa Rita Mountains approximately 30 miles southeast of Tucson, Arizona in Pima County (Figure 1.1). The *Rosemont Project, Mine Plan of Operations* was submitted to the Coronado National Forest in July 2007 (complete document available at www.rosemontcopper.com). The Coronado National Forest represents the Federal Land Manager for purposes of the Environmental Impact Statement (EIS) that will be prepared for the Rosemont Project.

Based on the expected emission levels from the facility, the Rosemont Project will be required to demonstrate protection of the National Ambient Air Quality Standards (NAAQS). Additionally the U.S. Forest Service evaluation requires an AQRV impact analysis to ensure that Class I area resources (i.e., visibility, flora, fauna, etc.) are not adversely affected by the projected emissions.

Evaluation of the ambient air quality impacts from the proposed Rosemont Project in Class I areas will be conducted using CALPUFF, which is the recommended model for long range transport applications (*Environmental Protection Agency 40 CFR Part 51 Revision to the Guidelines on Air Quality Models, November 2005*. Applied Environmental Consultants, Inc. (AEC) uses the commercial version of CALPUFF from Oris-Solutions (P.O. Box 7348, Asheville, NC 28802, (828) 628-0636).

The ensuing sections of this document describe the methodology that will be used to conduct the modeling. This protocol has been developed following applicable portions of the U.S. Environmental Protection Agency (EPA) guidance document: *Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report And Recommendations for Modeling Long Range Transport Impacts*, December 1998; *Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report*, June 2008 and the *Western Regional Air Partnership BART protocol*, August 2006.

1.1 Facility Description

The Rosemont Project will include open-pit mining, milling, leaching, and solvent extraction/electrowinning. The production schedule developed from mining sequence plans indicates a project operating life of approximately 20-25 years using only proven and probable mineral reserves. Mining rates of approximately 378,000 tpd of total material (ore and waste) will be realized in Years 1 and 2. Mining rates during Years 3-12 will be approximately 360,000 tpd of total material. These rates will taper off toward through the final years of the project (see previous referenced *Mine Plan of Operations* for details).

Mining of the ore will be through conventional open-pit mining techniques including drilling, blasting, loading, hauling and unloading. Ore will be transported by haul truck to the leach pad (oxide ore), or crushed and loaded onto a conveyor for transport to the mill (sulfide ore). The copper and molybdenum concentrates from the milling operations will be shipped off site for further processing. Oxide ore will be placed on the lined leach pad. Pregnant Leach Solutions (PLS) from the pad will be

collected in a solution pond and then processed through the SX/EW plant. Copper cathodes generated from the SX/EW plant will be transported off site for further processing.

1.2 Site Description and Relevant Class I Areas

The Rosemont Project will be located in Pima County, approximately 30 miles southeast of Tucson, Arizona as shown in Figure 1.1. Regionally, the facility location is in the Sonoran Desert Section of the Basin and Range Physiographic Province which is characterized by northerly trending fault block mountains separated by broad, down-faulted valleys (see Figure 4.1). The site is at an elevation of approximately 5,350 feet.



Figure 1.1 General location map of the Rosemont Project and surrounding area.

Figure 1.2 shows the proposed Rosemont Mine site and all the Class I areas present in Arizona. The distance from the Rosemont Project to the center of the Saguaro National Monument East and Saguaro National Monument West are approximately 44 KM and 66 KM respectively. The Galiuro Wilderness is approximately 95 KM from the Rosemont Project site.

ARIZONA CLASS I AREAS

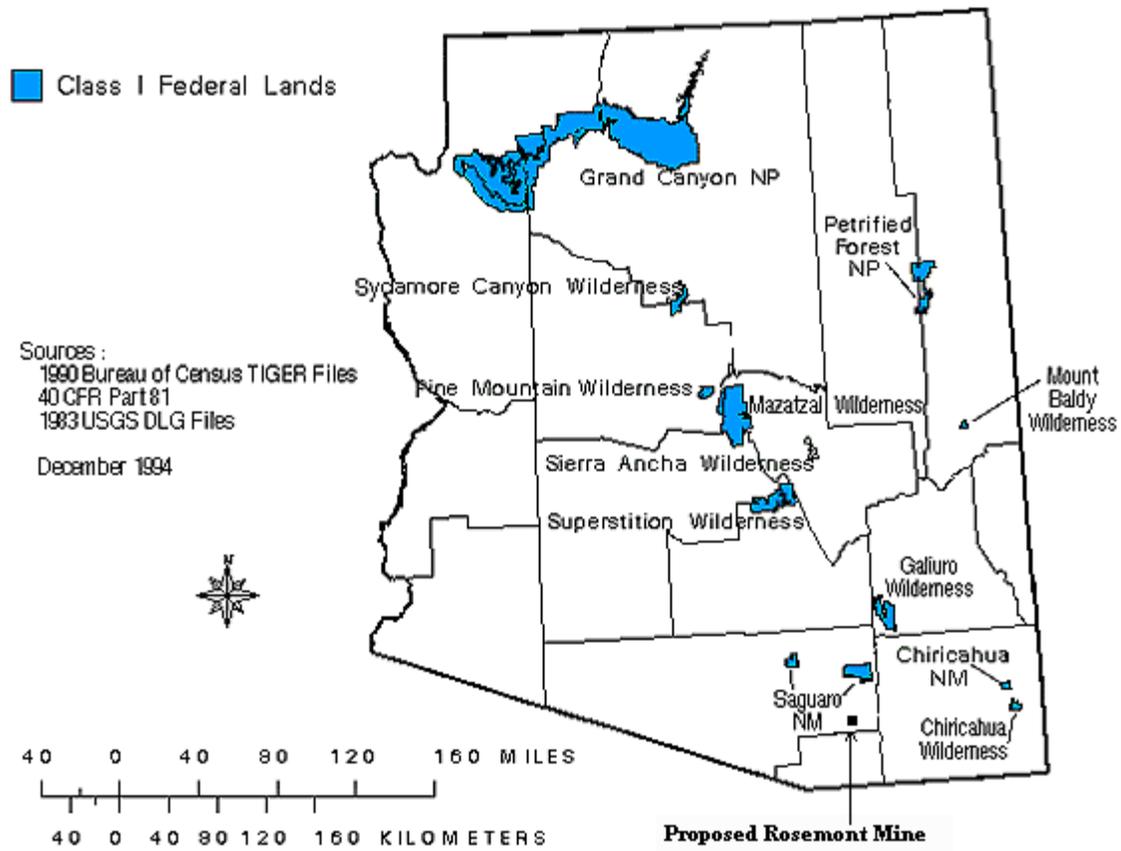


Figure 1.2 Proposed Rosemont Mine and Class I Areas.

2. REGULATORY STATUS

2.1 Source Designation

The Rosemont Project will be a non-categorical stationary source. Criteria pollutant emissions from the facility will be below the New Source Review major source threshold of 250 tons/year. Therefore, the facility will not be subject to PSD regulations. Additionally, the potential to emit hazardous air pollutants (HAPs) will be less than 10 tons/year for any individual (HAP), and less than 25 tons/year for all HAPs combined and therefore, the facility will not be a major HAP source. Point source emissions of criteria pollutants from the facility will be less than the Title V source threshold of 100 tons per year. Consequently, the facility will operate under a Class II Permit issued by the Pima County Department of Environmental Quality (PCDEQ).

2.2 Area Classifications

The Rosemont Project area is classified as “attainment” (better than national standards) or non-classifiable/attainment for total suspended particulates (TSP), particulate matter less than 10 microns nominal aerodynamic diameter (PM₁₀), carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen dioxide (NO₂), and ozone (O₃) (see 40 CFR Part 81.303).

2.3 Baseline Area

The Rosemont Project will be located within the Pima Intrastate Air Quality Control Region (AQCR) which encompasses Pima County. This AQCR represents the “baseline area” for PSD purposes. The Rosemont Project, however, will not be subject to PSD regulations.

3. CALPUFF MODELING SYSTEM

The CALPUFF Modeling System includes three main components: CALMET, CALPUFF, and CALPOST and a large set of preprocessing programs designed to interface the model with standard, routinely available meteorological and geophysical datasets. In the simplest terms, CALMET is a meteorological model that develops hourly wind and temperature fields on a three-dimensional gridded modeling domain. Associated two-dimensional fields such as mixing heights, surface characteristics, and dispersion properties are also included in the file produced by CALMET.

CALPUFF is a transport and dispersion model that advects “puffs” of material emitted from modeled sources, simulating dispersion and transformation processes along the way. In doing so it typically uses the fields generated by CALMET, or as an option, it may use simpler non-gridded meteorological fields explicitly incorporated in the resulting distribution of puffs throughout a simulation period. The primary output files from CALPUFF contain either hourly concentrations or hourly deposition fluxes evaluated at selected receptor locations.

CALPOST is used to process these files, producing tabulations that summarize the results of the simulation, identifying the highest and second highest 3-hour average concentrations at each receptor, for example. When performing visibility related modeling, CALPOST uses concentration from CALPUFF to compute extinction coefficients and related measures of visibility, reporting these for selected averaging times and locations.

4. MODELING METEOROLOGICAL DATA

According to 40 CFR Part 51 Appendix W, the length of the modeled meteorological period should be long enough to ensure that the worst-case meteorological conditions are adequately represented in the model results. The number of years of data needed to obtain a stable distribution of conditions depends on the variable of interest. U.S. EPA recommends that consecutive years from the most recent, readily available 5-year period are preferred. However, "less than five, but at least three, years of meteorological data (need not be consecutive) may be used if mesoscale meteorological fields are available. These mesoscale meteorological fields should be used in conjunction with available standard NWS or comparable meteorological observations within and near the modeling domain. Therefore this modeling analysis will be conducted using 3 years of mesoscale meteorological model output data coupled with observational data from nearby surface, upper air and precipitation stations.

4.1 Prognostic Data

Prognostic data for the years 2001 (36 km EPA), 2002 (12 km WRAP) and 2003 (36 km MRPO) will be used for developing the Initial Guess Wind Fields in the CALMET model. The CalMM5 extractions from the prognostic data were supplied by BEE-Line Software (now Oris-Solutions). The 2001 and 2003 data cover the conterminous United States at a spacing of 36 km. The 2002 data cover the western portion of the conterminous United States at a spacing of 12 km.

4.2 Surface Stations

Surface data for the years 2001, 2002 and 2003 will be used as observations in developing the Step 2 Wind Fields in the CALMET model. The processed surface data, obtained from the National Climatic Data Center (NCDC) in Asheville, North Carolina, will be provided by BEE-Line Software. Data from the following four surface stations will be used:

1. Nogales Airport (WBAN – 92728)
2. Douglas Bisbee Airport (WBAN – 93026)
3. Tucson Airport (WBAN – 23160)
4. Davis Monthan Air Force Base (WBAN – 23109)

4.3 Upper Air Stations

Upper air data for the years 2001, 2002 and 2003 from the NWS Tucson Airport Station (WBAN – 23160) will be used as observations in developing the Step 2 Wind Fields in the CALMET model. The processed upper air data, obtained from the National Oceanic and Atmospheric Administration (NOAA) Forecast Systems Laboratory web site, will be provided by BEE-Line Software. Missing data periods will be filled with data from other years for the same time period.

4.4 Precipitation Stations

Precipitation data for the years 2001, 2002 and 2003 will be used as observations in developing the Step 2 Wind Fields in the CALMET model. The precipitation data, obtained from the NCDC, will be provided by BEE-Line Software. Data from the following seven precipitation stations will be used.

1. Bisbee 2 WNW (WBAN – 20775)
2. Cochise 4 SSE (WBAN – 21870)
3. Nogales 6 N (WBAN – 25924)
4. Oracle 2 SE (WBAN – 26119)
5. Santa Rita Experimental Range (WBAN – 27593)
6. Tucson International Airport (WBAN – 28820)
7. Vail (WBAN – 28995)

4.5 CALMET: Meteorological Data Processing

CALMET is based on the Diagnostic Wind Model (Douglass, S. and R. Kessler, 1988). It has been significantly enhanced by Earth Tech, Inc (Scire, 2000). CALMET uses a two step approach to calculate wind fields. In the first step, an initial guess field is adjusted for slope flows and terrain blocking effects, for example, to produce a step 1 wind field. In the second step, an objective analysis is performed to introduce observational data into the Step 1 wind field. The meteorological fields developed by CALMET depend on the following parameter settings:

1. R1MAX – Maximum radius of influence of the observation over land in the surface layer.
2. R2MAX – Maximum radius of influence of the observation over land in the layers aloft.
3. R3MAX – Maximum radius influence of the observation over water.
4. R1 – Controls weighting of the surface layer. For example, it is the distance from the observational station at which the observation and first guess field are equally weighted.
5. R2 - Controls weighting of the layers aloft.
6. ZIMAX – Maximum mixing height.
7. TERRAD – Radius of influence of Terrain Features.

All the above parameters, except ZIMAX are user defined. ZIMAX has an EPA default value of 3000 m AGL. This value will be set to 4500 m AGL in accordance with the CALMET inputs used by the Western Regional Air Partnership (WRAP) Regional Modeling Center (RMC) in conducting a BART CALPUFF modeling analysis for the state of Arizona. A mixing height of 3000 m AGL would be appropriate in Eastern U.S., but for Western U.S., in the summer mixing heights may exceed this value. All the other parameters are set on a case by case basis taking the terrain surrounding the observation stations into consideration. Table 4.1 lists the proposed parameter settings for the Rosemont Mine.

Table 4.1 CALMET Parameter Settings		
Parameter	WRAP Setting	Proposed Setting
R1MAX	50 KM	20 KM
R2MAX	100 KM	30 KM
R3MAX	100 KM	100 KM
R1	100 KM	18 KM
R2	200 KM	20 KM
ZIMAX	4500 m AGL	4500 m AGL
TERRAD	10 KM	10 KM

A large R1 value (100 KM, as suggested by WRAP) results in wind fields surrounding surface stations to overwrite the MM5 wind fields, which then do not have terrain influences incorporated into them. This leads to non-uniform wind fields with abrupt changes in wind directions. ENSR Corporation conducted a BART CALPUFF modeling analysis for APS Four Corners Power Plant in New Mexico and used smaller values as proposed in Table 4.1, for R1, R2 and R1MAX after guidance from the Federal Land Managers of the National Park Services. Setting R1 and R1MAX to high values, as suggested by WRAP (see Table 4.1), is not recommended by the model developer and Federal Land Managers, especially with a MM5 data resolution of 36 km with areas of complex terrain. Typically, R1 is set to a fairly small value, generally not exceeding half of the MM5 data resolution (18 km). R3MAX is a very minor factor considering the lack of any large water bodies in the analysis domain. R3MAX will be set to the WRAP value of 100 KM. TERRAD will also be set to the WRAP value of 10 KM.

4.6 Analysis Domain

The proposed modeling domain is shown in Figure 4.1. It is based on UTM coordinates and includes two Class I areas, the Saguaro National Monument and the Galiuro Wilderness. The domain is about 175KM x 165KM in the Easterly and Northerly directions respectively, with 5 KM grid cells.

4.7 Terrain

Gridded terrain elevations for the modeling domain will be derived from 3 arc-second digital elevation models (DEMs) produced by the United States Geological Survey (USGS). The files cover 1-degree by 1-degree blocks of latitude and longitude. USGS 1:250,000 scale DEMs will be used.

4.8 Land Use

The land use data will be obtained from USGS in the form of 250K land use data files. Data for missing quads will be substituted using National Land Cover Data (NLCD).

4.9 Receptors

The receptors used for the Class I areas are based on the National Park Service database of Class I receptors. Saguaro National Monument and the Galiuro Wilderness are the only Class I areas that fall within a 100 KM radius of the source. See Figure 4.1.

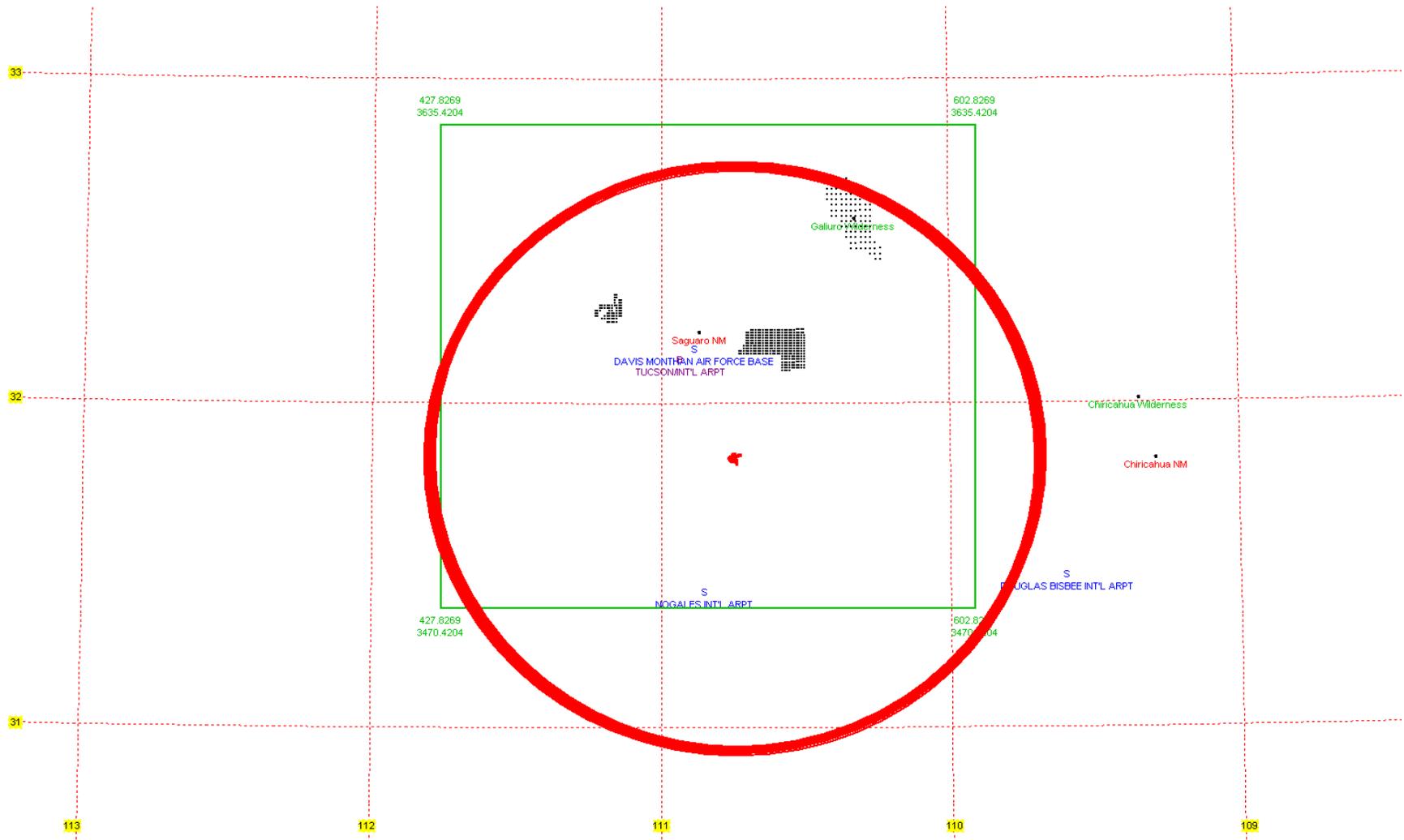


Figure 4.1 Modeling Domain Size and Class I Area Receptors.

5. CALPUFF MODELING

This section provides a summary of the modeling procedures that will be used for the CALPUFF analysis to be conducted for the Rosemont Mine.

5.1 Model Version

Version 6 of CALPUFF will be used to conduct the modeling analysis. The Federal Land Managers require the modeling to be done using the *FLAG Phase 1 Report Revised Draft* (June, 2008) guidelines which requires Version 6 of CALPUFF to be used.

5.2 Technical Options Used in Modeling

For CALPUFF model technical options, inputs and processing steps, the WRAP common BART protocol will be followed. Due to the large distance to the nearest Class I area, building downwash effects will not be included in the CALPUFF modeling.

5.2.1 Ozone Assumption

Monthly background ozone values will be calculated using data from the Clean Air Status and Trends Network (CASTNET) station located at the Chiricahua National Monument site. The Chiricahua NM station is the closest ozone data collection station to the analysis domain. Monthly averages will be calculated using the available hourly data and used as input to the CALPUFF model.

5.2.2 Ammonia Assumption

Ammonia is not simulated by CALPUFF, but rather a background value is specified. Ammonia is important because the level of particulate nitrate (NO_3) can depend on the amount of ammonia present. The partitioning of total nitrate between gaseous HNO_3 and particulate NO_3 depends on the amount of ammonia present and other parameters (e.g., SO_4 , temperature and RH). In the CALPUFF simulation, one value of background is assumed across the region and each puff uses the full background value in its equilibrium calculation. The IWAQM Phase II report contains the following recommendations for background ammonia: “typical (within a factor of 2) background values of ammonia are: 10 ppb for grasslands, 0.5 ppb for forest, and 1 ppb for arid lands at 20 C” (IWAQM, 1998). Based on the fact that the Saguaro National Monument lies in an arid region, a background ammonia value of 1 ppb will be used.

5.2.3 Natural Conditions and Monthly Relative Humidity Factors f(RH) at Class I Areas

For these Class I areas, natural background conditions must be established in order to determine a change in natural conditions related to a source's emissions. The EPA lists three types of Natural Conditions (natural background conditions) in their guidance document, Annual Average, Best 20% Days and Worst 20% Days (EPA, 2003a). The Best 20% Days and Annual Average Natural Visibility Conditions will be used and compared based on the recommendation of the EPA BART Guidance document (EPA, 2005). These EPA estimates were taken from the *Federal Land Managers Air Quality Related Values Workgroup (FLAG) Phase 1 Report Revised Draft Table V.1-1* (June, 2008).

The EPA, in its BART Guidelines (2005), concluded that by using monthly average Relative Humidity Adjustment Factors $f(RH)$ the likelihood that the highest modeled visibility impacts that were caused by short-term and geographically different meteorological phenomena (e.g., weather events) would be minimized. The FLAG (2008) report agrees with the EPA, therefore the visibility analysis will be conducted using monthly average $f(RH)$ values for large hygroscopic particles, small hygroscopic particles and sea salt, rather than hourly values.

5.2.4 Light Extinction and Haze Impact Calculations

The CALPOST postprocessor will be used for the calculation of the impact from the modeled source's primary and secondary particulate matter concentrations on light extinction. The formula that is used is the existing IMPROVE/EPA formula, which is applied to determine a change in light extinction due to increases in the particulate matter component concentrations. Using the notation of CALPOST, the formula is the following:

$$\begin{aligned}
 B_{ext} = & 2.2 \times f_S(RH) \times [\text{Small Sulfates}] + 4.8 \times f_L(RH) \times [\text{Large Sulfate}] \\
 & + 2.4 \times f_S(RH) \times [\text{Small Nitrates}] + 5.1 \times f_L(RH) \times [\text{Large Nitrates}] \\
 & + 2.8 \times [\text{Small Organic Mass}] + 6.1 \times [\text{Large Organic Mass}] \\
 & + 10 \times [\text{Elemental Carbon}] \\
 & + 1 \times [\text{Fine Soil}] \\
 & + 0.6 \times [\text{Coarse Mass}] \\
 & + 1.7 \times f_{SS}(RH) \times [\text{Sea Salt}] \\
 & + [\text{Rayleigh Scattering}] \\
 & + 0.33 \times [\text{NO}_2 \text{ (ppb)}]
 \end{aligned}$$

The concentrations, in square brackets, are in $\mu\text{g}/\text{m}^3$ and b_{ext} is in units of Mm^{-1} . The Rayleigh scattering term will be set to the value of 10 Mm^{-1} . This value for the Saguaro National Monument was taken from the *Federal Land Managers Air Quality Related Values Workgroup (FLAG) Phase 1 Report Revised Draft Table V.1-1* (June, 2008). This value is also the default, as recommended in EPA guidance for tracking reasonable progress (EPA, 2003a). The terms $f_S(RH)$, $f_L(RH)$ and $f_{SS}(RH)$ are relative humidity adjustment factors for small particles, large particles and sea salts respectively. These values will be taken from the *Federal Land Managers Air Quality Related Values Workgroup (FLAG) Phase 1 Report Revised Draft Table V.1-2, V.1-3 and V1.-4* (June, 2008) which list $f(RH)$ values for each Class I area.

The assessment of visibility impacts at the Class I areas will use CALPOST Method 6. Each hour's source-caused extinction is calculated by first using the hygroscopic components of the source-caused concentrations, due to ammonium sulfate and nitrate, and monthly Class I area-specific $f(RH)$ values. The contribution to the total source-caused extinction from ammonium sulfate and nitrate is then added to the other, non-hygroscopic components of the particulate concentration (from coarse and fine soil, secondary organic aerosols, and from elemental carbon) to yield the total hourly source-caused extinction.

6. SOURCE CHARACTERIZATION

Final design documents for the Rosemont Project processing plant are being developed and therefore, a detailed listing of all emission sources and their corresponding modeling input release parameters and emission rates cannot be provided with this protocol. A general description of how each source type will be treated is presented below.

6.1 Point Sources

Point sources at the Rosemont Project will include dust collectors, hot water heaters, and emergency generator(s). Emissions from these sources will be modeled as individual point sources. The baghouses will likely have ambient exit temperatures and therefore, will be modeled using a stack temperature of 0°K per ADEQ guidance, which forces the model to use the ambient temperature as the exit temperature. Stack parameters for the point sources will be based on design parameters and/or conservative estimated values. Particulate emissions from emergency generators will not be included as all other operations would likely be shut down if the generators are needed. The Point source emissions will be modeled using the particle size distribution shown in Table A.5 of Appendix A.

6.2 Volume Sources

6.2.1 Road Sources

A refined road network will be developed to depict the anticipated haul truck routes and truck discharge locations during the year of the mine plan with the estimated greatest emissions, which will be the basis of the emissions inventory that will be used for all of the modeling. Emissions due to haul road and general plant traffic on the unpaved road network will be modeled as volume sources and the modeling parameters will be based on Arizona Department of Environmental Quality guidance. All Road emissions will be modeled using the particle size distribution shown in Table A.1 of Appendix A.

6.2.2 Other Fugitive Particulate Sources

Other fugitive particulate emission sources that will be modeled as volume sources will include the following:

- Fugitive emissions from truck unloading at the primary crusher will be represented by a single volume source. The release height will be set to 0 meters (dump pocket is at grade level).
- Fugitive emissions due to wind erosion from the sulfide ore stockpile will be represented by a single volume source. The release height will be set to 6 meters (half the height of the stockpile).
- Fugitive emissions from conveyor transfer points will be represented by single volume sources. The release heights for this source will be set to the actual height of the conveyor transfer process.

The above material transfer emissions will be modeled using the particle size distribution shown in Table A.2 of Appendix A.

6.2.3 Particulate and Gaseous Emissions Due to Blasting

The emissions due to blasting in the pit will be modeled as volume sources. The PM₁₀ emissions from blasting will be modeled using the particle size distribution shown in Table A.3 of Appendix A.

6.2.4 Open Pit Source

Fugitive particulate emissions from the open pit at the Rosemont Project will be modeled as multiple volume sources. Unlike AERMOD, CALPUFF does not have an open pit source model. Therefore the emissions will be spread out in the pit as a series of volume sources. The majority of the emission inside the pit will be from Haul Truck travel on the unpaved roads. Table A.1 of Appendix A shows the particle size distribution developed for Haul Road Emissions. This distribution will be used for the volume sources in the pit.

6.2.5 Tail Pipe Emissions

Tail pipe emissions from Haul Trucks and support vehicles will be distributed among road emission sources and the open pit source. The amount of emissions assigned to each individual road segment and to the pit will be based upon an evaluation of the vehicle miles travelled (VMT) estimates for each vehicle type along each road segment and inside the pit. All Tailpipe particulate emissions will be modeled as PM 2.5 as recommended by ADEQ. See supporting email correspondence with ADEQ in Appendix B.

7. EMISSIONS INVENTORY

As stated previously, the final designs for the Rosemont Project facilities are being developed. Consequently, a detailed emissions inventory for all of the emission sources at the facility cannot be provided with this protocol. A complete, final design emissions inventory will be submitted with the permit application associated with the modeling described herein which will include explanations, references and justifications for the emission calculations.

8. DISPERSION MODELING IMPACT ANALYSIS

The purpose of the dispersion modeling outlined in this protocol is to demonstrate that emissions from the Rosemont Project will not cause exceedances of the applicable NAAQS and to evaluate potential effects on Air Quality Related Values (AQRV) at nearby Class I areas. The final impact analysis will include all the information necessary for this demonstration including: (a) 24-hr visibility impacts; (b) a source location map; (c) a complete list of source parameters; (d) complete modeling input and output files; and (e) graphic presentations of the modeling results for each pollutant showing the magnitude and location of the maximum ambient impacts.

APPENDIX A

PARTICLE SIZE DISTRIBUTIONS

A.1 PARTICLE SIZE DISTRIBUTIONS

The following sections describe the methodology used to estimate the particle size distributions for various emission sources.

A.1.1 Haul Roads

Section 13.2.4 of AP 42 lists the emission factors for emissions from unpaved roads. These emission factors were used to determine the distribution of emissions for particles with nominal diameters less than 30, 10 and 2.5 μm . Figure A.1 shows the distribution.

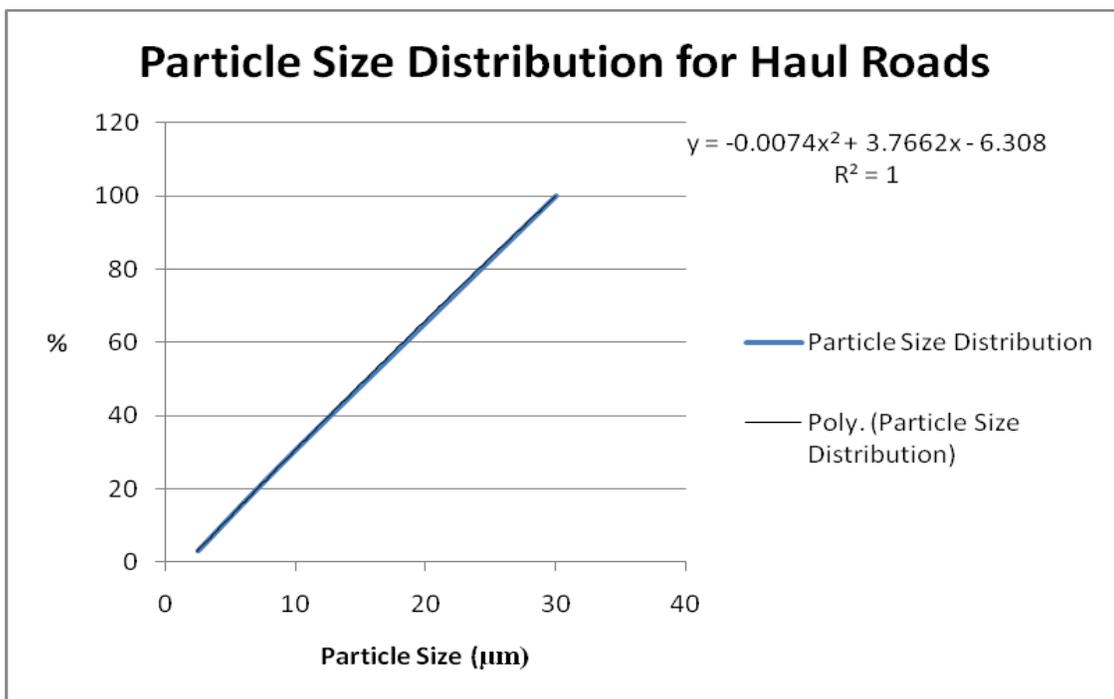


Figure A.8.1 Average size distribution for air borne dust generated by haul trucks for entire study period.

A 2nd degree polynomial equation was used to fit the data and determine particle size distributions for use with haul road emissions from the Rosemont mine. Table A.1 shows the calculated particle size distribution that will be used for haul road emissions.

Table A.1 Particle Size Distribution - Haul Road Emissions		
Diameter (microns)	Mass Fraction	Density (gm/cm3)
2.2	0.069	2.44
3.17	0.128	2.44
6.1	0.385	2.44
7.82	0.224	2.44
9.32	0.194	2.44

A.1.2 Material Transfer

Section 13.2.4 of AP 42 lists the emission factors for Aggregate Handling process. These emission factors were used to determine the distribution of emissions for particles with nominal diameters less than 30, 15, 10, 5 and 2.5 μm . Figure A.2 shows the distribution.

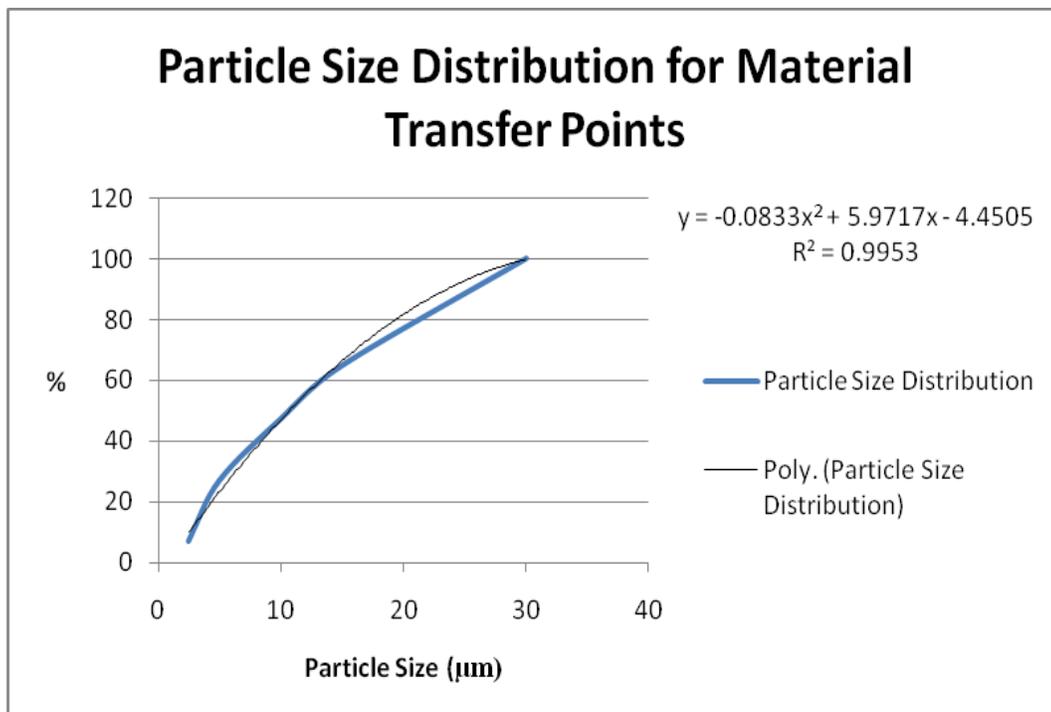


Figure A.8.2 Material Transfer Emissions (tpy) vs Particle Size (μm)

A 2nd degree polynomial was used to fit this data and determine the size distribution for other particle sizes. Table A.2 shows the calculated particle size distribution that will be used for material transfer emissions.

Table A.2 Particle Size Distribution - Material Transfer Points		
Diameter (microns)	Mass Fraction	Density (gm/cm ³)
2.2	0.188	2.44
3.17	0.122	2.44
6.1	0.347	2.44
7.82	0.188	2.44
9.32	0.155	2.44

A.1.3 Blasting

Table 11.9-1 from section 11.9 of AP 42 lists the emission factors for Western Surface Coal Mining processes. The Blasting emission factors were used to determine the distribution of emissions for particles with nominal diameters less than 30, 10 and 2.5 μm. Figure A.3 shows the distribution.

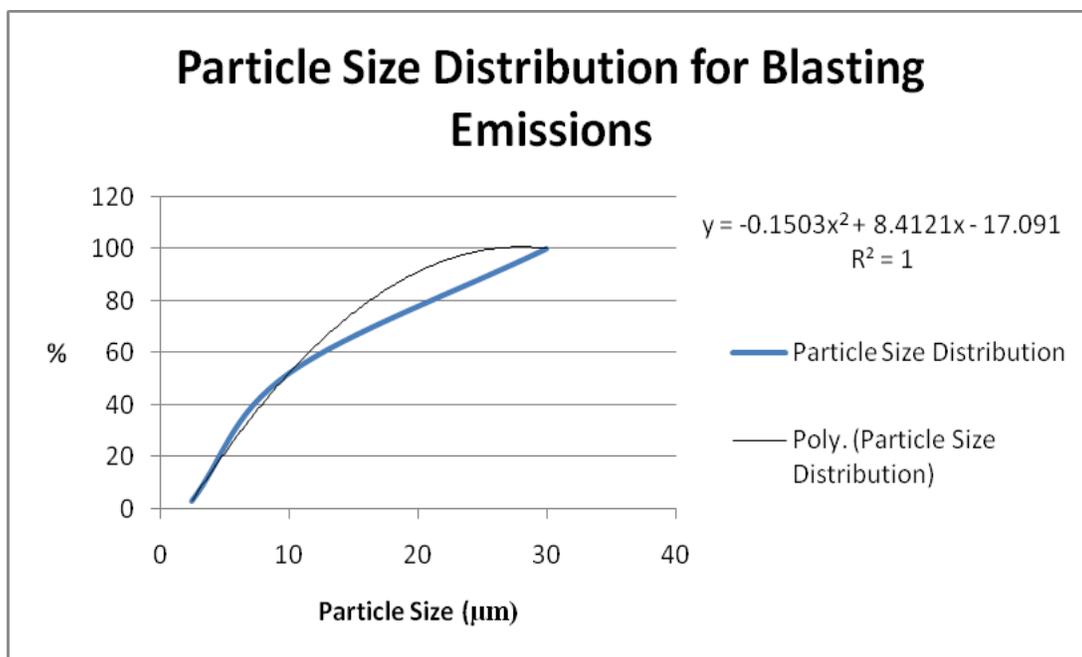


Figure A.8.3 Blasting Emissions (tpy) vs Particle Size (μm)

A 2nd degree polynomial was used to fit this data and determine the size distribution for other particle sizes. Table A.3 shows the calculated particle size distribution that will be used for material transfer emissions.

Table A.3 Particle Size Distribution - Blasting Emissions		
Diameter (microns)	Mass Fraction	Density (gm/cm3)
2.2	0.015	2.44
3.17	0.153	2.44
6.1	0.426	2.44
7.82	0.225	2.44
9.32	0.181	2.44

A.1.4 Point Sources

Page B.2-6, Appendix B.2 of AP 42 lists the collection efficiency of fabric filters used in baghouses for various particle sizes. These collection efficiencies were used along with particle size fractions for Aggregate handling processes (Section 13.2.4 of AP 42) to calculate particle size distribution that will be used for point source emissions. Figure A.4 shows the distribution.

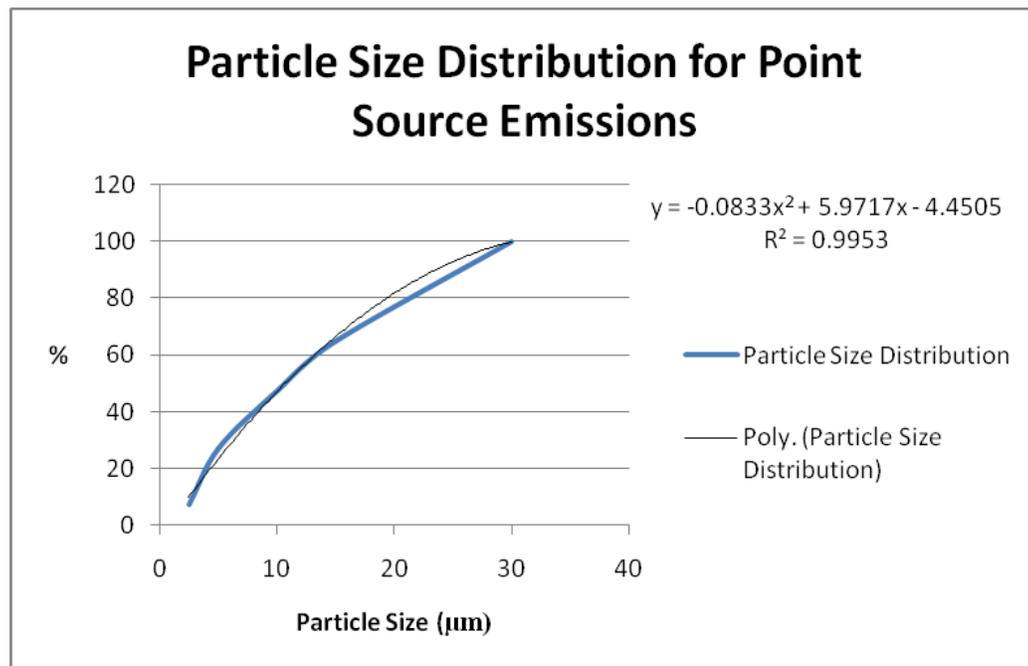


Figure A.4 Point Source Emissions (tpy) vs Particle Size

A 2nd degree polynomial was used to fit this data and determine the size distribution for other particle sizes. The obtained size distribution was then used along with the collection efficiency of the

baghouses for various sizes of particles. Table A.4 shows the collection efficiencies of fabric filters used in baghouses.

Table A.4 Collection Efficiency of Fabric Filters	
Diameter (microns)	Collection Efficiency (%)
0 - 2.5	99.0
2.5 – 6	99.5
6 - 10	99.5

Table A.5 shows the calculated particle size distribution that will be used for point source emissions.

Table A.5 Particle Size Distribution – Point Source Emissions		
Diameter (microns)	Mass Fraction	Density (gm/cm³)
2.2	0.317	2.44
3.32	0.103	2.44
6.1	0.292	2.44
7.8	0.158	2.44
9.32	0.130	2.44

APPENDIX B

CORRESPONDENCE WITH ADEQ

From: [Leonard H. Montenegro](#)
To: skongara@aecinc.org
Cc: [Feng Mao](#)
Subject: RE: Tail Pipe Emissions
Date: Friday, August 14, 2009 10:53:48 AM

Shantanu,
Please see below and in the future, feel free to direct your questions to Feng Mao or myself.
Cordially,
Leonard

-----Original Message-----
From: Feng Mao
Sent: Wed 8/12/2009 4:32 PM
To: Leonard H. Montenegro
Subject: RE: Tail Pipe Emissions

Leonard,

Table 3.3-1 in AP-42 provides the emission factors for PM10 with an assumption of "all particulate is assumed to be <1um in size". This assumption indicates that all particulate emissions are PM2.5 (the emission rate of PM10 is identical to that of PM2.5).

Based on Appendix B.2 of AP-42, the emission rate for PM2.5 is around 94% of the emission rate for PM10.

I did not see much difference between the two methods. To be conservative for modeling PM2.5, it is recommended to assume that all of the particulate emissions from tail pipes are PM2.5.

Feng

From: Leonard H. Montenegro
Sent: Wednesday, August 12, 2009 3:12 PM
To: Feng Mao
Subject: FW: Tail Pipe Emissions

Can you look this up?

Thanks