**TECHNICAL REVIEW AND EVALUATION
OF APPLICATION FOR
AIR QUALITY PERMIT NO. 67001**

Rosemont Copper Company

I. INTRODUCTION

This Class II synthetic minor permit is issued to Rosemont Copper Company (Rosemont), the Permittee, for the construction and operation of an open pit copper mine facility to be located approximately 30 miles southeast of Tucson, west of State Highway 83, within Pima County, Arizona. The facility has an anticipated lifetime production of about 1,230 million tons of ore and waste rock and an anticipated operating life of approximately 20 years.

A. Company Information

1. Facility Name: Rosemont Copper Project

2. Facility Location: 21900 S Sonoita Highway
   Vail, Arizona 85641
   Approximately 30 miles southeast of Tucson

3. Mailing Address: 5255 E. Williams Circle, Suite 1065
   Tucson, Arizona 85711

B. Attainment Classification

The Sonoita area is in attainment for all criteria pollutants.

II. PROCESS DESCRIPTION

The Rosemont Copper Project will primarily mine copper along with minor quantities of molybdenum, silver and other by-products. The copper mineralization in the area is a sulfide ore with a cap of oxide copper close to the surface. The sulfide and oxide ore will be mined through conventional open pit mining techniques. Ore (mostly comprised of sulfide ore) will be processed by crushing, grinding, and floatation to produce a copper concentrate product, which contains copper, silver, and possibly small amount of gold. A molybdenum concentrate will also be produced.

Description of the various steps involved is outlined below:

A. Open-Pit Mining

Open pit mining activities will include drilling, blasting, loading and hauling of ore and development rock using large-scale equipment including rotary blast hole drills (diesel and electric powered), a hydraulic percussion track drill, electric and hydraulic mining shovels, front end loaders, off-highway haul trucks, crawler dozers, rubber-tired dozers, motor graders and off-highway water trucks. Ore will be transported to the primary crushing area or stockpiled.

B. Primary Crushing and Coarse Ore Stockpile

Ore trucks will either dump the ore into the crusher dump hopper or stockpiled near the primary crusher and loaded to the crusher using a front end loader and/or loader/truck operation. Primary crushed ore will be conveyed to the coarse ore stockpile to be located within the stockpile building.

C. Stockpile Reclaim

A reclaim tunnel will be installed beneath the stockpile that will draw ore via apron feeders and onto conveyor belts that discharge to the semi-autogenous (SAG) grinding mill.

D. Milling and Flotation

Ore will be ground in water to the final product size in a SAG mill primary grinding circuit and a ball mill secondary grinding circuit. The primary grinding SAG mill will operate in closed circuit with a trommel screen, pebble wash screen, and a pebble crusher. Undersize from the trommel screen will be conveyed to the SAG mill grinding circuit. Oversize will be sent to the pebble crusher for further processing and then returned to the SAG mill. Material from the SAG mill undergoes a flotation process to produce copper and molybdenum mineral concentrate slurries which will then be transported to the dewatering circuits.

E. Copper Concentrate and Molybdenum Concentrate Dewatering and Preparation for Shipment

Copper concentrate slurry will be dewatered and thickened in a copper concentrate thickener. Thickener underflow will be pumped to copper concentrate filters. Filter cake will be stockpiled in the copper concentrate load out building that will be trucked for shipment. Molybdenum concentrate slurry from the filter feed tank will be pumped to a filter press. The filter cake will be discharged to a dryer/electrostatic precipitator. Dried molybdenum concentrate is stored in storage bins, which is then bagged and then trucked for shipment.

F. Tailings Dewatering and Placement

Tailings slurry will be dewatered and thickened in tailings thickeners. Thickener underflow will be pumped to the tailings filters. Filtered tailings cake will be discharged to the tailings placement system via conveyor belts and stacker system. The tailings placement system will be used to deposit the filtered tailings behind large pre-formed containment buttresses constructed from waste rock in the two tailings storage areas. A dozer may be used to spread the filtered tailings where needed, including compaction to provide a firm surface for the conveyor and stacker systems.

G. Control Devices

Rosemont will operate high efficiency cartridge filter dust collectors, one electrostatic precipitator, two wet scrubbers, water sprays, and dust suppressants on haul roads to reduce PM_{10} emissions from the facility.

III. EMISSIONS

Table 1 Potential Emissions

Pollutant	Non-Fugitive Emissions (tons per year)	Fugitive Emissions (tons per year)
PM	50.23	4986.73
PM_{10}	24.73	1384.55
$PM_{2.5}$	8.55	156.28
NO_x	14.89	205.56
CO	8.36	810.13
SO_2	0.02	24.18
VOC	2.37	0.00
H_2SO_4	0.00	0.00
HAPs	0.04	2.69
GHGs	1663.83	4581.82

Since the facility is a non-categorical source under state law, fugitive emissions are not considered for major-source applicability determinations. The fugitive emissions, however, are accounted for in the modeling analysis to determine compliance with the National Ambient Air Quality Standards (NAAQS).

IV. APPLICABLE REGULATIONS

Table 2 displays the applicable requirements for each permitted piece of equipment along with an explanation of why the requirement is applicable.

Table 2 Verification of Applicable Regulations

Unit	Control Device	Rule	Discussion
Metallic Mineral Processing Equipment	Cartridge Filters, Electrostatic Precipitator, Scrubber & Water sprays	40 CFR 60.382(a) 40 CFR 60.382(a)(2) 40 CFR 60.382(b) 40 CFR 60.386(a) 40 CFR 60.386(b)(1) 40 CFR 60.386(b)(2) P.C.C Section 17.16.490 AZ SIP R9-3-521 A.A.C. R18-2-702	The crushers, screens, conveyor belt transfer points, storage bins and truck unloading are affected facilities located in a metallic mineral processing plant as defined in NSPS Subpart LL The non-NSPS equipment are subject to the state regulations.
Tailings Dewatering and Placement Miscellaneous Sources – Silos, Lime Storage Bins, Sodium Metasciliate Storage Bins, Flocculant Storage Bins, Guar and Cobalt Sulfate Feeders	Water sprays Dust suppressants Dust Collector	A.A.C. R18-2-730 A.A.C. R18-2-702 P.C.C. Section 17.16.430	The opacity standards from A.A.C R18-2-702 apply to existing stationary point sources. The standards from A.A.C. R18-2-730 apply to unclassified sources.
Internal Combustion Engines	N/A	40 CFR 60, Subpart IIII	These standards apply to internal combustion engines manufactured after 2006. New engines subject to Subpart IIII meet the requirements of NESHAP Subpart ZZZZ by complying with the requirements of NSPS Subpart IIII.
Fugitive dust sources	Water Trucks Dust Suppressants	A.A.C. R18-2 Article 6 A.A.C. R18-2-702	These standards are applicable to all fugitive dust sources at the facility.
Petroleum Liquid Storage Tanks - Gasoline	Submerged filling device; Pump/ compressor seals	AAC R18-2-710 40 CFR 63 Subpart CCCCCC	This standard applies to the gasoline storage tanks. NESHAP Subpart CCCCCC applies to gasoline dispensing facilities.
Diesel Storage Tanks	N/A	A.A.C. R18-2-730	These standards apply to unclassified sources.
Laboratory Dust Collector	Dust Collector	A.A.C. R18-2-721, 702 AZ SIP Provision R9-3-521	The PM limits from A.A.C. R18-2-721 and AZ SIP apply
Abrasive Blasting	Wet blasting; Dust collecting equipment; Other approved methods	A.A.C. R-18-2-702 A.A.C. R-18-2-726	These standards are applicable to any abrasive blasting operation.

Unit	Control Device	Rule	Discussion
Spray Painting	Enclosures	A.A.C. R18-2-702 A.A.C. R-18-2-727	This standard is applicable to any spray painting operation.
Demolition/renovation operations	N/A	A.A.C. R18-2-1101.A.8	This standard is applicable to any asbestos related demolition or renovation operations.
Mobile sources	None	A.A.C. R18-2-801	These are applicable to off-road mobile sources, which either move while emitting air pollutants or are frequently moved during the course of their utilization.

A number of the applicable regulations refer to the "property line" and whether emissions cross the property line. As applied to the Rosemont project, the Department construes the fence line that excludes the public from the Rosemont project pursuant to Attachment "B", Condition XIII as the "property line" for compliance purposes.

V. PREVIOUS PERMIT CONDITIONS

Permit No. 55223 was issued on January 31, 2013, for the operation of this facility. Table 3 below illustrates if a section in Permit No. 55223 was revised or deleted.

Table 3 Permit No. 55223

Section No.	Determination		Comments
	Revised	Delete	
Att. A.	X		General Provisions - Revised to represent most recent template language.
Att. B. II	X		Facility-Wide Requirements – Updated opacity requirements to include alternative monitoring method(s).
Att. B. II.A.2	X		Operating Limitations – Updated throughput rock mined and ammonium nitrate and fuel oil used during blasting.
Att. B. III	X		Table 1: Emission Limits updated.
Att. B. III.D.2	X		Air pollution control requirements updated.
Att. B. V		X	Boiler At Solvent Extraction/ Electrowinning (SX/EW) process no longer applicable to facility.
Att. B. VI	X		Fugitive Dust Requirements – Revised to represent most recent template language. Updated vehicle speed.
Att. C	X		Equipment list updated to reflect changes to facility.

VI. MONITORING REQUIREMENTS

A. Facility Wide

1. The Permittee is required to maintain, on-site, records of the manufacturer's specifications or an operation and maintenance plan for all equipment listed in the

permit.

2. The Permittee is required to keep records of dates and times when blasting is conducted along with the amount of Ammonium Nitrate/Fuel Oil (ANFO) used in the blast.

3. The Permittee is required to perform comprehensive annual preventative maintenance checks on all dust control equipment at the facility.

4. The Permittee is required to follow the procedures for reducing emissions as stated in the Dust Control Plan, Visual Observation Plan and Dry Stack Tailings Management Plan included in the permit.

5. The Permittee is required to conduct daily visible emissions survey at places where facility fugitive dust generating activities are within 300 feet of the property boundary line in accordance with EPA Method 22. If any visible emissions are observed crossing the property line, it shall be reported as excess emissions.

B. Metallic Mineral Processing Subject to NSPS Subpart LL

1. The Permittee is required to show compliance with the opacity standards by having a Method 9 certified observer perform weekly surveys of visible emission from the dust collectors and process fugitive emission points. The observer is required to conduct a 6-minute Method 9 observation if the results of the initial survey appear, on an instantaneous basis, to exceed the applicable standard or baseline opacity level.

2. The Permittee is required to keep records of the name of the observer, the time, date, and location of the observation and the results of all surveys and observations.

3. The Permittee is required to keep records of any corrective action taken to lower the opacity of any emission point and any excess emission reports.

4. The Permittee is required to monitor the flow rate and pressure drop across the scrubber (AE-13).

5. The Permittee is required to monitor the voltage and current across the electrostatic precipitator according to the manufacturer's specifications.

C. Internal Combustion Engines

1. The Permittee is required to record the hours of operation using a non-resettable hours meter and the reason for operation.

2. The Permittee is required to keep records of maintenance conducted on all engines.

D. Fugitive Dust

1. The Permittee is required to keep record of the dates and types of dust control measures employed.

2. The Permittee is required to show compliance with the opacity standards by having a Method 9 certified observer perform weekly surveys of visible emission from

fugitive dust sources. The observer is required to conduct a 6-minute Method 9 observation if the results of the initial survey appear on, an instantaneous basis, to exceed the applicable standard.

3. The Permittee is required to keep records of the name of the observer, the time, date, and location of the observation and the results of all surveys and observations.

4. The Permittee is required to keep records of any corrective action taken to lower the opacity of any emission point and any excess emission reports.

5. The Permittee is required to monitor the forecast and wind speeds and conduct inspections of tailings as deemed necessary.

E. Gasoline Storage and Dispensing

The Permittee is required to maintain monthly record of gasoline throughput, Reid vapor pressure and dates of storage and when the dates when the tank was empty. If the vapor pressure is greater than 470mm Hg, the Permittee is required to record the average monthly temperature and true vapor pressure of gasoline at such temperature. The Permittee is required to record and report any malfunction of operation and corrective actions taken.

F. Periodic Activities

1. The Permittee is required to record the date, duration and pollution control measures of any abrasive blasting project.

2. The Permittee is required to record the type and quantity of paint used, any applicable SDS, and pollution control measures of any spray painting project.

3. The Permittee is required to maintain records of all asbestos related demolition or renovation projects. The required records include the "NESHAP Notification for Renovation and Demolition Activities" form and all supporting documents.

G. Mobile Sources

The Permittee is required to keep records of all emission related maintenance performed on the mobile sources. The Permittee is required to purchase haul trucks that meet US EPA Tier 4 requirements.

H. Ambient Monitoring Requirements

Rosemont is required to install and operate a continuous PM_{10} monitor and meteorological monitoring. Rosemont will be required to operate the instruments at least 90 days prior to the startup of the mine operations. Quarterly and annual reports are required to be submitted electronically. The permit identifies specific requirements for the maintenance and calibration of the monitors. The ambient monitors will serve as Special Purpose Monitors (SPM) that would be maintained by Rosemont.

VII. TESTING REQUIREMENTS

The Permittee is required to perform an annual Method 5, 17 or 201A performance test for PM/PM_{10} on the control equipment to verify compliance with applicable emission standards.

VIII. COMPLIANCE HISTORY

To date, the facility has not been constructed. As such, no inspection of the facility has taken place. The Permittee has, however, submitted timely compliance certifications reports indicating status since permit issuance in January 2013.

IX. INSIGNIFICANT ACTIVITIES

Table 4 below, lists insignificant activities identified at the Rosemont project:

Table 4 Insignificant/Trivial Activities

Equipment Description	Maximum Size or Capacity	Verification of Insignificance
Diesel and Fuel Oil Storage Tank < 40,000 gallons	10,000 gal – Plant Diesel Storage Tank 10,000 gal – Diesel Exhaust Fluid (DEF) Tank #1 10,000 gal – Diesel Exhaust Fluid (DEF) Tank #2	A.A.C. R18-2-101.68.a.i
Miscellaneous Storage Tanks < 40,000 gallons	21,100 gal – Flocculant Mixing Tank 1,000 gal – Promoter Storage Tank/Standpipe 22,520 gal – Frother Storage Tank 31,700 gal – NaHS Storage Tank 9,500 gal – NaHS Distribution Tank 9,500 gal – Sodium Silicate Storage Tank 19,800 gal – Collector (SIBX) Storage Tank (reagent) 9,500 gal – Collector (SIBX) Distribution Tank (reagent) 9,500 gal – Lime Storage Tank 5,000 gal – 10W40 Oil Storage Tank 5,000 gal – 15W40 Oil Storage Tank 5,000 gal – 30W Oil Storage Tank 5,000 gal – 50W Oil Storage Tank 5,000 gal – 90W Oil Storage Tank 5,000 gal – Anti-Freeze Storage Tank #1 5,000 gal – Anti-Freeze Storage Tank #2 3,000 gal – Compressor Oil Storage Tank 3,000 gal – Gear Oil Storage Tank 5,000 gal – HV43 Storage Tank (hydraulic oil) 5,000 gal – Spare Lubricant Tank 5,000 gal – Used Oil Storage Tank Misc. small equipment mounted hydraulic oil tanks Misc. small oil/grease totes	A.A.C. R18-2-101.68.a.i
Batch Mixers	< 5 cu.ft	A.A.C. R18-2-101.68.c.i
Wet Sand & Gravel Operations excluding crushing/grinding operations	< 200 tons per hour	A.A.C. R18-2-101.68.c.ii
Hand-held or manually operated equipment	Buffing, polishing, carving, cutting, drilling, machining, routing, sanding, sawing, surface, grinding, or turning of ceramic art work, precision parts, Leather, metals, plastics, fiberboard, masonry, carbon, glass, or wood	A.A.C. R18-2-101.146.b.i

Equipment Description	Maximum Size or Capacity	Verification of Insignificance
Lab Equipment used for chemical & physical analyses	Analytical laboratory equipment Small pilot scale R&D projects	A.A.C. R18-2-101.146.f.ii

X. AMBIENT AIR IMPACT ANALYSIS

This section summarizes the ADEQ's findings regarding the ambient assessment submitted by Rosemont in support of its Air Quality Class II Synthetic Minor Permit (Permit #55223) renewal. In 2012, ADEQ approved an ambient air impact analysis that Rosemont submitted as part of a Class II synthetic minor permit application. However, due to the revisions to the Mine Plan of Operations (MPO) compared to the 2012 submittal, the facility layout, process equipment and throughputs are changed. Additionally, the previously permitted heap leaching and solvent extraction/electrowinning (SX/EW) operations are no longer included. Since these changes may potentially affect the ambient impacts from the facility's emissions, ADEQ requested Rosemont perform dispersion modeling to demonstrate that the facility's emissions will not interfere with attainment and maintenance of the National Ambient Air Quality Standards (NAAQS). The pollutants subject to this ambient assessment review are PM_{10}, $PM_{2.5}$, NO_X, CO and Ozone.

ADEQ reviewed the ambient air impact analysis following the EPA's Guideline on Air Quality Models (40 CFR Part 51 Appendix W)[1] and ADEQ's Modeling Guidelines for Arizona Air Permits (hereafter "ADEQ Guidelines").[2]

A. Model Selection

The American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) model is the EPA-preferred model for estimating impacts at receptors located in simple terrain and complex terrain (within 50 km of a source) due to emissions from industrial sources. Rosemont used AERMOD for the ambient impact analysis.

The AERMOD Modeling System consists of three major components: AERMAP, used to process terrain data and develop elevations for receptors; AERMET, used to process the meteorological data; and AERMOD, used to estimate the ambient pollutant concentrations. Rosemont used AERMAP version 11103; AERMET version 16216; and AERMOD version 16216r. These are the most recent versions of the AERMOD Modeling System.

B. Source Inputs

This section provides a discussion on source characterization to develop appropriate source inputs, including modeled emissions, source configuration and source types, Good Engineering Practice (GEP) stack heights, urban/rural determination of the sources, and off-site sources.

1. Sources of Emissions

The Rosemont project will include an open-pit mine and ore processing operations comprised of crushing, milling, flotation, concentrate and tailings filtering as well as waste rock and tailings management. The primary emission sources are fugitive emissions from haul trucks traveling on haul roads and tailpipe emissions. Other

[1] https://www3.epa.gov/ttn/scram/guidance/guide/appw_17.pdf
[2] http://static.azdeq.gov/aqd/modeling_guidance.pdf

emission sources include: wind erosion from tailings storage facility and stockpiles; fugitive emissions from truck loading/unloading and conveying transfer points; emissions from drilling and blasting; and emissions from dust collectors and emergency generators. The primary pollutants emitted are particulate matter (PM), NOx and CO.

2. Modeled Emission Rates

Rosemont developed an emission inventory based on the Year 9 mining plan which has the highest projected annual mining rate and highest haul truck travel, both in and outside of the pit. As fugitive emissions from haul roads and tailpipe emissions are the primary emission sources, ambient impacts from operations during all other years are anticipated to be lower than during Year 9. Rosemont estimated maximum short-term emission rates for all modeled pollutants using the maximum daily process rates for Year 9 with a safety factor. Rosemont estimated long-term average emissions rates for all modeled pollutants using the average daily process rates for Year 9, the year with the highest annual values.

3. Source Configurations and Source Types

Rosemont modeled the emissions from dust collectors and emergency generators as point sources. Stack parameters for the point sources were based on design parameters and/or conservative estimated values.

Rosemont used AERMOD's open-pit algorithm to characterize the emissions generated within the open-pit. Emissions from drilling, loading, hauling, water truck use, and support vehicle inside the pit were combined and modeled as a pit source. The same approach was also used to model the emissions emitted within the waste rock storage area as this area is surrounded by elevated berms that are built prior to each section of waste rock being placed, resulting in pit emission retention just like an open pit. The open pit source parameters for model inputs reflect the physical orientation and size (i.e., depth and horizontal dimensions) of the open-pit and the bermed area for Year 9.

Rosemont characterized the emissions from road ways outside the pit as a series of volume sources. Rosemont also characterized the fugitive emissions from material loading/unloading as well as material transfer points as volume sources. Additionally, Rosemont characterized the wind erosion from tailings storage facility and stockpiles as volume sources. The volume source parameters, including initial lateral dimension (σy_0), initial vertical dimension (σz_0) and release height, were estimated based on the horizontal and vertical dimensions of the volume source, following ADEQ Guidelines and the AERMOD User's Guide.

Rosemont characterized the emissions from blasting as volume sources, a recommended approach in ADEQ Guidelines. Since the Rosemont project anticipates routine blasting to occur between 12 PM and 4 PM, the variable emission rate option HROFDY in AERMOD was used to model the emissions between the above 4-hour intervals every day. ADEQ determined that this approach was acceptable.

Rosemont utilized the mine planning drawing for Year 9 of the mine life to estimate the base elevations, source dimensions and source locations. This coincides with the maximum emissions year for the Rosemont project and the mining inputs used in the emissions calculations.

4. Good Engineering Practice (GEP) stack heights

Rosemont modeled all stacks with actual heights. Rosemont evaluated building downwash effects based on building and stack location and dimensions, and the EPA's Building Profile Input Program Plume Rise Model Enhancements (BPIP-PRME).

5. Urban/rural Determination

The rural/urban classification of an area is determined by either the dominance of a specific land use or by population data in the study area. The land-use procedure specifies that the land-use within a three-kilometer radius of the source should be determined using the typing scheme developed by Auer.[3] Rosemont determined the project site area as "Rural" based on the land use method.

6. Off-site (nearby) Sources

The EPA recommends that all nearby sources, that are not adequately represented by background ambient monitoring data, should be explicitly modeled as part of the NAAQS analysis. To determine which nearby sources should be explicitly modeled in the air quality analysis, the EPA has established "a significant concentration gradient in the vicinity of the source under consideration" as the sole criterion for this determination. There are no off-site stationary sources near Rosemont that would cause a significant concentration gradient within the vicinity of the project site. Therefore, there are no near-by sources that should be explicitly modeled. The impact from distant off-site sources are represented by background ambient monitoring data as discussed in **E**.

C. Meteorological Data

1. Meteorological Data Selection

For regulatory dispersion modeling analyses, 5 years of National Weather Service (NWS) station meteorological data, or at least 1 year of site-specific meteorological data, or at least 3 years of prognostic meteorological data should be used. Per Appendix W Section 8.4.2.d, "*If 1 year or more, up to 5 years, of site specific data are available, these data are preferred for use in air quality analyses*".

Rosemont initiated site-specific meteorological monitoring in April 2006. The meteorological monitor was located at the center of the proposed open-pit. The database, however, was not continuous as data between December 2006 and February 2007 were lost due to a data logger malfunction. After June 2009, quality control checks at the meteorological monitoring station were reduced so data quality at that station was no longer applicable for air modeling purposes. In the 2012 permit application, Rosemont used three full years of site-specific data from April 2006 to March 2009, with missing data periods filled in with data from other

[3] Auer, A.H. 1978. Correlation of Land Use and Cover with Meteorological Anomalies, Journal of Applied Meteorology, 17:636-643.

years for the same time period.

For this ambient impact assessment, ADEQ requested Rosemont conduct their modeling analyses based upon two full years of continuous data from March 2007 to February 2009, excluding the three-month missing meteorological data. Following the EPA's Meteorological Monitoring Guidance for Regulatory Modeling Applications, the two full years of site-specific data met QA/QC and completeness requirements.[4] The dataset also complies with the requirement of "at least 1 year of site-specific data" as specified in Appendix W Section 8.4.2. ADEQ further performed a sensitivity analysis to compare the modeled concentrations for the three-year dataset versus the two-year dataset, and found that the differences in modeled design concentrations were very marginal.

There is no age restriction on a meteorological data set. Appendix W Section 8.4.1b 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. ADEQ determined that the site-specific meteorological data Rosemont collected during March 2007 through February 2009 were representative of transport and dispersion conditions between the sources of concern and areas where maximum design concentrations are anticipated to occur (the perimeter fenceline of the facility).

2. Meteorological Data Processing

Rosemont used the more recent version of AERMET meteorological preprocessor (v16216) to process two-years of site-specific data along with concurrent cloud cover data and upper air radiosonde data obtained from the Tucson NWS station. Rosemont also used the EPA's AERSURFACE tool (v13016) to calculate surface characteristic parameters (albedo, Bowen ration and surface roughness) required by AERMET.

<u>Arid Region vs. Non-Arid Region</u>

AERSURFACE requires the users to specify whether the project site is in an arid region or a non-arid region. Rosemont specified that the project site is in an arid region, which reflects the overall climatic conditions of the project site area. However, the summer monsoon rainfall may cause vegetative growth and thus affect the surface characteristic parameters. Specifically, the albedo and Bowen ratio are anticipated to be lower and the surface roughness higher during the monsoon season. ADEQ performed a sensitivity analysis to investigate the response of the modeled concentrations to the changes of surface characteristic parameters during the summer monsoon season. Since AERSURFAC does not allow the users to define "Arid Region" for one season (or months) while define "Not-Arid Region" for another season (or months), ADEQ manually modified the surface characteristic parameters during June-September in the AERSURFACE output file. As shrubland is the dominant land cover at the project site area, ADEQ selected the surface characteristic parameters during June-September based on Shrubland (Not-Arid Region) as listed in the AERSURFACE Surface

[4] https://www3.epa.gov/scram001/guidance/met/mmgrma.pdf

Characteristics Tables[5]. The sensitivity analysis revealed that the modification of the surface characteristics for the monsoon season resulted in a slight drop of the modeled design concentration for PM_{10}. Therefore, ADEQ determined that the use of the "Arid Region" through the whole modeled years was defensible and acceptable.

Cloud Cover Sensitivity Analysis

Cloud cover measurement is not typically available from site-specific monitoring programs. For applications of AERMOD, the cloud cover measurements from the nearest NWS station are routinely used. Rosemont used the cloud cover data obtained from the Tucson NWS station since the site - surface measurements did not include the cloud cover data. ADEQ performed a sensitivity analysis to investigate the effect of cloud cover on the model design concentration for PM_{10}. ADEQ tested two hypothetical meteorological datasets, one using only clear sky cover (CCVR =0) and one using only overcast sky cover (CCVR =10). ADEQ found that the variations in cloud cover did not substantially alter the modeling results. The difference between the two modeling runs was approximately 5 $\mu g/m^3$ while the dataset with clear skies showed slightly higher modeled concentration. ADEQ further modified the Tucson cloud data during June-September by increasing CCVR by 3, considering the Rosemont project site has more cloud cover and precipitation than the NWS Tucson station during the summer season. ADEQ found that the use of the modified cloud cover dataset yielded a similar modeled designed concentration for PM_{10} compared to the original Tucson cloud cover dataset. Based on the results of the cloud cover sensitivity analysis, ADEQ determined that the use of the cloud cover data obtained from the Tucson NWS station was acceptable.

D. Ambient Air Boundary and Receptor Network

The applicants are required to demonstrate modeled compliance with NAAQS at receptors spaced along and outside the ambient air boundary (AAB). For modeling purposes, the ambient air is "the air everywhere outside of contiguous plant property to which public access is precluded by a fence or other effective physical barrier".[6] The general public may not include mail carriers, equipment and product suppliers, maintenance and repair persons, as well as persons who are permitted to enter restricted land for the business benefit of the person who has the power to control access to the land.[7]

Rosemont is required to build fences or use other physical barriers to effectively preclude the public access. See the Draft Permit XIII - PUBLIC ACCESS RESTRICTIONS. Therefore, Rosemont used the perimeter fenceline as the ambient air boundary for modeling purposes. Following ADEQ Guidelines, Rosemont set up a receptor network to determine areas of maximum predicted concentrations. The grid spacing utilized for the receptors are as follows: process area boundary set at 25 m intervals; fine receptor grid of 100 m, extending from AAB to 1 km; medium receptor grid of 500 m, extending from 1 km to 5 km; coarse grid receptor grid of 500 m, extending from 5 km to 10 km. Rosemont used the AERMAP terrain processor (version 11103) to process the National Elevation Data (NED) data to

[5] https://www3.epa.gov/scram001/7thconf/aermod/aersurface_userguide.pdf
[6] U.S. EPA. 1985. Ambient Air. Regional Meteorologists' Memorandum dated May 16, 1985. Chicago, IL 60604.
[7] U.S. EPA. 2007. Interpretation of "Ambient Air" In Situations Involving Leased Land Under the Regulations for Prevention of Significant Deterioration (PSD). Stephen D. Page Memorandum dated June 22, 2007. Research Triangle Park, North Carolina 27711.

generate the receptor elevations and hill heights.

E. Background Concentration

Background concentrations should be representative of regional air quality in the vicinity of a facility. Typically, background concentrations should be determined based on the air quality data collected in the vicinity of the proposed project site. However, if there are no monitors located in the vicinity of the project, a "regional site" may be used to determine background concentrations. Per Appendix W Section 8.3.2 b, a regional site is "*one that is located away from the area of interest but is impacted by similar or adequately representative sources*." There is no cutoff of distance between the project site and the regional monitor. The key criterion is that the project site and the regional monitor should have a similar source impact.

1. Background Concentration for 24-hour PM_{10}

Rosemont conducted PM_{10} monitoring in the vicinity of the project site from June 2006 to June 2009, yielding a little over twelve quarters of data. The highest concentration for 24-hour PM_{10} over the three-year period was 71.3 $\mu g/m^3$. While this monitored concentration appears to be a statistical outlier, the reasons resulting in this high concentration were unknown. Therefore, ADEQ requested Rosemont incorporate this value into the calculation of background concentration. Rosemont calculated the 24-hour PM_{10} background concentration based on the average of the highest 24-hour concentrations recorded for each year, which was 47.7 $\mu g/m^3$.

2. Background Concentration for 1-hour NO_2

There are no monitoring sites in the immediate vicinity of the proposed Rosemont project site. Therefore, a "regional site" must be selected to determine the background concentration based on similar/representative source impacts. There are very limited NO_2 monitoring sites in Arizona and all monitoring sites are currently located in the Phoenix/Tucson metropolitan area. These urban monitors are significantly influenced by emissions from heavy vehicular traffic and industrial sources that do not exist near the Rosemont project site area.

ADEQ has collected two-year hourly NO_2 ambient air monitoring data at the Alamo Lake site from July 2014 to June 2016. As the Rosemont site is similar to the Alamo Lake site in that the only sources of NO_2 are minor vehicle traffic, Rosemont selected the Alamo Lake site as a representative site for the background determination. To calculate the background concentration, the EPA recommends using the 98th percentile (the 8^{th} highest) of the annual distribution of daily maximum 1-hour values averaged across the most recent three years of monitoring.[8] Rosemont used the highest 1-hour concentration of the two-year monitoring data as the 1-hour background NO_2 concentration. This method was conservative and acceptable.

The Rosemont project is located approximately 30 miles southeast of Tucson. ADEQ determined that the Tucson/I-10 plume has an insignificant influence on the Rosemont project site. Neither of Tucson airport meteorological data nor Rosemont site-specific meteorological data supports that there is a significant connection between the Rosemont project site and Tucson/I-10 airshed. The

[8] https://www.epa.gov/sites/production/files/2015-07/documents/appwno2_2.pdf

presence of the mountain range between Tucson/I-10 and the Rosemont project site also substantially separates the Rosemont site from Tucson/I-10 airshed.

ADEQ further reviewed the historical NO_2 monitoring data collected from the Tonto National Monument site, which is located 35 miles east of the Phoenix metropolitan area. Unlike an infrequent connection between Rosemont and Tucson airshed, the connection between Tonto National Monument and Phoenix airshed is very strong and significant, mainly due to the prevailing western wind (from west to east) in the Phoenix area. Even under such conditions, the 1-hour NO_2 concentrations collected from the Tonto National Monument monitor were very significantly low (10-15 ppb) in comparison with those collected from Phoenix monitors (around 60-70 ppb). ADEQ also found that the 1-hour NO_2 concentrations from the Alamo Lake site and the Tonto National Monument site were comparable. Based on the historical monitoring data collected from Phoenix and the Tonto National Monument site, ADEQ determined that regional transport effects, if there are any, can be neglected for the background determination for 1-hour NO_2.

3. Background Concentration for $PM_{2.5}$

There are no $PM_{2.5}$ monitoring sites in the immediate vicinity of the Rosemont project site. ADEQ has identified two Interagency Monitoring of Protected Visual Environments (IMPROVE) sites that could be considered for determining the background concentration of $PM_{2.5}$: one is Saguaro National Park-East and the other is Chiricahua National Monument. The Saguaro National Park site is located in close proximity to the Tucson metropolitan area, and thus directly influenced by urban and industrial emissions from Tucson. Comparatively, the Chiricahua National Monument site is more representative of the Rosemont project site due to similar terrain features, elevation and source impacts. As discussed in E-2 above, there is no evidence to demonstrate that the Rosemont project site and the Tucson airshed are significantly connected. Therefore, Rosemont selected the Chiricahua National Monument site for the background determination. Rosemont calculated the annual $PM_{2.5}$ background value based on the average of the most recent three years of the annual average $PM_{2.5}$ concentrations. Rosemont calculated the 24-hour background $PM_{2.5}$ value based on the average of the 98th percentile 24-hour values measured over the last three years.

4. Background Concentrations for SO_2, CO and Annual NO_2

Rosemont used the ADEQ's recommended background concentrations for CO, annual SO_2 and annual NO_2. These values have long been used for permitting sources that are located in rural areas in Arizona. For 1-hour SO_2 background concentration, Rosemont selected the monitor with the highest monitoring concentrations in the Phoenix/Tucson areas. This method was conservative and acceptable.

F. One –Hour NO_2 Modeling Methodology

Per Appendix W Section 4.2.3.4-d, the EPA recommends three-tiered approach for 1-hour NO_2 modeling. Plume Volume Molar Ratio Method (PVMRM) and Ozone Limiting Method (OLM) are available as regulatory options in AERMOD as the preferred Tier 3 screening methods for NO_2 modeling. In general, ADEQ recommends using PVMRM for relatively isolated and elevated point sources, and using OLM for large groups of sources, area sources, and near-surface releases (including roadway sources). Since the vast majority of the NO_2 emissions at the Rosemont project are from mobile sources with low-level plumes, Rosemont selected OLM for 1-hour NO_2 modeling. Rosemont used the "OLMGROUP ALL" option following the ADEQ's Modeling Guidelines. Two key model inputs for both the PVMRM and OLM options, namely in-stack ratios of NO_2/NO_X emissions and background ozone concentrations, are discussed as follows.

1. In-Stack Ratio

The modeled sources of NOx include mobile sources, stationary engines, and blasting sources.

Mobile Sources

In-stack NO_2/NOx for mobile sources must be representative of exhaust gases before leaving the tail pipe and before any mixing or oxidation by ambient air has occurred. To determine the representative NO_2/NOx estimates, the data must be sampled by either direct in-pipe measurement methods or by methods designed for mitigating oxidation from ambient ozone (such as measuring NO_2 and NOx inside of tunnels).

In the 2012 permit application, Rosemont provided a literature review and concluded a ratio ranging from 0.02 to 0.06 was appropriate for mobile sources. In this permit application renewal, Rosemont provided source-specific testing data from the manufacturer (Caterpillar), suggesting a lower NO_2/NOx ratio (0.01). Considering the ratio under the lab conditions may not reflect operating conditions as well as environmental conditions, Rosemont used a ratio of 0.05 for conservatism and also to be consistent with previous modeling.

Stationary Engines

Rosemont used an in-stack ratio of 0.065 for stationary engines based on the average of similar engines found in EPA's NO_2/NOx In-Stack Ratio (ISR) Database.[9] The database was sorted by engine type, fuel and engine capacity. The average of the ratios for reciprocating IC diesel engines, rating in size from 400 kW to approximately 1900 kW, was used to calculate the average for use in the model.

Blasting sources

Rosemont used an in-stack ratio of 0.1 for blasting based on field testing data presented in a scientific paper published in *Atmosphere Environment*.[10] A maximum in-stack ratio of 0.08 (rounded to 0.10 for input in the model) was

[9] https://www3.epa.gov/scram001/no2_isr_database.htm
[10] Attalla, et al, 2008. NOx emissions from blasting operations in open-cut coal mining. Atmosphere Environment, 42:7874–7883.

calculated based on ANFO blasting plume measurement results from blasting with ANFO.

2. Ozone Data

Rosemont used hourly ozone background concentrations obtained from the Clean Air Status and Trends Network (CASTNET) ozone monitor at the Chiricahua National Monument. ADEQ further reviewed the ozone data from the Green Valley site (the nearest monitoring site to Rosemont) and found that the hourly maximum ozone concentrations of the Chiricahua site are comparable or higher than Green Valley site. Therefore, ADEQ approved the use of the Chiricahua dataset since it would likely provide a relatively conservative estimation for the 1-hour NO_2 impacts from the proposed sources. For a single missing hour, ADEQ used linear interpolations to fill in the missing concentrations based on the previous and subsequent hour concentrations. For multiple missing hours, ADEQ calculated the maximum ozone concentration for each diurnal hour for each month and use these hourly maximum concentrations to fill in their corresponding missing diurnal hours. ADEQ provided hourly ozone dataset to Rosemont for modeling.

G. Methodology for Ozone and Secondary $PM_{2.5}$ Impacts Analysis

Per Appendix W Section 5.3.2 and Section 5.4.2, the EPA recommends a two-tiered demonstration approach for addressing single-source impacts on ozone and secondary $PM_{2.5}$. The first tier involves use of technically credible relationships between precursor emissions and a source's impacts that may be published in the peer-reviewed literature; developed from modeling that was previously conducted for an area by a source, a governmental agency, or some other entity and that is deemed sufficient; or generated by a peer-reviewed reduced form model. The second tier involves application of more sophisticated case-specific chemical transport models (e.g., photochemical grid models) to be determined in consultation with the EPA Regional Office and conducted consistent with new EPA single-source modeling guidance. It is anticipated that the case for using a full quantitative chemical transport model is rare.

One of the first-tier demonstration tools is Model Emissions Rates for Precursors (MERPs). The MERPs can be described as an emission rate of a precursor that is expected to result in a change in ambient ozone (O_3) or fine particulate matter ($PM_{2.5}$) that would be less than a specific air quality concentration threshold such as a significant impact level (SIL). Basically, if the emission rates of precursors for a proposed source are less than MERPs, it is concluded that the proposed source (1) will not cause or contribute to a violation of the NAAQS for ozone or (2) the secondary formation of $PM_{2.5}$ from the proposed source will be insignificant. For $PM_{2.5}$, the SILs the EPA recommends are 0.2 $\mu g/m^3$ and 1.2 $\mu g/m^3$ for annual NAAQS and 24-hour NAAQS, respectively.[11] For the 8-hour ozone NAAQS, the EPA recommends a SIL value of 1.0 parts per billion (ppb). Moreover, the EPA issued a

[11] U.S. EPA. Draft Guidance on Significant Impact Levels (SILs) for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program. Stephen D. Page Memorandum dated August 24, 2016. Research Triangle Park, North Carolina 27711.

draft guidance on development of MERPs as a Tier l demonstration tool for Ozone and $PM_{2.5}$.[12] At this time, both the SIL guidance and MERP guidance have not been finalized.

Per the ADEQ's request, Rosemont performed ozone impacts and secondary $PM_{2.5}$ formation analysis using the following methods:

- Rosemont used technically credible relationships between precursor emissions and a source's impacts based on the 2005 Four Corners Air Quality Task Force (FCAQTF) 12/4 km modeling database and a 2006 12 km modeling database covering eastern Utah and western Colorado (UT-CO 12 km domain). It was appropriate to use the two existing modeling databases due to the similarity between the modeled sources in the oil and gas (O&G) modeling and the Rosemont sources, as well as the similarity of background environment between the O&G modeling area and the Rosemont project area. Rosemont compared the NOx and VOC emissions from the Rosemont project to those of the various O&G complexes modeled, along with the modeled ozone impact of each O&G complex, to demonstrate that ozone impacts from the Rosemont project will be below an interim 8-hour ozone significant impact level (SIL) of 1.0 ppb.

- In the EPA's MERP draft guidance, the EPA investigated single source impacts on ozone and secondary $PM_{2.5}$ formation from some hypothetical sources and provided most conservative illustrative MERP values for VOCs, NOx and SO_2 for western US. Rosemont incorporated the draft guidance in the ozone impacts and secondary $PM_{2.5}$ formation analysis.

- ADEQ has developed a streamlined methodology to address the secondary formation of $PM_{2.5}$ under the minor NSR program. This methodology uses the "offset ratios" approach established by the National Association of Clean Air Agencies (NACAA) $PM_{2.5}$ Workgroup. Rosemont incorporated this methodology in the secondary $PM_{2.5}$ formation analysis. Rosemont calculated the emission ratio of the total equivalent primary $PM_{2.5}$ emissions to the primary $PM_{2.5}$ emissions. Rosemont then estimated the total impact from primary $PM_{2.5}$ and secondarily formed $PM_{2.5}$ by multiplying the modeled concentration for primary $PM_{2.5}$ by such emission ratio.

H. Model Results

1. Modeled Results for PM_{10}, Primary $PM_{2.5}$, NO_2, SO_2 and CO.

Table 4 summaries the modeled results for PM_{10}, Primary $PM_{2.5}$, NO_2, SO_2 and CO. Representative background concentrations were added to modeled impacts and the total concentrations were then compared to the NAAQS. As shown in Table 4, emissions from the Rosemont project will not cause or contribute to a violation of the NAAQS under the operational limits/conditions as proposed in the draft permit. The AERMOD modeling analysis also revealed that the modeled design concentrations for all pollutants occurred within or near the ambient air boundary. Because PM_{10} is the primary pollutant of concern, ADEQ requires Rosemont to install and operate a PM_{10} monitor in the area, providing additional assurances that the project's operations are protective of NAAQS and public health.

[12] U.S. EPA. Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier l Demonstration Tool for Ozone and $PM_{2.5}$ under the PSD Permitting Program. Richard A. Wayland Memorandum dated December 2, 2016. Research Triangle Park, North Carolina 27711.

Table 4 Modeled Results for PM_{10}, Primary $PM_{2.5}$, NOx, SO_2 and CO

Pollutant	Averaging Period	Modeled Concentration ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Maximum Ambient Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
PM_{10}	24-hour	97.66	47.7	145.4	150
$PM_{2.5}$	24-hour	9.31	9.3	18.6	35
	Annual	2.91	3.2	6.11	12
NO_2	1-hour	127.5	26.3	153.8	188.6
	Annual	15.2	4.0	19.2	100
SO_2	1-hour	26.1	22.6	48.7	196
	Annual	0.03	3	3.03	80
CO	1-hour	1,711	582	2,293	40,000
	8-hour	277.6	582	859.6	10,000

2. Ozone Impacts

The 2005 FCAQTF modeling study shows that an O&G complex with NOx and VOC emissions on the order of 700-800 tons per year (tpy) resulted in 8-hour ozone impacts of approximately 1.2 ppb. The 2006 UT-CO modeling study shows that an O&G complex with NOx and VOC emissions, on the order of 100 tpy, resulted in 8-hour ozone impacts of approximately 0.1 ppb. The combined emission of NOx and VOC from the Rosemont Project is approximately 220 tpy. While the relationship between the combined emission of NOx and VOC emissions and the modeled ozone impact is not linear, modeled impacts generally increase with increases in emissions.

The EPA's MERPs draft guidance provides most conservative illustrative MERP values by precursor, pollutant and region. For Western US, the lowest MERPs for NOx and VOC are 184 tpy and 1,049 tpy, respectively. However, the lowest MERP of 184 tpy for NOx was based on the model results for a hypothetical 90-m stack that was located in North Dakota. The EPA modeled two hypothetical sources with a ground-level release in Arizona (one was located in Gila and the other in LA PAZ), which may be more be representative of Rosemont. These hypothetical sources have source derived NOx MERPs of 406.5 tpy and 213.7 tpy, respectively, which are larger or comparable to the Rosemont's proposed emission of 220.5 tpy.

Based on the modeled results of the O&G modeling and the EPA's MERP modeling, it is appropriate to conclude that the 8-hour ozone impacts due to the emissions from the Rosemont project would be below the SIL of 1.0 ppb.

3. Secondary $PM_{2.5}$ Formation

Based the "offset ratio" approach as discussed in **G**, the total $PM_{2.5}$ 24-hour and annual modeled impacts (taking both primary $PM_{2.5}$ and secondarily formed $PM_{2.5}$ into account) from the Rosemont project were calculated to be 9.46 $\mu g/m^3$ and 2.96 $\mu g/m^3$, respectively. By adding the background concentrations to the modeled impacts, the total $PM_{2.5}$ 24-hour and annual concentrations were determined to be below the NAAQS.

For Western US, the lowest MERPs for NOx and SO_2 derived based on a critical daily $PM_{2.5}$ threshold of 1.2 $\mu g/m^3$ are 1,155 tpy and 225 tpy, respectively. The lowest MERPs for NOx and SO_2 derived based on a critical annual $PM_{2.5}$ threshold of 1.2 $\mu g/m^3$ are 3,184 tpy and 2,289 tpy, respectively. Both the proposed NOx and SO_2 emissions from the Rosemont project are well below the lowest $PM_{2.5}$ MERP value. Therefore, the potential contribution from secondary formation of $PM_{2.5}$ due to the emissions from the Rosemont project is expected to be insignificant.

XI. LIST OF ABBREVIATIONS

AAB .... Ambient Air Boundary
A.A.C. .... Arizona Administrative Code
ADEQ .... Arizona Department of Environmental Quality
AERMAP .... Terrain data preprocessor for AERMOD
AERMET .... Meteorological data preprocessor for AERMOD
AERMOD .... American Meteorological Society/EPA Regulatory Model
AERSURFACE .... Surface characteristics preprocessor for AERMOD
ANFO .... Ammonium Nitrate/Fuel Oil
AQD .... Air Quality Division
BPIP .... Building Profile Input Program
Btu/ft^3 .... British Thermal Units per Cubic Foot
CASTNET .... Clean Air Status and Trends Network
CO .... Carbon Monoxide
CO_2 .... Carbon Dioxide
ft .... Feet
g .... Grams
GEP .... Good Engineering Practice
HAP .... Hazardous Air Pollutant
hp .... Horsepower
hr .... Hour
IC .... Internal Combustion
IMPROVE .... Interagency Monitoring of Protected Visual Environments
ISR .... In-Stack Ratio
MERP .... Model Emissions Rates for Precursors
MMBtu .... Million British Thermal Units

$\mu g/m^3$ .... Microgram per Cubic Meter
NAAQS .... National Ambient Air Quality Standard
NED .... National Elevation Dataset
NO_x .... Nitrogen Oxide
NO_2 .... Nitrogen Dioxide
NWS .... National Weather Service
OLM .... Ozone Limiting Method
O_3 .... Ozone
PRIME .... Plume Rise Model Enhancements
PVMRM .... Plume Volume Molar Ratio Method
Pb .... Lead
PM .... Particulate Matter
PM_{10} .... Particulate Matter Nominally less than 10 Micrometers
PTE .... Potential-to-Emit
SIL .... Significant Impact Level
SO_2 .... Sulfur Dioxide
TPY .... Tons per Year
TSP .... Total Suspended Particulate
VOC .... Volatile Organic Compound
yr .... Year