CLASS I SIGNIFICANT PERMIT REVISION

El Paso Natural Gas Company, L.L.C. – Vail Compressor Station

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8. AIR DISPERSION MODELING ANALYSIS

As part of the PSD review process, the completion of an air quality dispersion modeling analysis is required to demonstrate that potential impacts from the proposed project will not:

- Cause or contribute to a violation of any applicable NAAQS;
- Exceed a PSD increment; or
- Significantly affect Air Quality Related Values (AQRV) and visibility in Class I areas.

This section describes the air quality dispersion modeling methodologies for the PSD review process. This section is prepared in accordance with Appendix W of the Guideline on Air Quality Models (Revised)[24], Air Dispersion Modeling Guidelines for Arizona Air Quality Permits[25], Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report – Revised (referenced herein as FLAG 2010),[26] and Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report (referenced herein as IWAQM Phase 2)[27]. The modeling analysis is performed in the following two steps:

- Step 1 – A significant impact analysis, and if required;
- Step 2 – A full impact analysis.

8.1. MODEL OVERVIEW

This section contains a description of the model, meteorological data, terrain data, building wake effects, and receptors that used in the air dispersion modeling analysis.

8.1.1. Dispersion Model Selection

The U.S. EPA American Meteorological Society / Environmental Protection Agency Regulatory Model (AERMOD) model includes a state-of-the-science downwash algorithm and utilizes AERMET, a meteorological data preprocessor that utilizes current planetary boundary layer (PBL) theory to calculate the dispersion coefficients (σ_y and σ_z).[28] The most current version of the AERMOD model (version 19191) was used in conducting the modeling analysis. The modeling was performed using the regulatory default option, which includes the following:

- Stack-tip downwash; and
- A routine for processing averages when calm wind conditions occur or when meteorological data is missing.

[24] U.S. EPA, 40 CFR Part 51, Appendix W, January 17, 2017.

[25] Arizona Department of Environmental Quality, Air Dispersion Modeling Guidelines for Arizona Air Quality Permits, November 1, 2019.

[26] U.S. Forest Service, National Park Service, and U.S. Fish and Wildlife Service, Federal Land Managers' Air Quality Related Values Work Group (FLAG) Phase I report – Revised (2010). National Resource Report NPS/NRPC/NRR-2010/232. National Park Service, Denver, Colorado. November 2010.

[27] EPA, IWAQM Phase 2 Summary Report and Recommendations for Modeling Long-Range Transport Impacts, Research Triangle Park, North Carolina, EPA-454/R-95-006, 1995.

[28] U.S. EPA, User's Guide for the AMS/EPA Regulatory Model-AERMOD, September 2004.

8.1.2. Meteorological Data

EPA modeling guidance allows the use of five years of off-site meteorological data or at least one year of on-site meteorological data. EPNG utilized ADEQ model-ready data developed from five years of surface and upper air meteorological data from the Tucson International Airport (station identifier KTUS). This data was processed by ADEQ using the most recent version of EPA's AERMET (Version 19191) and used in this modeling demonstration. ADEQ has Quality Assured the data to ensure it meets EPA guidance that a meteorological database "*must be 90 percent complete (before substitution) in order to be acceptable for use in regulatory dispersion modeling*" and "*The 90 percent requirement applies on a quarterly basis such that 4 consecutive quarters with 90 percent recovery are required for an acceptable one-year data base.*"[29]

8.1.3. Terrain

The terrain elevation for each modeled receptor, building, and source was determined using the USGS National Elevation Dataset (NED). Specifically, the USGS NED 1/3 arc second (approximately 10-meter resolution) was used.

The terrain height for each modeled receptor was calculated using the AERMOD terrain processor (AERMAP version 18081). In addition to terrain elevation, an additional parameter called the hill height scale is required for each receptor to execute AERMOD's terrain modeling algorithms. AERMOD computes the impact at a receptor as a weighted interpolation between horizontal and terrain-following states using a critical dividing streamline approach. This scheme assumes that part of the plume mass will have enough energy to ascend and traverse over a terrain feature and the remainder will impinge and traverse around a terrain feature under certain meteorological conditions. The hill height scale was computed by the AERMAP terrain preprocessor for each receptor as a measure of the one terrain feature in the modeling domain that would have the greatest effect on plume behavior at that receptor.

The hill height scale does not represent the critical dividing streamline height itself but supplies the computational algorithms with an indication of the relative relief within the modeling domain for the determination of the critical dividing streamline height for each hour of meteorological data.

According to Section 2.2.1 of the AERMOD Users Guide, the NED array boundary for AERMAP must include all terrain features that exceed a 10 percent elevation slope from any given receptor to properly calculate the hill height scale at each receptor.[30] The domain for the hill height analysis was set to the minimum coverage required for proper handling of elevation slope.

8.1.4. Building Wake Effects (Downwash)

The emission sources considered in this analysis were evaluated in terms of their proximity to nearby structures. The purpose of this evaluation is to determine if stack discharge might become caught in the turbulent wakes of these structures. Wind blowing around a building creates zones of turbulence that are greater than if the building was absent. Plumes entrained in the zones of turbulence experience enhanced plume growth and restricted plume rise. AERMOD incorporates the Plume Rise Model Enhancements (PRIME) algorithms using dimensions from the EPA's Building Profile Input Program (BPIP) for estimating for plumes affected by building wakes. The site layout was used to digitize buildings and structures to be included in the downwash analysis.

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[29] EPA, 2000: Meteorological Monitoring Guidance for Regulatory Modeling Applications. U.S. Environmental Protection Agency, Research Triangle Park, NC.
[30] U.S. Environmental Protection Agency, User's Guide for the AMS/EPA Regulatory Model – AERMOD, Research Triangle Park, North Carolina, EPA-454/B-03-001, September, 2004.

Direction-specific building dimensions and the dominant downwash structure parameters was determined using the *BREEZE*® BPIPP software, developed by Trinity Consultants, Inc. This software incorporates the algorithms of the U.S. EPA-sanctioned Building Profile Input Program with PRIME enhancement (BPIP-PRIME), version 04274.[31]

8.1.5. Receptor Grid

8.1.5.1. Class II Receptor Grid

Four receptor grids will be used covering a region that extends 50 km beyond the facility fence line. Note that all receptor coordinates were established using the UTM NAD83 coordinate system. The primary receptor grids will include the following:[32]

1. The "fence line grid" is a discrete receptor grid with the receptors spaced at 25-meter intervals along the fence line.
2. The "fine grid" contains 100-meter spaced receptors extending approximately 1 km from the fence line, excluding the receptors within the fence line.
3. The "medium grid" contains 500-meter spaced receptors extending from 1 km to 5 km from the fence line.
4. The "coarse grid" contains 1,000-meter spaced receptors extending from 5 km to 50 km from the fence line.

The receptor grid elevations and scaling heights were calculated using AERMAP based on USGS NED 1/3 arc second data files.

8.1.5.2. Class I Receptor Grid

Various Class I areas are located within 300 km from EPNG, with Saguaro Wilderness East and West located within 50 km of the facility. For Saguaro Wilderness East and West, the Class I area receptors developed by the NPS were used in the Class I area modeling analysis. As discussed in other parts of this report, the determination of impacts outside 50 km from the facility is not expected to be required.

8.1.6. Land Use Classification

As depicted in Figure 3-2, the Facility is located in an area with desert shrub land and agricultural as the dominant land cover. EPA guidance provides two procedures to determine whether the character of an area is predominantly urban or rural. One procedure is based on land-use typing and the other is based on population density. Both procedures require an evaluation of characteristics within a 3-km radius from a source. The land-use typing method is based on the work of August Auer and is preferred because it is more directly related to the surface characteristics of the evaluated area that affect dispersion rates.[33] The Auer land-use approach considers four primary land-use types: Industrial (I), Commercial (C), Residential (R), and Agricultural (A). Within these primary types, subtypes are identified in Table 8-1.

[31] U S. Environmental Protection Agency, User's Guide to the Building Profile Input Program, Research Triangle Park, NC, EPA-454/R-93-038.
[32] Per ADEQ, Air Dispersion Modeling Guidelines for Arizona Air Quality Permits, November 1, 2019.
[33] Per J. Appl. Meteor., Correlation of Land Use and Cover with Meteorological Anomalies, August Auer Jr., 1978.

Table 8-1. Vail Compressor Station – Land Use Types and Corresponding Dispersion Classification *

Type	Description	Class
I1	Heavy industrial	Urban
I2	Light/Moderate Industrial	Urban
C1	Commercial	Urban
R1	Common Residential (Normal Easements)	Rural
R2	Compact Residential (Single-Family)	Urban
R3	Compact Residential (Multi-Family)	Urban
R4	Estate Residential (Multi-Acre)	Rural
A1	Metropolitan Natural	Rural
A2	Agricultural	Rural
A3	Undeveloped (Grass/Weeds)	Rural
A4	Undeveloped (Heavily Wooded)	Rural
A5	Water Surfaces	Rural

* Per ADEQ, Air Dispersion Modeling Guidelines for Arizona Air Quality Permits, November 1, 2019.

EPNG conducted a land cover analysis using the draft version of the EPA AERSURFACE model (version 19039) within 3-km radius from the facility. The draft version of AERSURFACE was used so that more recent 2011 land use data could be used. AERSURFACE provides a tally of the number of land cover grid cells for land cover categories that are present in the area of interest. Table 8-2 contains the results from the AERSURFACE model for the number of different land cover categories encountered in the 3-km analysis area. In addition, in Table 8-2, a classification of "rural" or "urban" was assigned to the land cover categories based on Table 8-1. As contained in Table 8-2, almost 92% of land within 3 km from EPNG is considered "rural." Therefore, because the land use classification is over 50% rural, the urban dispersion coefficient will not be applied.

Table 8-2. Vail Compressor Station – Land Cover Analysis

Category No.	Category Description	Class	Counts	% of Total
0	Missing, Out-of-Bounds, or Undefined:	Unclassified	0	0.00%
11	Open Water:	Rural	0	0.00%
12	Perennial Ice/Snow:	Rural	0	0.00%
21	Developed, Open Space	Urban	1143	3.64%
22	Developed, Low Intensity	Urban	818	2.60%
23	Developed, Medium Intensity	Urban	453	1.44%
24	Developed, High Intensity	Urban	218	0.69%
31	Bare Rock/Sand/Clay:	Rural	289	0.92%
32	Unconsolidated Shore	Rural	0	0.00%
41	Deciduous Forest:	Rural	0	0.00%
42	Evergreen Forest:	Rural	0	0.00%
43	Mixed Forest:	Rural	0	0.00%
51	Dwarf Shrub land:	Rural	0	0.00%
52	Shrub/Scrub	Rural	28,122	89.51%
71	Grasslands/Herbaceous:	Rural	373	1.19%
72	Sedge/Herbaceous	Rural	0	0.00%
73	Lichens	Rural	0	0.00%
74	Moss	Rural	0	0.00%
81	Pasture/Hay:	Rural	0	0.00%
82	Cultivated Crops:	Rural	0	0.00%
90	Woody Wetlands:	Rural	0	0.00%
91	Palustrine Forested Wetland	Rural	0	0.00%
92	Palustrine Scrub/Shrub Wetland	Rural	0	0.00%
93	Estuarine Forested Wetland	Rural	0	0.00%
94	Estuarine scrub/Shrub Wetland	Rural	0	0.00%
95	Emergent Herbaceous Wetland	Rural	0	0.00%
96	Palustrine Emergent Wetland	Rural	0	0.00%
97	Estuarine Emergent Wetland	Rural	0	0.00%
98	Palustrine Aquatic Bed	Rural	0	0.00%
99	Estuarine Aquatic Bed	Rural	0	0.00%
Total – Counts			***31,416***	**-**
Percentage – Rural			**-**	***91.62%***
Percentage – Urban			**-**	***8.38%***

8.1.7. Considerations for 1-hour NO_2 Modeling

The EPA's memorandums dated June 28, 2010 and March 1, 2011[34, 35] recommended the following three-tiered approach for 1-hour NO_2 modeling:

- Tier 1 Total Conversion - assuming full conversion of NO to NO_2 without any additional justification.
- Tier 2 Ambient Ratio Method 2 (ARM2) - multiply Tier 1 result by empirically-derived NO_2/NO_x ratio, with 0.8 as default ambient ratio for the 1-hour NO_2 standard without additional justification.

[34] U.S. EPA, Applicability of Appendix W Modeling Guidance for the 1-hour NO2 National Ambient Air Quality Standard, Research Triangle Park, North Carolina 27711, June 28, 2010.
[35] U.S. EPA, Additional Clarification Regarding the Application of Appendix W Modeling Guidance for the 1-hour NO2 National Ambient Air Quality Standard, Research Triangle Park, North Carolina 27711, March 1, 2011.

- Tier 3 - Plume Volume Molar Ratio Method (PVMRM)/ Ozone Limiting Method (OLM) - the two approaches are available as non-regulatory-default options within the AERMOD model.

In this modeling analysis, EPNG utilized the Tier 3 approach using the PVMRM algorithm. The PVMRM accounts for ambient conversion of NO to NO_2 in the presence of ozone, namely the ozone titration mechanism. The ozone background data for use in the analysis was obtained from the Fairground monitor in southeast Tucson (AQS site ID 04-019-1020), for the period from 2014 through 2018, due to its close proximity to the Vail Compressor Station. Any missing ozone background data was substituted using the maximum monthly/hourly value over the 5 year period.[36]

Modeling for the facility was conducted using an in-stack NO_2/NO_x ratio (ISR) of 0.5 for the emergency generator per EPA guidance.[37] An ISR of 0.124 was used for the turbines based on the analysis contained in Table 8-3. EPNG evaluated ISR data from four databases: EPA's Formal Database[38], EPA's Alpha Database[39], the database published by the Alaska Department of Environmental Conservation (DEC)[40], and the database published by the San Joaquin Valley Air Pollution Control District.[41] For sources categorized as turbines, there were two entries with a horsepower rating within 1,000 hp of the EPNG units. Of these two, the Solar Centaur Turbine with SoLoNOx controls listed in the Alaska DEC database had a lower ISR value and an older test date. Therefore, EPNG applied the ISR from the Solar Centaur T-4702 turbine as listed in the EPA Alpha Database. Note that the database lists three ISR values for this turbine; EPNG conservatively applied the largest ISR of the three from this source.

Table 8-3. Vail Compressor Station – Turbines ISR

Parameter	Vail Compressor Station	Selected ISR [1]
Manufacturer	General Electric	Solar
Max. Output (hp)	5,290	4,400
Fuel Type	Natural Gas	Natural Gas
ISR		0.124

[1] Per EPA Alpha Database (https://www3.epa.gov/scram001/no2_isr_Database.htm)

8.1.8. Background Concentration

A "representative" background concentration is required for each modeled pollutant and averaging period to complete the NAAQS modeling analysis. In this modeling analysis NAAQS is only required for the NO_2 1-hour averaging period. The background concentration accounts for sources of air pollution other than those explicitly modeled (i.e., the facility and the industrial neighbors identified to represent the nearby inventory sources). Typically, background concentrations are accounted for by using air quality data measured at an appropriate monitoring station.

[36] EPA, Technical Support Document (TSD) for NO2 - related AERMOD modifications, EPA- 454/B-15-004, July 2015.
[37] U.S. EPA, Additional Clarification Regarding the Application of Appendix W Modeling Guidance for the 1-hour NO2 National Ambient Air Quality Standard, Research Triangle Park, North Carolina 27711, March 1, 2011.
[38] Located at https://www3.epa.gov/ttn/scram/guidance/guide/NO2_ISR_database.xlsx
[39] Located at https://www3.epa.gov/ttn/scram/guidance/guide/NO2_ISR_alpha_database.xlsx
[40] Located at https://dec.alaska.gov/media/10228/no2-nox-instack-ratios-from-source-tests-082313.xlsx
[41] Located at http://www.valleyair.org/busind/pto/tox_resources/CAPCOANO2GuidanceDocument10-27-11.pdf

Appendix W of 40 CFR Part 50 discusses requirements for obtaining representative background concentrations. Specifically, "air quality data should be used to establish background concentrations in the vicinity of the source(s) under consideration". Based on this, the NO_2 background concentration was determined from the 3 most recent years of complete data collected at the 22nd & Craycroft monitor, 10.3 miles from the facility. This monitor is representative of the actual background concentration at the facility due to its close proximity to the site along with its similar climatology and elevation. A summary of the monitor's yearly background data is contained in Table 8-4. The complete evaluation of background concentrations is contained in Appendix G.

Table 8-4. Vail Compressor Station – Representative Background Concentrations

Pollutant	Averaging Period	Site Name	Distance to the Vail Compressor Station (miles)	Year	Percent Complete [1]	Concentration Format	Concentration (µg/m³) [1]	
							Actual	Selected
NO_2	1-hr	22nd & Craycroft	10.3	2016	97	98th Percentile	63.0	70.2
				2017	100		70.3	
				2018	100		77.5	

[1] Background concentrations obtained from EPA's AirData Air Quality Monitors.

Actual values are converted to µg/m³ with the following conversion 1 ppb = 1.88 µg/m³.

8.1.9. Impact Analysis for Class I Area

Class I areas are federally protected areas for which more stringent air quality standards apply. Class I areas are generally defined as federal lands such as national parks (NP), national wilderness areas, and national monuments. There are ten (10) Class I areas within 300 km of the facility location. A list of these Class I areas, approximate distance of each area from the facility, and the responsible Federal Land Manager (FLM) for each area is contained in Table 8-4. Figure 8-1 depicts various Class I areas and their distances from the facility. The following two principal air quality impacts are considered for Class I areas within 300 km of the EPNG Vail Compressor Station. In this case, emissions of NO_x and the resulting NO_2 impacts are the only relevant PSD triggering pollutants for the Class I area analyses.

- Assessment of the proposed project's emissions impacts on air quality related values (AQRV); and
- PSD increment analysis for the Class I areas for pollutants greater than the applicable SERs and for which a PSD increment exists.

Table 8-4. Vail Compressor Station – Class I Areas within 300 km

Name	Distance of Closest Point to EPNG (km)	Federal Land Manager
Saguaro National Park East	11.4	U.S. National Park Service
Saguaro National Park West	32.1	U.S. National Park Service
Galiuro Wilderness	62.3	U.S. Forest Service
Chiricahua Wilderness	130.7	U.S. Forest Service
Chiricahua NM	135.5	U.S. National Park Service
Superstition Wilderness	150.4	U.S. Forest Service
Sierra Ancha Wilderness	188.0	U.S. Forest Service
Mazatzal Wilderness	213.6	U.S. Forest Service
Mount Baldy Wilderness	241.5	U.S. Forest Service
Pine Mountain Wilderness	259.0	U.S. Forest Service

Figure 8-1. Vail Compressor Station - Class I Areas within 300 km

8.2. EMISSIONS MODELED & SOURCE CHARACTERIZATION

The following sections discuss the source inventory for the modeling analysis, including the source characterization, parameters, and emission rates to be included in the modeling demonstration.

8.2.1. EPNG Sources

The source characterization and emissions modeled for all NO_x and CO emission sources at the facility are detailed below.

8.2.1.1. Source Characterization

Table 8-5 contains a summary of the facility emission sources that evaluated in this modeling demonstration. The facility does not operate any other emission sources. The emission sources were modeled as point sources with the appropriate stack parameters.

Table 8-5. Vail Compressor Station – Model Emission Sources & Stack Parameters

Emission		Exhaust Height		Exhaust Diameter		Exhaust Velocity		Exhaust Temperature	
Model ID	Unit	(ft)	(m)	(ft)	(m)	(ft/sec)	(m/sec)	(deg F)	(deg K)
A1	Turbine A-1	51	15.54	6	1.83	99.47	30.32	550	560.93
A2	Turbine A-2	51	15.54	6	1.83	99.47	30.32	550	560.93
A3	Turbine A-3	51	15.54	6	1.83	99.47	30.32	550	560.93
GENSET	eGen Aux-1	8.06	2.46	0.5	0.15	404.72	123.36	898	754.26

8.2.1.2. Emissions Modeled

The post-project PTE for site-wide sources, as contained in Appendix B, were modeled. As summarized in Table 8-6, hourly emission rates were used to develop the short term modeled concentrations (including 1-hour and 8-hour), and annual emission rates were used to develop the annual modeled concentrations.

Per EPA guidance[42], the emergency generator can be considered an "intermittent" emission source. The ADEQ allows such sources to be excluded from the 1-hour NO_2 NAAQS modeling evaluations, if they meet the following criteria:[43]

- Any intermittent units that operate no more than 200 hours per year;
- Emergency generators that operate up to 500 hours per year and no more than 100 hours per year for maintenance and readiness testing purposes; and
- Infrequent startup/shutdown operations.

Per ADEQ guidance, because the emergency generator operates up to 500 hours per year and no more than 100 hours per year for maintenance and readiness testing purposes, it is classified as an intermittent source. Therefore, NO_2 model impacts for the emergency generator are based on annualized hourly emission rate rather than the maximum hourly emission rate. Specifically, the

[42] EPA memo "Additional Clarification Regarding the Application of Appendix W Modeling Guidance for the 1-hour NO2 National Ambient Air Quality Standard," March 1, 2011.
[43] Per Arizona Department of Environmental Quality, Air Dispersion Modeling Guidelines for Arizona Air Quality Permits, November 1, 2019.

annualized emission rate is based on the ratio of operating hours to hours in a year, or 500 hours out of 8,760 hours.

Table 8-6. Vail Compressor Station – Model Emission Rates

Source		Significant Impact/NAAQS Analysis						
		CO Emissions Short-Term		NO_2 Emissions				
				Short-Term			Annual	
Model ID	Unit	(lb/hr)	(g/sec)	Calculated	Modeled	(g/sec)	(tpy)	(g/sec)
A1	Turbine A-1	13.15	1.66	41.25	41.25	5.20	180.68	5.20
A2	Turbine A-2	13.15	1.66	41.25	41.25	5.20	180.68	5.20
A3	Turbine A-3	13.15	1.66	41.25	41.25	5.20	180.68	5.20
GENSET	eGen Aux-1	5.79	0.73	2.65	0.15	0.02	0.66	0.02

8.2.1.3. Determination of Worst-Case Combination

As noted in other parts of this application, only two of the turbine units will operate simultaneously at any given time. Therefore, an analysis was completed to evaluate the different combinations of turbines that can operate at any time and determine the worst-case combination for modeling impacts purposes. For purposes of this evaluation, the source parameters in Table 8-5 were considered with a unit emission rate of one gram/second (1 g/sec). The results of the unit run analysis are contained in Table 8-7a to Table 8-7d.

A unit run for NO_2 1-hour is modeled with the concatenated 2014-2018 met data set. As shown, the Units A-1 and A-2 combination is the worst-case scenario for the 1-hour averaging period with this data set. Therefore, for NO_2 1-hour modeling, the turbine combination is the simultaneous operation of Units A-1 and A-2.

For CO short-term modeling, the Units A-1 and A-2 combination has the worst overall result for both the 1-hour averaging period (2014) and 8-hour averaging period (2017). Therefore, for CO short-term modeling, the turbine combination is the simultaneous operation of Units A-1 and A-2.

For NO_2 annual modeling, the Units A-1 and A-2 combination is the worst-case scenario for each of the five years of met data. Therefore, for NO_2 annual modeling, the turbine combination is the simultaneous operation of Units A-1 and A-2.

The major conclusion drawn from the unit run is that the difference in model results between each turbine combinations for any given averaging period and met data year is minimal, often on the order of a hundredth of a $\mu g/m^3$ or smaller. Therefore, the turbine combination modeled makes a marginal difference in the conclusion of the analysis.

Table 8-7a. Vail Compressor Station – Determination of Worst-Case Combination- 1hr NO_2

1-hr Averaging Period Modeled Concentrations				
Model Year	**A-1 & A-2**	**A-1 & A-3**	**A-2 & A-3**	**Max**
2014-2018	381.090	381.088	381.088	A-1 & A-2

Table 8-8b. Vail Compressor Station – Determination of Worst-Case Combination – 1-hr CO

1-hr CO Averaging Period Modeled Concentrations				
Model Year	**A-1 & A-2**	**A-1 & A-3**	**A-2 & A-3**	**Max**
2014	375.13	375.13	375.14	A-2 & A-3
2015	381.090	381.088	381.088	A-1 & A-2
2016	353.849	353.848	353.848	A-1 & A-2
2017	376.107	376.105	376.104	A-1 & A-2
2018	380.1291	380.1285	380.1288	A-1 & A-2

Table 8-9c. Vail Compressor Station – Determination of Worst-Case Combination – 8-hr CO

8-hr CO Averaging Period Modeled Concentrations				
Model Year	**A-1 & A-2**	**A-1 & A-3**	**A-2 & A-3**	**Max**
2014	85.396	85.397	85.399	A-2 & A-3
2015	123.845	123.846	123.847	A-2 & A-3
2016	93.218	93.2186	93.2194	A-2 & A-3
2017	129.56784	129.5676	129.56779	A-1 & A-2
2018	99.85	99.85	99.86	A-2 & A-3

Table 8-10d. Vail Compressor Station – Determination of Worst-Case Combination – Annual NO_2

Annual Averaging Period Modeled Concentrations				
Model Year	**A-1 & A-2**	**A-1 & A-3**	**A-2 & A-3**	**Max**
2014	10.6091	10.6085	10.6013	A-1 & A-2
2015	9.151	9.149	9.139	A-1 & A-2
2016	9.330	9.329	9.324	A-1 & A-2
2017	10.91	10.90	10.89	A-1 & A-2
2018	11.1165	11.1157	11.1025	A-1 & A-2

8.2.2. Off-Site Emissions Inventory

A Full Impact Analysis was performed for emissions of NO_x; therefore, in accordance with EPA modeling guidelines, off-site sources were evaluated. EPNG submitted a public records request to PDEQ for data on NO_x emission sources within 50 km of the facility. PDEQ provided the NO_x inventory data, and also provided separately NO_x emission data on hot mix asphalt plants within 50 km of the facility. Additionally, per discussions at the October 31, 2019 pre-application meeting with PDEQ and EPA, the Full Impact Analysis included recently permitted NO_x emissions from reciprocating internal combustion engines (RICE) at Tucson Electric Power Company's (TEP) Irvington Generating Station (IGS). Note that the IGS permit indicates selective catalytic reduction (SCR) NO_x emissions control will be applied to the RICE sources, but the NO_x emission rate listed in the IGS permit did not account for this emissions control. Therefore, to avoid over-conservatism in the modeling analysis, a conservative SCR NO_x control efficiency of 70% is applied. This is conservative because 70% is the lowest NO_x control efficiency for SCR operation per EPA guidance[44]. The inventory data was then formatted for compatibility with the AERMOD model. Note that for any source with a missing stack parameter, conservative default values were used, such as one-foot release heat and 0.003 fps stack exit velocity. A summary of the off-site NO_x inventory is contained in Table 8-11.

8.3. MODELING APPROACH & RESULTS

8.3.1. Significant Impact Analysis

In the significant impact analysis, only project sources are modeled to determine if the proposed emission changes have a significant impact on the surrounding areas. The threshold for a significant impact is established through significant impact levels (SILs). The maximum modeled concentrations from the significant impact analysis are compared to the applicable SIL for each pollutant and averaging period undergoing analysis.[45] If the maximum modeled concentration is less than the SIL, no further analysis is required to demonstrate compliance with the NAAQS or PSD Increment. For any location where the maximum modeled concentration exceeds the applicable SIL, a full impact analysis must be completed. For Class I areas located more than 50 km from the facility (e.g., Chiricahua Wilderness and others), impacts at the boundary of the model (i.e., 50 km from the facility) were compared with Class I area SILs. If the concentration at the modeling boundary is less than the SIL, no further analysis will be required for Class I areas greater than 50 km distance from the source. Table 8-8 summarizes the applicable SILs and model results for each modeled pollutant. Based on the results presented below, the only pollutant proceeding to a Full Impact Analysis is NO_2 for the 1-hr averaging period.

[44] Per EPA Air Pollution Control Technology Fact Sheet, Selective Catalytic Reduction (SCR), EPA-452/F-03-032.

[45] Significant Impact Levels per ADEQ, Air Dispersion Modeling Guidelines for Arizona Air Quality Permits, November 1, 2019.

Table 8-11. Vail Compressor Station – Significant Impact Levels & Results

Pollutant	Averaging Period	Design Concentration	Significant Impact Level (µg/m³)		Significant Impact Analysis Results (µg/m³)		
			Class I	Class II	Model Year	Class I	Class II
NO_2	1-hour	H1H	-	7.5	2014 - 2018	-	40.61
	Annual	H1H	0.1	1	2014	0.01	0.91
					2015	0.04	0.72
					2016	0.01	0.85
					2017	0.01	0.88
					2018	0.01	0.81
CO	1-hour	H1H	-	2,000	2014	-	420.16
					2015	-	426.85
					2016	-	396.34
					2017	-	421.27
					2018	-	425.77
	8-hour	H1H	-	500	2014	-	95.72
					2015	-	138.71
					2016	-	104.41
					2017	-	145.13
					2018	-	111.86

8.3.2. Full Impact Analysis

Because project CO and annual NO_2 impacts were under the SIL, only 1-hour NO_2 impacts required consideration under the Full Impact Analysis. A significant impact area (SIA, or area in which project impacts exceeded the SIL) was defined for 1-hour NO_2. Therefore, the analysis was completed at receptors where impacts from the Significant Impact Analysis are above the SIL. The full impact analysis also considered post-project facility-wide emissions (i.e., not just the project sources) as well as off-site NO_x emissions inventory within 50 km of the facility, as detailed in Section 8.2.2 and summarized in Table 8-11. The modeled H8H impacts from site-wide and off-site emission sources were added to the background concentrations detailed in Section 8.1.8. The overall impact is compared to the appropriate NAAQS, as applicable, in Table 8-9. The results of the analysis demonstrate that the project will not cause or contribute to a violation of any applicable NAAQS.

Table 8-12. Vail Compressor Station – NAAQS and PSD Increment Results

Pollutant	Averaging Period	Design Concentration	NAAQS (µg/m³)	NAAQS Analysis Results (µg/m³)	PSD Increment (µg/m³)		PSD Increment Results (µg/m³)	
					Class I	Class II	Class I	Class II
NO_2	1-hour	H8H	188	96.05 [2]	-	-	-	-
	Annual	H1H	100	N/A [1]	2.5	25	N/A [1]	N/A [1]
CO	1-hour	H2H	40,000	N/A [1]	-	-	-	-
	8-hour	H2H	10,000	N/A [1]	-	-	-	-

[1] Project impacts less than SIL.

[2] Based on maximum modeled concentration of 25.85 µg/m³ as well as background concentration of 70.2 µg/m³.

8.3.3. Pre-Construction Monitoring Analysis

As part of a PSD modeling analysis, a pre-construction monitoring analysis must be performed to determine whether preconstruction monitoring may be required to evaluate existing air quality before the permit is issued. The U.S. EPA's Significant Monitoring Concentrations (SMC) establish the levels at which a facility may need to conduct pre-construction ambient air quality monitoring for pollutants subject to PSD review in order to evaluate the existing air quality. The SMCs are compared to the Significant Impact Analysis results for NO_2 and CO in Table 8-10 below. As shown, the maximum impacts did not exceed the corresponding SMC, and pre-construction monitoring is not required.

Table 8-13. Vail Compressor Station – Significant Monitoring Concentrations & Results

Pollutant	Averaging Period	SMC (µg/m³)	SMC Results (µg/m³)
NO_2	1-hour	-	-
	Annual	14	0.65
CO	1-hour	-	-
	8-hour	575	85.77

Table 8-14. Vail Compressor Station – NAAQS Off-Site Inventory

Source	Model ID	UTM Location (m)		Distance to EPNG Vail (km)	NO_x Emission Rates (tpy)	Q/d	Source Modeled?	Exhaust Height (ft)	Exhaust Temp. (deg F)	Exhaust Velocity (fps)	Exhaust Diameter (ft)
		East	North								
Granite Construction - Swan Road	5	510,989	3,549,248	7.10	47.97	6.76	Yes	16	213	81.55	3.26
Los Reales Landfill	40	511,399	3,553,697	8.80	1.40	0.16	Yes	35.9	681.0	33.1	2.90
Vulcan Asphalt - Black Angus	7	524,405	3,555,491	10.04	86.00	8.57	Yes	1	215.0	0.003	2.73
Raytheon	33	506,879	3,550,929	11.49	8.41	0.73	Yes	27.1	182.0	32.4	1.40
Raytheon	26	505,775	3,551,791	12.80	7.38	0.58	Yes	27.1	182.0	32.4	1.40
Raytheon	25	505,669	3,551,946	12.95	2.40	0.19	Yes	27.1	182.0	32.4	1.40
Raytheon	21	505,603	3,551,782	12.96	1.70	0.13	Yes	27.1	182.0	32.4	1.40
Davis-Monthan AFB AZ	34	511,015	3,558,882	13.06	27.19	2.08	Yes	35.6	313.0	31.4	2.30
Raytheon	24	505,547	3,552,332	13.19	1.15	0.09	Yes	27.1	182.0	32.4	1.40
TEP IGS	1	509,448	3,557,910	13.20		-	Yes	160.0	628.7	95.1	7.40
TEP IGS	2	509,448	3,557,910	13.20		-	Yes	160.0	628.7	95.10	7.40
TEP IGS	3	509,448	3,557,910	13.20		-	Yes	160.0	576.6	84.61	9.10
TEP IGS	4	509,448	3,557,910	13.20		-	Yes	160.0	576.6	84.61	9.10
Raytheon	20	505,488	3,552,237	13.22	1.77	0.13	Yes	27.1	182.0	32.35	1.40
Raytheon	22	505,460	3,552,172	13.22	1.85	0.14	Yes	27.1	182.0	32.35	1.40
Raytheon	27	505,336	3,552,017	13.29	1.06	0.08	Yes	27.1	182.0	32.35	1.40
Raytheon	23	505,373	3,552,175	13.31	0.83	0.06	Yes	27.1	182.0	32.35	1.40
Raytheon	29	505,127	3,552,339	13.59	2.76	0.20	Yes	27.1	182.0	32.35	1.40
Raytheon	28	504,831	3,552,160	13.81	2.76	0.20	Yes	27.1	182.0	32.35	1.40
Raytheon	32	504,428	3,552,008	14.15	0.88	0.06	Yes	27.1	182.0	32.35	1.40
Raytheon	30	504,262	3,552,175	14.36	3.61	0.25	Yes	27.1	182.0	32.35	1.40
Raytheon	31	504,269	3,552,327	14.40	4.60	0.32	Yes	27.1	182.0	32.35	1.40
Learjet Inc - Tucson Facility	38	504,338	3,553,139	14.61	1.97	0.13	Yes	41.6	73.0	45.05	4.50
SFPP- LP - Tucson Terminal	35	508,458	3,560,297	15.68	4.36	0.28	Yes	30.3	151.0	6.85	1.30
University of Arizona	18	504,581	3,565,981	22.55	29.91	1.33	Yes	64.0	407.0	35.19	3.30
University of Arizona	19	504,849	3,567,169	23.37	19.72	0.84	Yes	64.0	407.0	35.19	3.30
ASARCO - Mission Complex	17	495,213	3,540,058	24.02	88.00	3.66	Yes	64.6	216.0	39.36	5.20
TEP - DeMoss Petrie Generating	39	500,738	3,568,397	26.83	1.57	0.06	Yes	85.5	565.0	67.33	9.30

Source	Model ID	UTM Location (m) East	UTM Location (m) North	Distance to EPNG Vail (km)	NO_x Emission Rates (tpy)	Q/d	Source Modeled?	Exhaust Height (ft)	Exhaust Temp. (deg F)	Exhaust Velocity (fps)	Exhaust Diameter (ft)
Freeport-McMoRan Sierrita	16	490,110	3,526,678	34.95	134.73	3.86	Yes	64.6	216.0	39.36	5.20
Vulcan Materials - Orange Grove	9	494,697	3,576,562	36.97	14.78	0.40	Yes	13.0	215.0	54.76	3.35
Vulcan Materials - Marana	8	524,334	3,585,099	37.83	19.00	0.50	Yes	14.0	299.0	41.00	4.50
TEP - North Loop Generating	37	488,118	3,584,767	47.49	3.66	0.08	Yes	85.5	565.0	67.33	9.30
CalPortland Rillito Cement	11	485,771	3,585,944	49.89	1,131.23	22.67	Yes	161.7	309.0	69.063	7.2
CalPortland Rillito Cement	10	485,771	3,585,944	49.89	1,063.57	21.32	Yes	161.7	309.0	69.063	7.2
CalPortland Rillito Cement	12	485,771	3,585,944	49.89	7.00	0.14	Yes	25.9	296.0	54.858	2.8
CalPortland Rillito Cement	14	485,771	3,585,944	49.89	0.03	0.00	Yes	39.7	370.0	25.569	1.9
CalPortland Rillito Cement	13	485,771	3,585,944	49.89	0.01	0.00	Yes	39.7	370.0	25.569	1.9
Granite Construction - Tangerine	6	483,206	3,587,463	52.72	57.28	1.09	No	-	-	-	-
Marana Landfill	41	473,665	3,586,143	58.57	0.16	0.00	No	-	-	-	-

8.3.4. Class I Area AQRV Analysis

For the AQRV analysis, a Q/D screening analysis was performed in a manner consistent with the proposed method outlined in *FLAG 2010*. As per the FLM guidance, if this screening is passed, then the impact on all AQRVs are assumed to be insignificant and no further modeling analysis is required. This method compares the ratio of project-wide annual emissions of visibility-affecting pollutants [VAP, which includes NO_x, SO_2, PM_{10}, and sulfuric acid mist (H_2SO_4)] to the distance from proposed project to the Class I area. For the *FLAG 2010* approach; "Q" includes NO_x, SO_2, PM_{10} and H_2SO_4 emissions and is calculated as the net emission increase associated with the project. The "D"' term in the ratio is defined as the distance, in kilometers (km), from the compressor station to the closest boundary in each corresponding Class I area. If a source has a Q/D screening ratio less than the *FLAG 2010* recommended threshold of ten (10), any potential impacts are assumed to be acceptable, and no further AQRV modeling will be required. This applies to both the Class I visibility impacts and deposition analysis. Class I areas other than Saguaro National Park East and West will have a Q/d < 10 and will not be subject to AQRV review.

8.3.4.1. Class I Area AQRV Analysis - Visibility

To demonstrate that local visibility impairment does not result from operation of the EPNG Vail Compressor Station operation the EPA VISCREEN Model was used following the guidelines published in the *Workbook for Plume Visual Impact Screening and Analysis* to assess potential plume impairment.[46] The primary variables that affect whether a plume is visible or not at a certain location are (1) quantity of emissions, (2) type of emissions, (3) relative location of source and observer, and (4) the background visibility range. The VISCREEN model is designed to determine whether a plume from a facility may be visible from a given vantage point using these four variables to determine the level of impact. As shown in Figure 8-1, the two Class I areas under the Q/d threshold were the Saguaro National Park West and Saguaro National Park East. Because potential NO_x emissions from the Vail Compressor Station triggers a PSD review, all VISCREEN visibility affecting pollutants emitted by the proposed project were considered in the analysis. Direct emissions of primary NO_2, Soot, and Primary SO_4 were treated as zero emissions (the VISCREEN default) due to either their accounting elsewhere (NO_x) or due to the nature of the source not producing measurable quantities of these pollutants. Pursuant to the FLAG 2010[47]

> *Applicants should calculate the 24-hour average net emission increase for each pollutant from modified facilities as the maximum allowable 24-hour average minus the actual hourly rate averaged over the past two years (annual emissions over past two years/hours of operation over last two years).*

Because the turbines have not be in operation for the past two years, the maximum allowable turbine emissions, or PTE, are used for purposes of evaluating visibility impacts.

Two levels of visibility screening are available in the VISCREEN Model. Level-1 is designed to provide a conservative estimate of plume visual effects and Level-2 provides a more realistic estimate of visual effects based on more detailed information about the source, meteorology, and area of interest. If the Level-1 screening is passed, then the analysis is deemed complete.

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[46] Workbook for Plume Visual Impact Screening and Analysis (Revised), EPA-450/R-92-023, U.S. Environmental Protection Agency, Research Triangle Park, NC, October 1992.

[47] U.S. Forest Service, National Park Service, and U.S. Fish and Wildlife Service, Federal Land Managers' Air Quality Related Values Work Group (FLAG) Phase I report – Revised (2010). National Resource Report NPS/NRPC/NRR-2010/232. National Park Service, Denver, Colorado. November 2010.

For views at the observer location selected, calculations are performed by the model for two assumed plume-viewing backgrounds: the horizon sky and a dark terrain object. VISCREEN assumes that the terrain object is black and located adjacent to the plume on the side of the centerline opposite the observer. The VISCREEN model output shows separate tables for inside and outside of the sensitive area. Each table contains several variables: theta, azi, distance, alpha, critical and actual plume ΔE, and critical and actual plume contrast. These variables are defined as:

- *Theta* - Scattering angle (the angle between direction solar radiation and the line of sight). If the observer is looking directly at the sun, theta equals zero degrees. If the observer is looking away from the sun, theta equals 180 degrees.
- *Azi* - The azimuthal angle between the line connecting the observer and the line of sight.
- *Alpha* - The vertical angle between the line of sight and the plume centerline.
- *ΔE* - Used to characterize the perceptibility of a plume on the basis of the color difference between the plume and a viewing background. A ΔE less than 2.0 signifies that the plume is not perceptible.
- *Contrast* - The contrast at a given wavelength of two-colored objects such as plume/sky or plume/terrain. A value less 0.05 signifies that the plume is not perceptible by contrast or color.

The analysis is considered satisfactory if ΔE and Green Contrast are less than critical screening values of 2.0 and 0.05, respectively.

VISCREEN conducts four (4) tests of screening calculations. The first two tests refer to visual impacts caused by plume parcels located ***inside*** the boundaries of the given area. Tests of impacts inside the boundary are used to determine visual impacts when integral vistas are not protected.[48] The last two tests are for plume parcels located ***outside*** the boundaries of the area. The tests of visual impacts outside the boundaries of Class I areas are only required if analyses for protected integral vistas are required. An integral vista is a view from a location inside a Class I area of landscape features located outside the boundaries of the Class I area.[49]

For a VISCREEN Level-1 screening analysis, default particulate size and density and worst-case meteorological conditions of F stability with a 1.0 m/s wind speed were used. These worst-case meteorological conditions were assumed to persist for up to 12 hours with a wind direction that would transport the plume directly adjacent to the observer causing the highest, most conservative level of loss of contrast (*Δ*E) and color obscuration. Direct particulate and NO_x emissions increases associated with the proposed project were used as inputs to the model. PM emissions were used to represent direct particulate as PM usually has the highest, net emissions increase from among the available PM species (PM, PM_{10}, and $PM_{2.5}$). In this case the estimated PM, PM_{10} and $PM_{2.5}$ emissions are equal. Remaining VISCREEN Level-1 input parameters were set to those values specified by the VISCREEN user's manual as listed in Table 8-12.[50]

[48] Workbook for Plume Visual Impact Screening and Analysis, p. 27.

[49] Ibid.

[50] EPA OAQPS, Tutorial Package for the VISCREEN Model, Research Triangle Park, NC, June 1992.

Table 8-15. Vail Compressor Station – VISCREEN Level-1 Inputs

Parameter	Input Value
Particulate Emission Rate	3.04 tpy
NO_x Emission Rate	362.02 tpy
Default VISCREEN primary NO_2, soot & H_2SO_4 Rate	0 tpy
Distance between EPNG & observer (Saguaro East / West)	11.6 / 37.45 km
Distance between EPNG & nearest Saguaro East / West boundary	11.6 / 37.45 km
Distance between EPNG & farthest Saguaro East / West boundary	34.95 / 47.27 km
Background visual range (Average of FLAG2010, Table 10)	250 km

The VISCREEN Level-1 screening technique results contained in Appendix H provided a passing result for the Saguaro West National Park but showed a potential exceedance for the Saguaro East National Park. Therefore, a Level 2 visibility impact analysis was performed for Saguaro East National Park.

A VISCREEN Level 2 analysis involves an analysis of the dispersion characteristics and meteorological conditions. The *Workbook for Plume Visual Impact Screening and Analysis* specifies the methodology to identify the worst-case wind direction, wind speed, and atmospheric stability to identify the conditions for the VISCREEN Level-2 evaluation. The first step is to construct a table that shows worst-case dispersion condition ranked in order of decreasing severity and the frequency of occurrence of these conditions associated with the wind direction that could transport emissions toward the Class I area. Dispersion conditions are ranked by evaluating the product $\sigma_y \sigma_z u$, where σ_y and σ_z are the Pasquill-Gifford horizontal and vertical diffusion coefficients for the given stability class and downwind distance. The values are ranked smallest value (worst case) of $\sigma_y \sigma_z u$ to largest. The transport time for each condition is added based on the midpoint value of the wind speed. Any transit time over 12 hours is not considered since it is assumed that the steady-state plume conditions would not persist for that time[51]. Table 8-13 contains a summary of this evaluation.

Step 3 is to sum the frequency of occurrences of the worst-case conditions. The first condition where the sum of the frequencies is 1 or higher is considered the worst-case condition for modeling purposes. Step 4 is to run VISCREEN with the worst-case meteorological condition and compare the results to the screening threshold.

[51] Pursuant to EPA, Workbook for Plume Visual Impact Screening and Analysis (Revised), EPA-454/R-92-023, October 1992.

Table 8-16. Vail Compressor Station – VISCREEN Level 2 Meteorological Conditions Review

Dispersion Condition (stability, wind speed)	σyσzu (m^3/s)	Transport Time (hours)	Frequency (f) and Cumulative Frequency (cf) of occurrence of given dispersion condition associated with source-site wind directions for given time of day (%)							
			1 - 6		7 - 12		13 - 18		19 - 24	
			f	cf	f	cf	f	cf	f	cf
F,1	1.51E+04	6.4	0.06	0.06	0.04	0.04	0.00	0.00	0.03	0.03
F,2	3.02E+04	2.1	2.48	**2.54**	0.30	0.34	0.06	0.06	3.63	**3.66**
E,1	3.89E+04	6.4	0.00	2.54	0.00	0.34	0.00	0.06	0.00	3.66
F,3	4.52E+04	1.3	2.10	4.64	0.13	0.47	0.01	0.07	5.30	8.96
E,2	7.78E+04	2.1	0.00	4.64	0.05	0.52	0.01	0.08	0.01	8.97
D,1	8.99E+04	6.4	0.00	4.64	0.00	0.52	0.00	0.08	0.00	8.97
E,3	1.17E+05	1.3	1.05	5.69	0.12	0.64	0.05	0.13	2.85	11.82
E,4	1.56E+05	0.9	1.01	6.70	0.05	0.69	0.14	0.27	3.89	15.71
D,2	1.80E+05	2.1	0.00	6.70	0.03	0.72	0.00	0.27	0.00	15.71
E,5	1.94E+05	0.7	0.29	6.99	0.05	0.77	0.14	0.41	1.64	17.35
D,3	2.70E+05	1.3	0.00	6.99	0.07	0.84	0.04	0.45	0.05	17.40
D,4	3.59E+05	0.9	0.01	7.00	0.04	0.88	0.10	0.55	0.09	17.49
D,5	4.49E+05	0.7	0.06	7.06	0.04	0.92	0.23	0.78	0.58	18.07
D,6	5.39E+05	0.6	0.16	7.22	0.06	0.98	0.45	**1.23**	1.32	19.39
D,7	6.29E+05	0.5	0.11	7.33	0.07	**1.05**	0.61	1.84	0.74	20.13
D,8	7.19E+05	0.4	0.05	7.38	0.09	1.14	0.74	2.58	0.43	20.56

The VISCREEN Level-2 analysis for the Saguaro National Park East, predicted a worst-case meteorological condition of stability class F and a wind speed of 2 m/s. These values were input into the VISCREEN models along with the default particle characteristics. Actual NO_2 emission rates were used in the VISCREEN Level-2 modeling along with an estimate of downwind NO_2 formation based on 10% of the remaining NO_x emitted[52]. Primary NO_2 from the turbines was calculated using the ISR factor of 0.124. That yielded 44.809 tpy of primary NO_2. The remaining turbine NO_x was estimated as the difference between the total NO_x emissions and the primary NO_2 emissions, or 316.55 tpy. VISCREEN assumes 10% of the NO_x is converted to NO_2; 10% of the remaining turbine NO_x is 31.655 tpy. This value along with 10% of the emergency generator NO_x (0.066 tpy) was added to the primary NO_2 yielding a total in-plume NO_2 of 76.530 tpy.

As contained in Appendix H, for Saguaro East National Park the VISCREEN Level 2 predicted visual impacts were below the screening criteria for the areas inside the Class I areas. Areas outside the Class I areas are only required if analyses for protected integral vistas are required and Saguaro National Park is not currently considered a protected integral vista. Because the predicted impacts inside the Class I areas were below the screening criteria, there will be negligible visibility impact at both Class I areas and no further analysis is required.[53]

[52] Pursuant to EPA, Workbook for Plume Visual Impact Screening and Analysis (Revised), EPA-454/R-92-023, October 1992.
[53] U.S. Forest Service, National Park Service, and U.S. Fish and Wildlife Service, Federal Land Managers' Air Quality Related Values Work Group (FLAG) Phase I report – Revised (2010). National Resource Report NPS/NRPC/NRR-2010/232. National Park Service, Denver, Colorado. November 2010.

8.3.4.2. Class I Area AQRV Analysis - Deposition

Because of the location of the Saguaro National Park East and West within 50 km of the facility, the AERMOD model was utilized for the assessment of deposition impacts at these areas. AERMOD is the preferred model for distances less than 50 km and the model contains gaseous deposition algorithms. Sulfur deposition was considered insignificant given the low emission rate of SO_2. Nitrogen deposition was conducted by modeling the NO_x deposition rate.

The oxidation of nitrogen oxides is a complicated process that can include a large variety of nitrogen species, such as nitrogen dioxide (NO_2), nitric acid (HNO_3) and organic nitrates (RNO_3) such as peroxyacetylnitrate (PAN). Atmospheric chemical reactions that occur in sunlight result in the formation of ozone and other compounds. Depending on atmospheric conditions, these reactions can start to occur within several hundred meters of the original NO_x source, or after the pollutants have been carried tens of kilometers downwind. Ultimately, some nitrogen oxides are converted to nitric acid vapor or particulate nitrates. Precipitation is one mechanism that removes these pollutants from the air. Forms of atmospherically derived nitrogen are removed from the atmosphere by both wet deposition (rain) or dry deposition (direct uptake by vegetation and surfaces).

Ammonia and ammonium are other forms in which nitrogen occurs. Ammonia is a gas that becomes ammonium when dissolved in water, or when present in soils or airborne particles. Unlike NO_x, which forms during combustion, soil microorganisms naturally form ammonia and ammonium compounds of nitrogen and hydrogen.

In urban atmospheres, the oxidation rate of NO_x to HNO_3 is estimated to be approximately 20 percent per hour, with a range of 10 to 30 percent per hour[54]. Aerosol nitrates (NO_3) are present, mainly in the form of ammonium nitrate (NH_4NO_3). Nitrate and ammonium (NH_4) are the predominant forms by which plants absorb nitrogen. In California, ammonium nitrate is the predominant airborne nitrate bearing particle in the atmosphere.[55]

To assess the potential for nitrogen deposition, AERMOD was used. No chemistry was used in the AERMOD analysis. Instead, all emissions of NO_x were assumed to instantaneously form depositional nitrogen in stack, thus being immediately available for deposition. AERMOD used Class I receptors provided by the NPS. AERMAP was run to assign receptor elevations and hill heights for AERMOD's complex terrain algorithms. The following gas diffusion parameters were used in AERMOD:

- Diffusivity in air = 0.14E-04 cm^2/s
- Diffusivity in water = 0.30E-08 cm^2/s
- Leaf Lipid Resistance = 0.18E+4 s/cm
- Henry's Law Coefficient = 0.80E-07 m^3/mol

AERMOD also requires land use categories by season through the GDLANUSE keyword. The surrounding area around EPNG is primarily undeveloped desert so the land use category of Barren land, mostly desert was applied. The maximum annual nitrogen deposition rate predicted by AERMOD was 0.000487 kg/ha/yr, well below the NPS threshold for Saguaro National Park of 0.005 kg/ha/yr.[56]

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[54] CARB (Air Resources Board). The Effects of Oxides of Nitrogen on California Air Quality. By Technical Support Division State of California Air Resources Board. Report Number: TSD-85-01. March 1986

[55] Ibid.

[56] Pursuant to National Park Service "Guidance on Nitrogen and Sulfur Deposition Analysis Thresholds", located at http://npshistory.com/publications/air-quality/ns-dep-guidance.pdf

8.4. SECONDARY $PM_{2.5}$ & OZONE ASSESSMENT

Precursor pollutants for $PM_{2.5}$ (i.e., NO_x, and SO_2) can undergo photochemical reactions with gases in the atmosphere, such as ammonia (NH_3) and VOC, resulting in the formation of secondary $PM_{2.5}$ downwind of an emission source, which can add to concentrations resulting from direct (or primary) emissions of $PM_{2.5}$. Two of the largest constituents of secondary $PM_{2.5}$ in the U.S. are sulphates (SO_4^{2-}) and nitrates (NO_3^-), both of which are formed from their respective precursor pollutants (i.e., SO_2 for SO_4^{2-}, NO_x for NO_3^-). Pursuant to Table ES-1 of EPA's May 20, 2014 $PM_{2.5}$ modeling guidance, a proposed project with an increase of NO_x and/or SO_2 emissions in excess of 40 tpy triggers a secondary $PM_{2.5}$ air impact analysis. Furthermore, pursuant to 40 CFR §52.21, a proposed project with an increase of VOC or NO_x emissions in excess of 100 tpy triggers an ambient ozone impact analysis for that project. Since the project emission increase for NO_x exceeds 100 tpy, an analysis must be performed on the secondary formation of $PM_{2.5}$ and ozone.

To address the secondary formation of $PM_{2.5}$ and ozone, EPA devised a two-tier approach as detailed in 40 CFR 51. A Tier 1 assessment uses the relationship between source characterization and modeled concentration of a representative (hypothetical) source and location to assess potential impacts from a new source. EPA has published hypothetical source modeled concentrations with relationship to location and source characterization in the April 2019 Modeled Emission Rates for Precursors (MERP) Memo. These hypothetical sources use one year of meteorological data from 2011 to determine modeled impacts.[57]

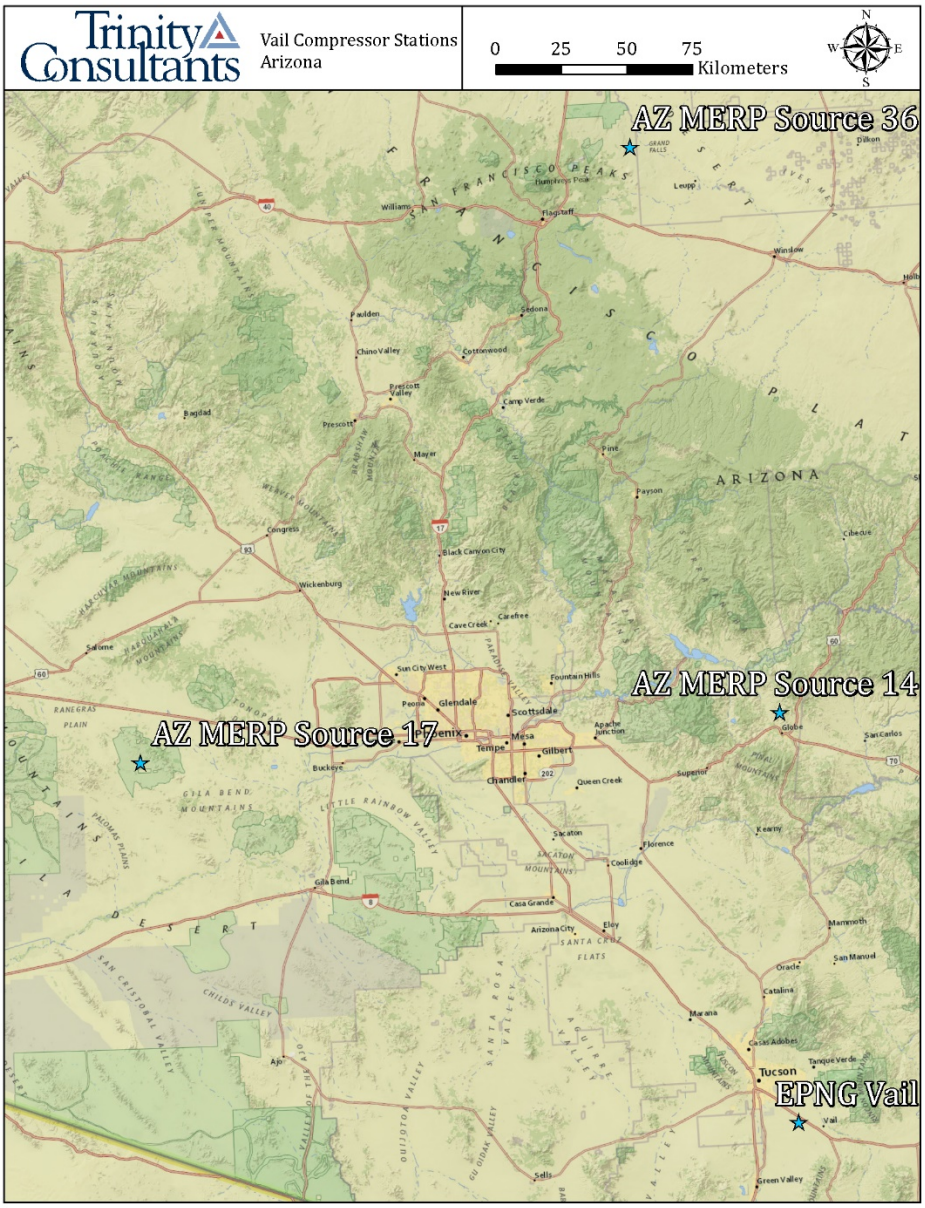
Table 8-5 contains a summary of the maximum terrain and urban fraction between the three Arizona hypothetical facilities contained in the EPA MERP guidance and the facility. Similarly, Figure 8-2 depicts the locations of these facilities in Arizona. Based on an evaluation of proximity, elevations, urban fraction, and climatology unique to each location, hypothetical Facility 14 (FIPS 4007) is considered most representative of the facility location.

Table 8-5. Vail Compressor Station - EPA Arizona MERP Facilities

Reference	FIPS	County	Source	Latitude	Longitude	Max Nearby Terrain (m)	Max Nearby Urban (%)
EPA MERP Guidance	4005	Coconino	36	35.428	-111.270	2,483	7.4
	4007	Gila	14	33.469	-110.789	1,592	4.3
	4012	La Paz	17	33.400	-113.408	757	0.9
EPNG Vail	-	Pima	-	32.066	-110.810	900	8.4

[57] EPA Memorandum, Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier I Demonstration Tool for Ozone and PM2.5 under the PSD Permitting Program , April 30, 2019.

Figure 8-2. Vail Compressor Station - Location of EPA Arizona MERP Facilities



To evaluate the facility's impact on secondary pollutants, EPNG will follow the EPA April 2019 MERP Memo.

- Step 1: Calculate the MERP based on the equation provided by EPA guidelines:

$$\text{MERP} = \text{SIL Value x } \frac{\text{Modeled emission rate from hypothetical source}}{\text{Modeled air quality impact from hypothetical source}}$$

The modeled emission rate and air quality impacts are obtained from EPA's December 28, 2018, workbook with underlying maximum impact and MERPs information for each hypothetical source.[58]

[58] The workbook is available on EPA's Clean Air Act Permit Modeling Guidance webpage, https://www.epa.gov/scram/clean-air-act-permit-modeling-guidance.

EPNG used the hypothetical source assuming the lowest emission rate of 500 tpy and the lowest stack height of 10 m. Table 8-6 lists the calculated MERPs.

Table 8-6. Vail Compressor Station - Calculated MERPs

Secondary Pollutant	Source Pollutant	Stack Height (m)	Source #	Emission Rate (tpy)	Max Impact (ppb)	SIL (ppb)	Calculated MERP (tpy)
Ozone	NO_x	10	14	500	1.226	1	407
Secondary Pollutant	**Source Pollutant**	**Stack Height (m)**	**Source #**	**Emission Rate (tpy)**	**Max Impact (μg/m³)**	**SIL (μg/m³)**	**Calculated MERP (tpy)**
$PM_{2.5}$ - 24hr	NO_x	10	14	500	0.011	1.2	54,500
$PM_{2.5}$ - Annual	NO_x	10	14	500	0.00094	0.3	159,000

- Step 2a: For each pollutant and averaging period, the emissions from the facility are compared to the MERP values as summarized in Table 8-7. EPNG's proposed emissions are below the MERP values so the SIL will not be exceeded.
- Step 2b: EPA has requested that EPNG additionally provide pre and post-project background concentrations for $PM_{2.5}$ and ozone. Table 8-7 summarizes the impact on background concentration by applying the estimated percent-of-SIL impact to the pre-project background concentration to determine the post-project background concentrations.

Table 8-7. Vail Compressor Station - Emissions Compared to MERP

Secondary Pollutant	Source Pollutant	EPNG NEI (tpy)	Calculated MERP (tpy)	Total Impact (ppb)	Pre-Project Background Concentration [1] (ppb)	Post-Project Background Concentration (ppb)	Tier 1 MERP Modeled Air Quality Impact as % of SIL
Ozone	NO_x	232.20	407	0.57	68.33	68.90	57%
Secondary Pollutant	**Source Pollutant**	**EPNG NEI (tpy)**	**Calculated MERP (tpy)**	**Total Impact (μg/m³)**	**Pre-Project Background Concentration [2] (μg/m³)**	**Post-Project Background Concentration (μg/m³)**	**Tier 1 MERP Modeled Air Quality Impact as % of SIL**
$PM_{2.5}$ - 24hr	NO_x	232.20	54,500	0.0051	15.07	15.08	0.43%
$PM_{2.5}$ - Annual	NO_x	232.20	159,000	0.00044	6.13	6.13	0.15%

[1] Pre-project ozone concentration determined using average 2016, 2017, and 2018 data from the Fairground Monitor (AQS Site ID 04-019-1020) and applying the annual fourth-highest daily maximum 8-hr concentration.

[2] Pre-project $PM_{2.5}$ concentration determined using average 2016, 2017, and 2018 data from the Children's Park Monitor (AQS Site ID 04-019-1028) and applying the 98th percentile concentration for the 24-hr averaging period and the annual mean for the annual averaging period.

8.5. ADDITIONAL IMPACTS ANALYSIS

The PSD additional impacts analysis depends on existing air quality, the quantity of emissions, and the sensitivity of local soils, vegetation, and visibility in the source's impact area.

8.5.1. Growth Analysis

The purpose of the growth analysis is to quantify project associated growth; that is, to predict how much new growth is likely to occur in order to support the source or modification under review, and then to estimate the air quality impacts from this growth. Because the Vail Compressor Plant is an existing facility and the permit action will not significantly increase full-time employment after the project is completed, the proposed project is anticipated to have a limited growth impact in employment or nearby Pima County infrastructure and therefore, on any emissions growth in the area. While some workers employed during the construction phase of the project are likely to currently reside outside the region and thus may commute to the area, any related potential air quality impacts from these out-of-town workers was considered to be insignificant and too small to be reasonably quantified. Furthermore, no increases in employment levels at the EPNG Vail Compressor Station are expected. Therefore, the project was considered to have insignificant impact on emissions due to any growth related air quality impacts.

8.5.2. Soil and Vegetation Analysis

An analysis of the project's potential impact on soils and vegetation in the vicinity of the facility was performed in accordance with the procedures recommended in EPA's "A Screening Procedure for Impacts of Air Pollution Sources on Plants, Soils and Animals"[59] The highest modeled concentrations of NO_2 and CO were compared to the screening concentrations as shown in Table 8-14. As shown, the modeled

[59] U.S. EPA, A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals. EPA-450/2-81-078., 1980.

concentrations are all well below their screening thresholds; therefore, no significant impacts on local vegetation is expected as a result of the project.

Table 8-17. Vail Compressor Station – Impacts on Vegetation

Pollutant	Averaging Period	Maximum Modeled Concentration (µg/m³)	EPA's 1980 Screening Concentration [1] (µg/m³)
NO_2	4 hour [2]	40.61	3,760
	8 hour [2]		3,760
	1 month [2]		564
	1 year	0.91	188
CO	1 week [3]	145.13	1,800,000

[1] "A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals". EPA 450/2-81-078, December 1980.

[2] NO_2 impact is the 1-hour significant analysis impact.

[3] CO impact is the 8-hour significant analysis impact.

8.6. ELECTRONIC FILES

The electronic files provided contain all of the AERMOD air dispersion modeling analyses electronic input, output, and other files used to generate the modeling results. The following is a list of files provided:

- All AERMOD input and output files
- AERMOD meteorological data files
- AERMOD terrain data files
- Ozone background file
- All BPIP/BPIPP input and output files

APPENDIX G. BACKGROUND DATA DETERMINATION DETAILS

Background concentrations for the modeling analysis are needed for NO_2. Section 8.3 of Appendix W of 40 CFR Part 51 discusses the requirements for obtaining "representative" background concentrations. Per Section 8.3.2.b of Appendix W, Recommendations for Isolated Single Sources, "The EPA recommends use of the most recent quality assured air quality monitoring data collected in the vicinity of the source to determine the background concentration for the averaging times of concern. In most cases, the EPA recommends using data from the monitor closest to and upwind of the project area. If several monitors are available, preference should be given to the monitor with characteristics that are most similar to the project area." Additionally, per US EPA guidance, in determining whether background data is representative, one must consider the quality and age of the data collected. Figure G-1 shows the location of the monitoring stations surrounding the Vail Compressor Station using EPA AirData Air Quality Monitors. Figure G-2 shows a wind rose using the 2014-2018 meteorological data for Tucson International Airport obtained from ADEQ's website. This meteorological station is the nearest National Weather Service station. The wind rose shows the majority of the wind blowing from the southeast to the northwest.

Figure G-1. Location of Neighboring Monitoring Stations

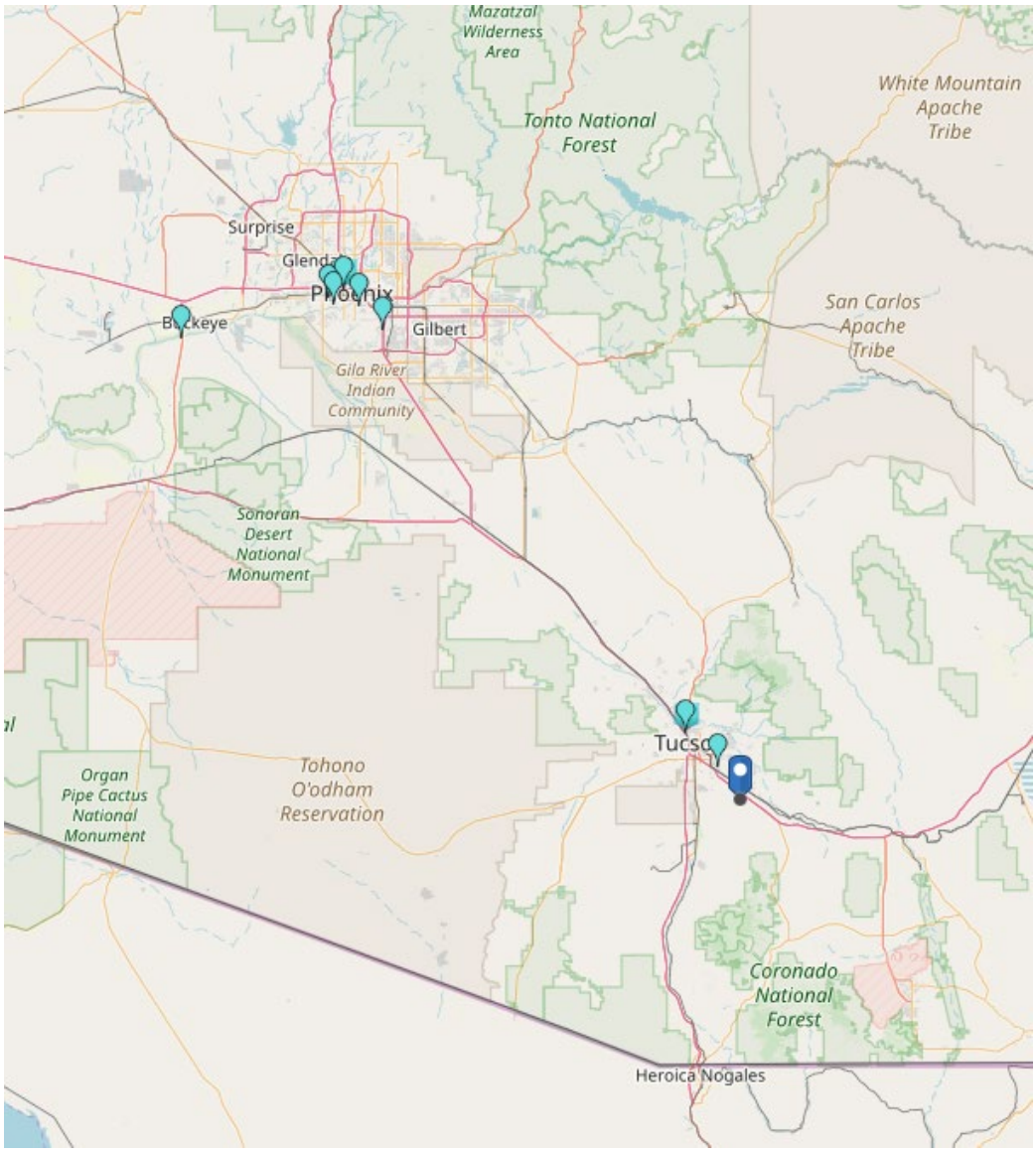
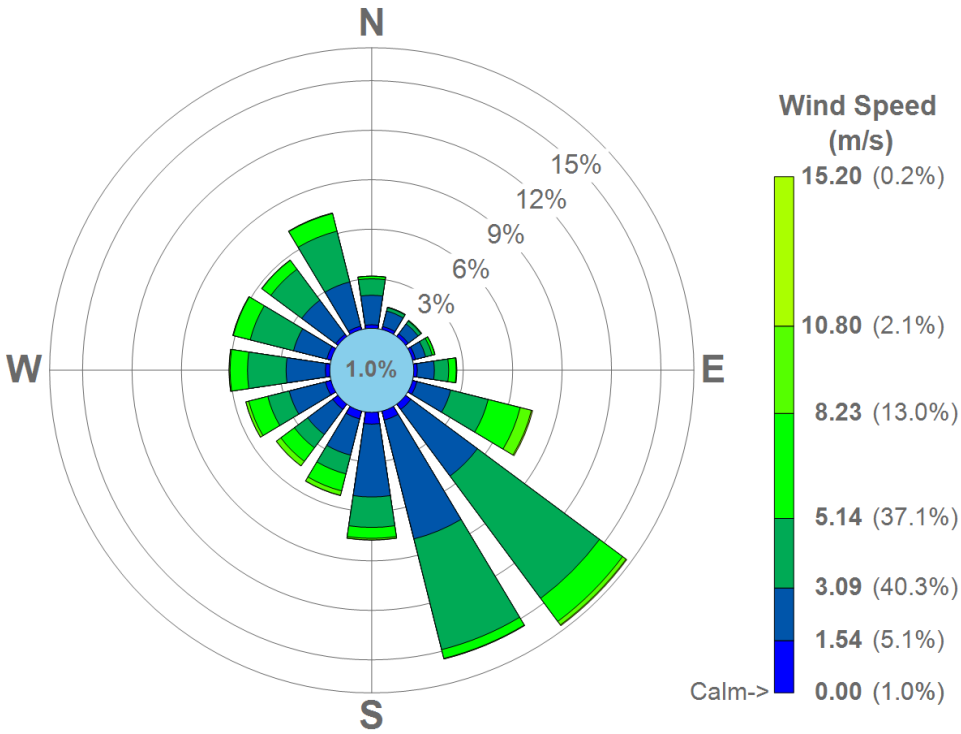


Figure G-2. Tucson ADEQ 2014-2018 Meteorological Data Wind Rose



Due to the scarcity of monitors with complete data from the most recent three years in unpopulated areas of Arizona, EPNG utilized the nearest, most representative monitoring station with data corresponding to the pollutant and averaging period in which the background data, excluding exceptional events, is more than complete according to the criteria contained in Table G-1. Background concentrations for NO_2 are selected based on the criteria contained in Table G-2.

Table G-1. Background Concentration – Completeness Criteria

Pollutant	Averaging Period	Completeness (%)	Regulatory Reference
NO_2	Annual	75%	40 CFR Part 50, Appendix S, Section 3.1(b)
	1-hour	75%	40 CFR Part 50, Appendix S, Section 3.2(b)

Table G-2. Background Concentration – Selection Criteria

Pollutant	Averaging Period	Concentration Format	Average or Single	Number of Years Considered
NO_2	Annual	Arithmetic Mean	Single	1, most recent
	1-hour	Annual 98th percentile daily max 1-hr values	Average	3, consecutive

Because the majority of the wind flow occurs in the southeast to northwest direction, monitoring stations to the southeast of the Vail Compressor Station will be considered first followed by any monitoring stations

northwest. Since there are no monitors to the southeast of the Vail Compressor Station, monitors to the northwest were evaluated.

A summary of the background data proposed is contained in Table G-3.[60] The monitoring station which is closest and lies northwest of the Vail Compressor Station (i.e., 22nd & Craycroft – EPA ID 04-019-1011) has the three most recent years of data. The data was then evaluated for completeness and a representative concentration was selected. Since the 22nd & Craycroft monitoring station collected data for the pollutant in question, the second closest monitor's data did not need to be examined. The following is an evaluation of the monitoring stations nearest the Vail Compressor Station that were considered as part of this analysis.

- 22nd & Craycroft (AQS ID 04-019-1011)
  - Distance to Vail Compressor Station = 10.3 miles
  - Location: Northwest of the Vail Compressor Station
  - Pollutants considered = NO_2
  - For NO_2
    - The data at this monitor is complete.
    - The elevation of this monitor is 789 meters while the elevation of the Vail Compressor Station is 899 meters.
    - This monitor is the closest NO_2 monitor northwest of the Vail Compressor Station with complete data and a similar elevation; therefore, the 22nd & Craycroft monitor was selected.
      - 1-hr Concentration: 70.2 $\mu g/m^3$

The remaining monitors are further from the Vail Compressor Station and have similar, residential surroundings; therefore, these monitors were determined to be less representative compared to the 22nd & Craycroft monitor.

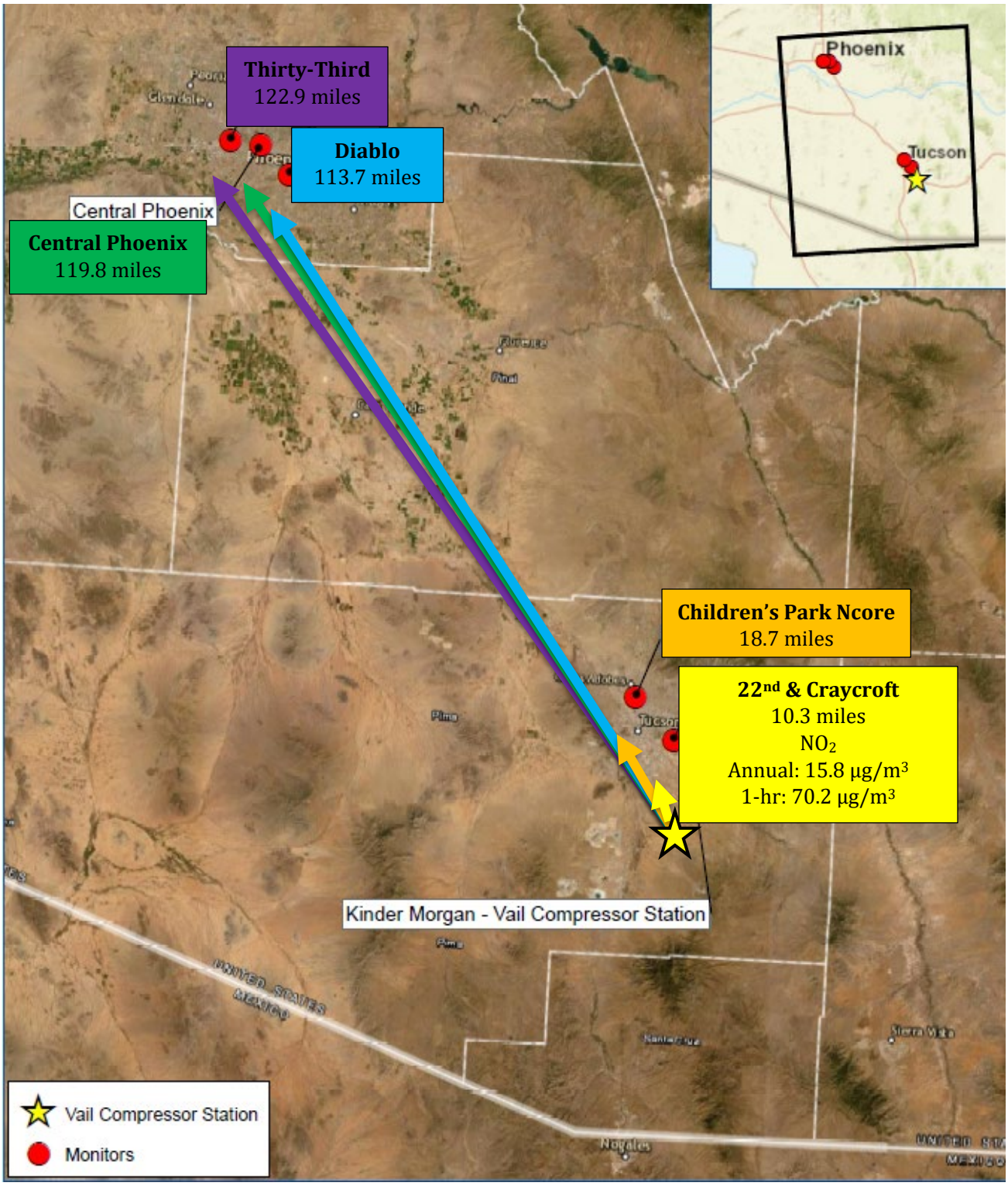
[60] Background concentrations obtained from EPA's AirData Air Quality Monitors.

Table G-3. Background Concentration Values

Pollutant	Averaging Period	Site Name	Distance to the Vail Compressor Station (miles)	Year	Percent Complete [1]			Concentration Format	Concentration (µg/m³) [1]			
					Actual Count	Max Count	% Complete		Actual	NAAQS	Selected	Difference
NO_2	1-hr	22nd & Craycroft	10.3	2016	356	366	97	98th Percentile	63.0	188	70.2	117.8
				2017	365	365	100		70.3			
				2018	365	365	100		77.5			

[1] Background concentrations obtained from EPA's AirData Air Quality Monitors.
Actual values are converted to µg/m³.

Figure G-3. Monitoring Station Evaluation



APPENDIX H. VISCREEN MODEL OUTPUT

Visual Effects Screening Analysis for
Source: EPNG
Class I Area: Saguaro West

*** Level-1 Screening ***

Input Emissions for

Particulates	3.04	TON/YR
NOx (as NO2)	362.02	TON/YR
Primary NO2	0.00	TON/YR
Soot	0.00	TON/YR
Primary SO4	0.00	TON/YR

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	0.04 ppm
Background Visual Range:	250.00 km
Source-Observer Distance:	37.45 km
Min. Source-Class I Distance:	37.45 km
Max. Source-Class I Distance:	47.27 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	6
Wind Speed:	1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	134.	47.3	35.	2.00	1.931	0.05	-0.008
SKY	140.	134.	47.3	35.	2.00	1.432	0.05	-0.010
TERRAIN	10.	84.	37.5	84.	2.00	0.482	0.05	0.002
TERRAIN	140.	84.	37.5	84.	2.00	0.368	0.05	0.001

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	5.	11.7	164.	2.00	3.948*	0.05	-0.022
SKY	140.	5.	11.7	164.	2.00	2.898*	0.05	-0.029
TERRAIN	10.	0.	1.0	168.	2.00	2.583*	0.05	0.032
TERRAIN	140.	0.	1.0	168.	2.00	1.744	0.05	0.014

Visual Effects Screening Analysis for
Source: EPNG
Class I Area: Saguaro East

*** Level-1 Screening ***

Input Emissions for

Particulates	3.04	TON/YR
NOx (as NO2)	362.02	TON/YR
Primary NO2	0.00	TON/YR
Soot	0.00	TON/YR
Primary SO4	0.00	TON/YR

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	0.04 ppm
Background Visual Range:	250.00 km
Source-Observer Distance:	11.60 km
Min. Source-Class I Distance:	11.60 km
Max. Source-Class I Distance:	34.95 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	6
Wind Speed:	1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	163.	35.0	5.	2.00	7.959*	0.05	-0.045
SKY	140.	163.	35.0	5.	2.00	5.850*	0.05	-0.060*
TERRAIN	10.	163.	35.0	5.	2.00	6.432*	0.05	0.031
TERRAIN	140.	163.	35.0	5.	2.00	5.158*	0.05	0.020

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	5.	3.6	164.	2.00	10.870*	0.05	-0.040
SKY	140.	5.	3.6	164.	2.00	8.139*	0.05	-0.057*
TERRAIN	10.	1.	1.0	168.	2.00	6.742*	0.05	0.046
TERRAIN	140.	1.	1.0	168.	2.00	3.283*	0.05	0.008

Visual Effects Screening Analysis for
Source: EPNG
Class I Area: Saguaro East

*** User-selected Screening Scenario Results ***

Input Emissions for

Particulates	3.04	TON/YR
NOx (as NO2)	0.00	TON/YR
Primary NO2	76.53	TON/YR
Soot	0.00	TON/YR
Primary SO4	0.00	TON/YR

PARTICLE CHARACTERISTICS

	Density	Diameter
Primary Part.	2.5	6
Soot	2.0	1
Sulfate	1.5	4

Transport Scenario Specifications:

Background Ozone:	0.04 ppm
Background Visual Range:	250.00 km
Source-Observer Distance:	11.60 km
Min. Source-Class I Distance:	11.60 km
Max. Source-Class I Distance:	34.95 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	6
Wind Speed:	2.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

Backgrnd	Theta	Azi	Distance	Alpha	Delta E Crit	Delta E Plume	Contrast Crit	Contrast Plume
SKY	10.	163.	35.0	5.	2.00	1.008	0.05	0.000
SKY	140.	163.	35.0	5.	2.00	0.724	0.05	-0.008
TERRAIN	10.	163.	35.0	5.	2.00	0.879	0.05	0.008
TERRAIN	140.	163.	35.0	5.	2.00	0.598	0.05	0.003

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE Exceeded

Backgrnd	Theta	Azi	Distance	Alpha	Delta E Crit	Delta E Plume	Contrast Crit	Contrast Plume
SKY	10.	1.	1.0	168.	2.00	3.474*	0.05	0.001
SKY	140.	1.	1.0	168.	2.00	2.696*	0.05	-0.022
TERRAIN	10.	1.	1.0	168.	2.00	3.596*	0.05	0.023
TERRAIN	140.	1.	1.0	168.	2.00	1.751	0.05	0.004