DISPERSION MODEL PROTOCOL FOR MESA VERDE ENTERPRISES, INC. REVISION OF PERMIT 3295-M1

La Luz, New Mexico

PREPARED FOR
MESA VERDE ENTERPRISES, INC.

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1.0 INTRODUCTION

This dispersion modeling analysis will be conducted by Class One Technical Services, Inc. (CTS) on behalf of Mesa Verde Enterprises, Inc., to evaluate ambient air quality impacts from the revision of Permit 3295-M1. Presently, the permit allows operation of a 600 ton per hour (tph) main aggregate processing plant and a 600 tph aggregate wash plant, 10 hours per day. Additional permit limitations include; 5 days a week operation for the main aggregate plant, 7 days a week operation for the aggregate wash plant, 6,000 tons per day of aggregate material transported from the site, 208 haul road round trips per day, and 1,040 haul road round trips per week.

Mesa Verde recently acquired the property to the west of the present site with includes an existing pit identified as the Brown pit. With this permit modification Mesa Verde is proposing the following:

1. Increase the hourly throughput for the existing main aggregate plant from 600 to 800 tph.
2. Additional equipment for the main aggregate plant including a multi-bin feeder and fourteen (14) mine conveyors operating both in the existing mine pit and at the existing main aggregate plant.
3. Additional equipment for the wash plant including a screw conveyor, two log washers, wet screen with conveyors, and four (4) additional conveyors.
4. A new 300 tph crusher plant for operation in the pit, consisting of a feeder, crusher with under conveyors, screen with conveyors and three (3) mine conveyors powered by a 550 horsepower (hp) diesel-fired engine.
5. A new 540 tph aggregate processing plant to be operated in the newly acquired Brown Pit property. It will extract material from either the existing pit or Brown pit. It will include a grizzly feeder/jaw crusher with under conveyors, two (2) secondary crushers with under conveyors, two (2) screens with under conveyors, a surge bin, a multi-bin feeder with under conveyor, fourteen (14) mine conveyors operating both in the mine pit and at the plant, and powered by a 770 horsepower (hp) diesel-fired generator.
6. Increase operating hours to daylight hours, seven days per week, for all processing equipment. Truck traffic round trips will equal the amount of material processed daily or approximately 34.8 trips per hour from the main plant and 23.9 trips per hour from the new 540 tph aggregate plant.

The objective of this evaluation is to determine whether ambient air concentrations from the maximum operation of the proposed project for nitrogen dioxide (NO_2); carbon monoxide (CO); sulfur dioxide (SO_2); particulate matter, total suspended particles (TSP), and both 10 microns or less (PM_{10}) and 2.5 microns or less ($PM_{2.5}$); are below Class II federal and state ambient air quality standards (NAAQS and NMAAQS) found in 40 CFR part 50 and the New Mexico air quality regulation 20.2.3 NMAC and PSD Class I and II Increment Standards.

The dispersion modeling will be conducted using the American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee Dispersion

Model (AERMOD), Version 15181. This model is recommended by EPA for determining Class II impacts within 50 km of the source being assessed. Additionally, AERMOD was developed to handle complex terrain. In this analysis, AERMOD will be used to estimate pollutant ambient air concentrations of NO_2, CO, SO_2, TSP, PM_{10}, and $PM_{2.5}$ from the Mesa Verde La Luz Aggregate Plant emission sources. CTS employs the general modeling procedures outlined in "New Mexico Air Pollution Control Bureau, Dispersion Modeling Guidelines", revised 06/17/2016, and the most up to date EPA's *Guideline on Air Quality Models*.

Aggregate plant material handling equipment, stockpiles, and haul roads will be input into the model as volume sources. Exhaust stack sources will be input into the model as point sources. Model input parameters for the generators/engines point sources are based on parameters for similar sized equipment information, since specific equipment may not have been purchased. Model input parameters for feeders, crushers, screens, and transfer points will follow the NMED model guidelines Table 23. Model input parameters for haul roads will follow the NMED model guidelines Tables 24 and 25.

Figure 1 below shows the location of the site in relation to the surrounding terrain. Figure 2 below presents the equipment layout for the new additional plant. Figure 3 below presents the La Luz Aggregate Plant after initial installation of the new additional plant extracting material from the Brown Pit. Figure 4 presents the La Luz Aggregate Plant after full expansion of material quarries with the new plant extracting material from either the Brown Pit or the existing pit..

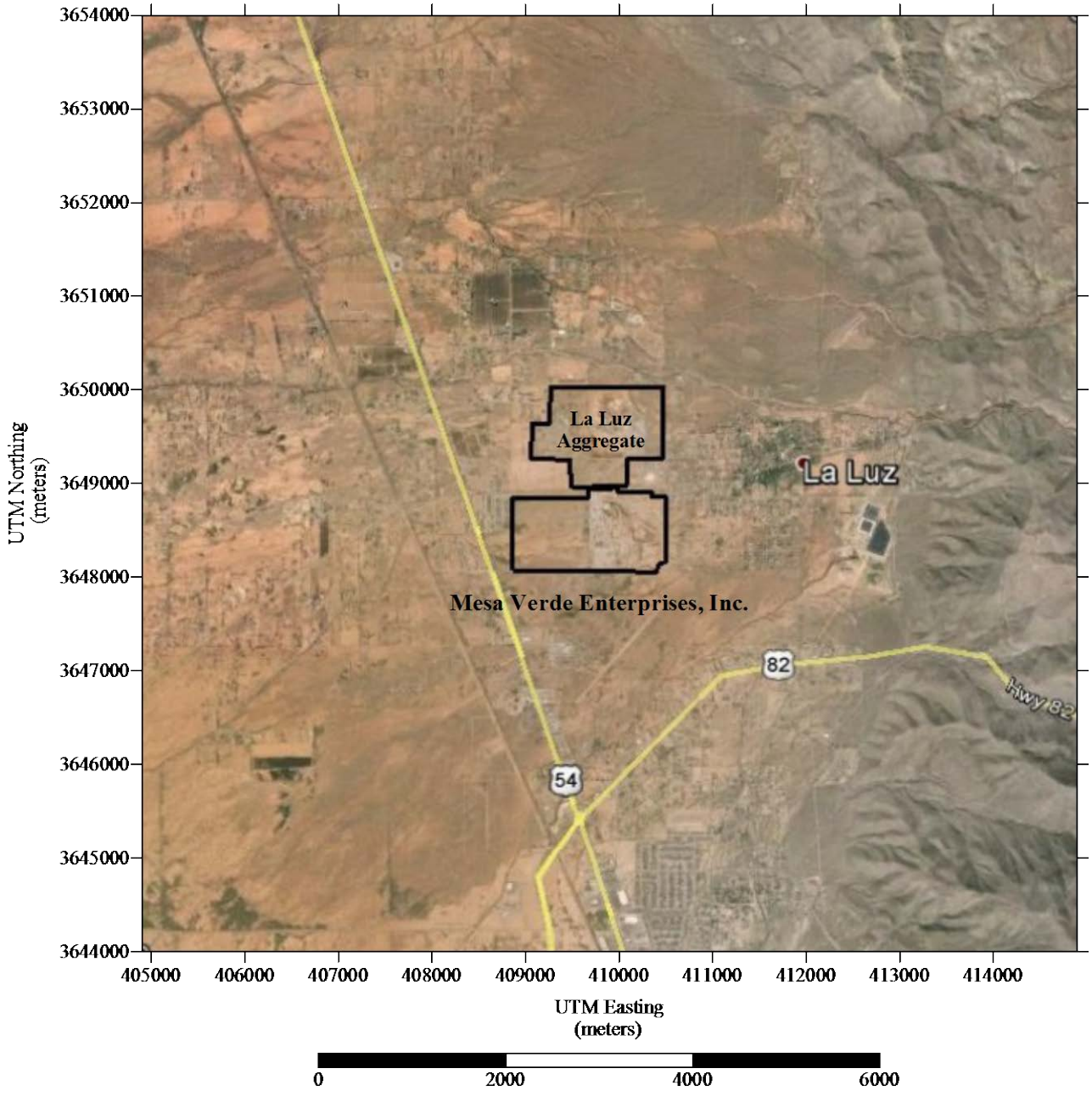

FIGURE 1: Mesa Verde La Luz Aggregate Plant Site Location

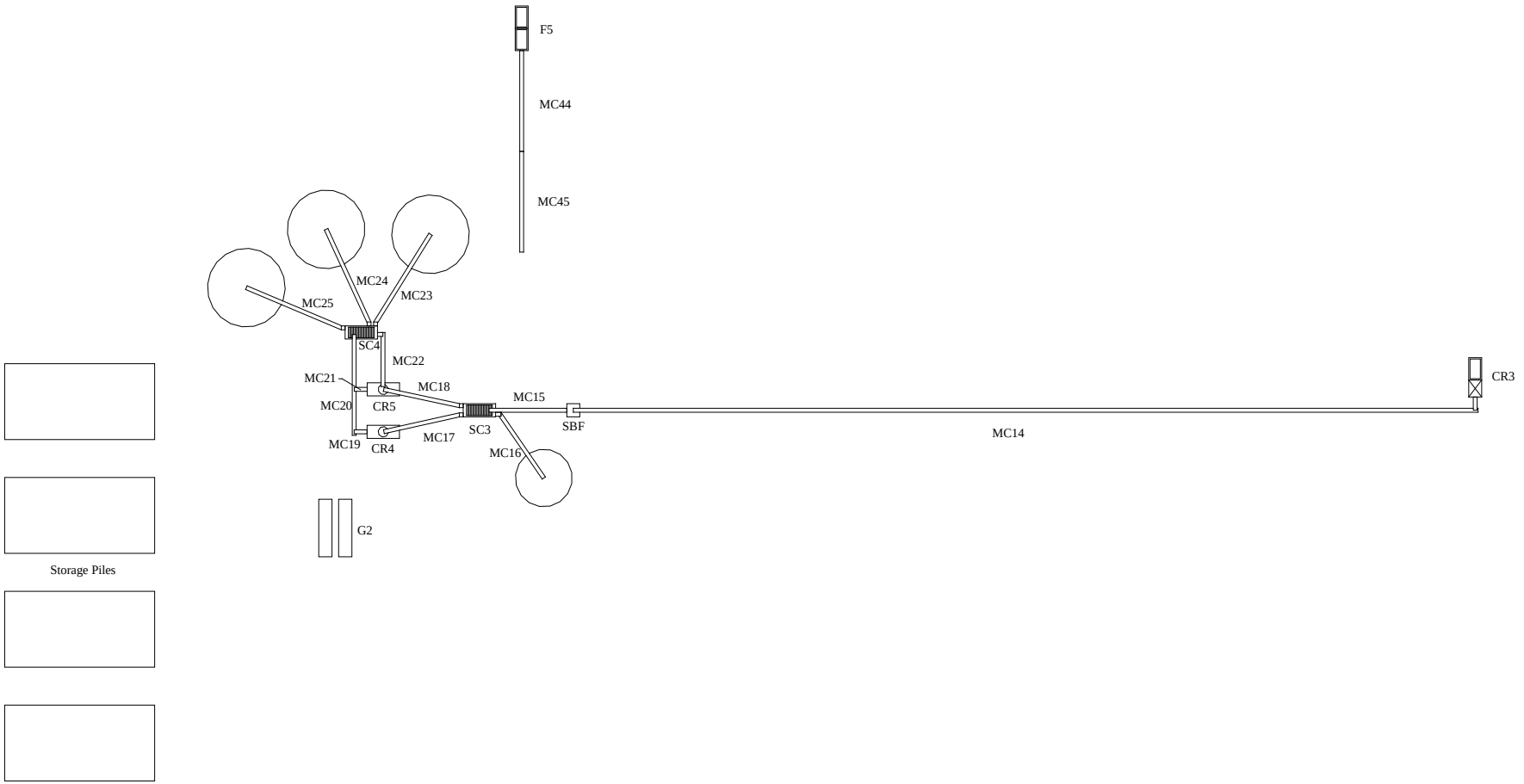

FIGURE 2: Proposed Mesa Verde La Luz Aggregate Plant – New Plant Layout

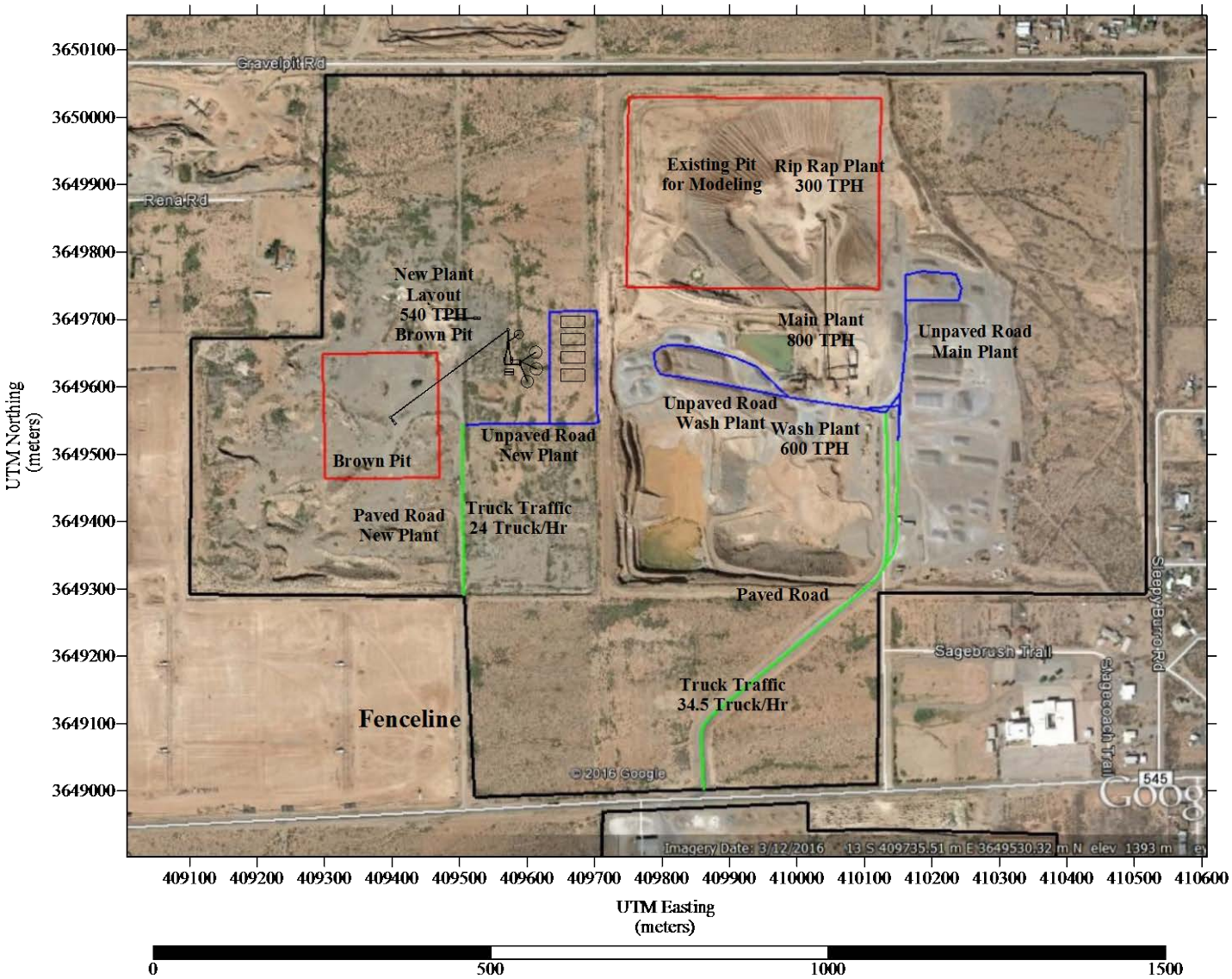

FIGURE 3: Proposed Mesa Verde La Luz Aggregate Plant Site – New Plant Layout Initial

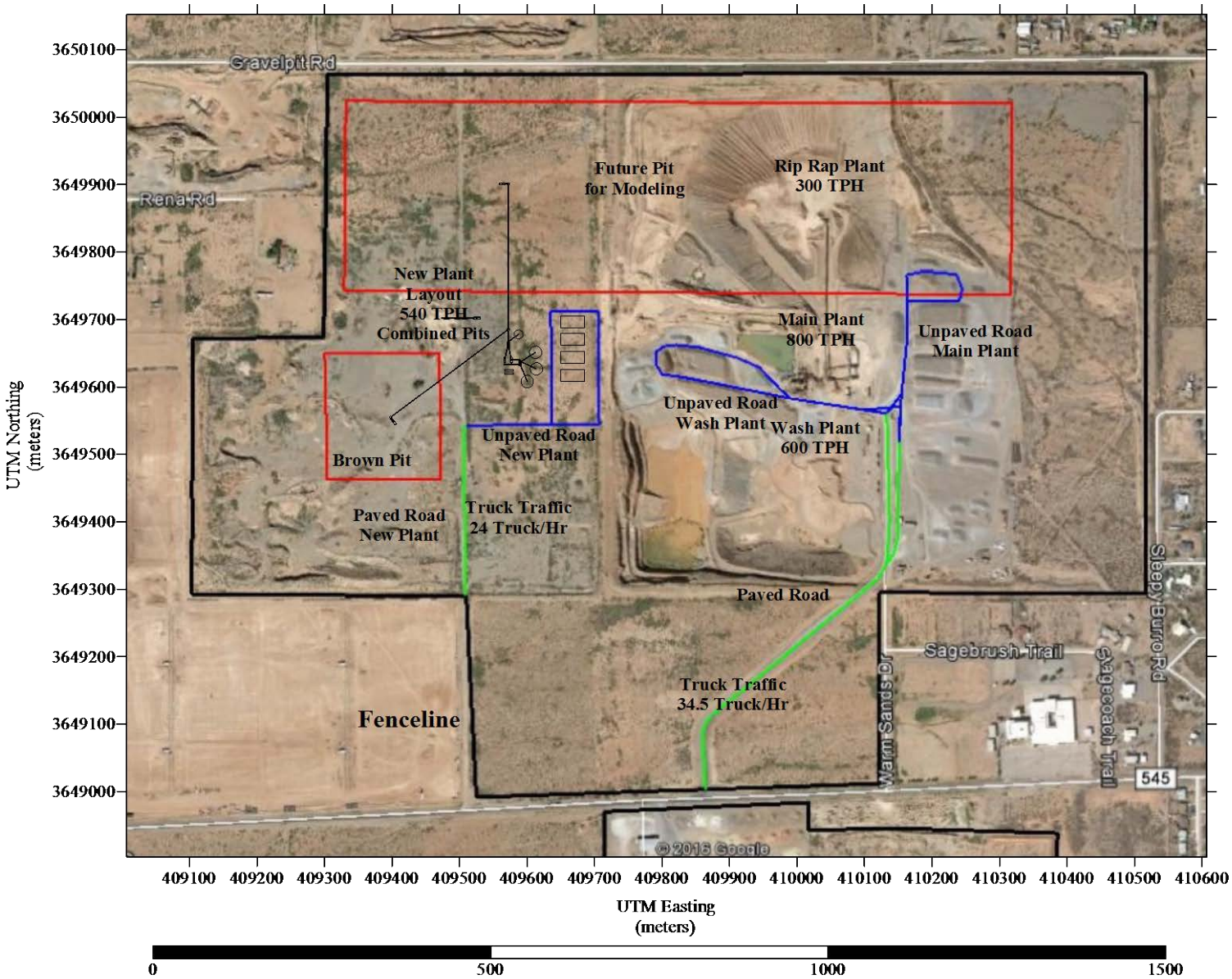

FIGURE 4: Proposed Mesa Verde La Luz Aggregate Plant Site – Plant Final Full Layout

2.0 DISPERSION MODELING PROTOCOL

This section identifies the technical approach and dispersion model inputs that will be used for the Class II federal and State ambient air quality standards for this source. New Mexico Environmental Department (NMED) Air Quality Bureau (AQB) requires that all applicable criteria pollutant emissions be modeled using the most recent versions of US EPA's approved models and be compared with National Ambient Air Quality Standards (NAAQS), and New Mexico Ambient Air Quality Standards (NMAAQS). Table 1 shows the NAAQS and NMAAQS (with footnotes) that the source's ambient impacts must meet in order to demonstrate compliance. Table 1 also lists the Class I and II Significant Impact Levels (SILs) which are used to assess whether a source has a significant impact at downwind receptors.

The dispersion modeling analysis will be performed to estimate concentrations resulting from the operation of the La Luz Aggregate Plant using the maximum hourly emission rates while all emission sources are operating for all daylight hours. The modeling will determine maximum off site concentrations for nitrogen dioxide (NO_2); carbon monoxide (CO); sulfur dioxide (SO_2); particulate matter, total suspended particles (TSP), and both 10 microns or less (PM_{10}) and 2.5 microns or less ($PM_{2.5}$), for comparison with modeling significance levels and national/New Mexico ambient air quality standards (AAQS).

The La Luz Aggregate Plant is located in Air Quality Control Region 153 where the minor source baseline date has been triggered for both NO_2 (8/2/1995) and PM_{10} (6/16/2000). PSD Class II Increment modeling will be performed to determine if the increases to the site will cause an exceedance to the PSD Class II Increment limits. PSD Class I Increment modeling will be performed to determine if the increases to the site will cause an exceedance to the PSD Class I Increment limit to Class I areas within 50 kilometers of the site. For this location, the White Mountain Wilderness Area is within 50 kilometers at 45 kilometers.

The modeling will follow the guidance and protocols outlined in the "New Mexico Air Pollution Control Bureau, Dispersion Modeling Guidelines", revised 06/17/2016, and the most up to date EPA's *Guideline on Air Quality Models*.

Initial modeling will be performed with Mesa Verde La Luz Aggregate Plant sources only to determine pollutant and averaging periods that exceeds pollutant SILs. If initial modeling for any pollutant and averaging period exceeds SILs, than cumulative modeling will be performed for those pollutants and averaging periods that exceeds the SILs will include significant neighboring sources along with background ambient concentrations.

TABLE 1: Air Quality Standard Summary

Pollutant	Avg. Period	Sig. Lev. ($\mu g/m^3$)	Class I Sig. Lev. ($\mu g/m^3$)	NAAQS	NMAAQS	PSD Increment Class I	PSD Increment Class II
CO	8-hour	500		9,000 ppb(1)	8,700 ppb(2)		
	1-hour	2,000		35,000 ppb(1)	13,100 ppb(2)		
NO_2	annual	1.0	0.1	53 ppb(3)	50 ppb(2)	2.5 $\mu g/m^3$	25 $\mu g/m^3$
	24-hour	5.0			100 ppb(2)		
	1-hour	7.54		100 ppb(4)			
$PM_{2.5}$	annual	0.3	0.06	12 $\mu g/m^3$(5)		1 $\mu g/m^3$	4 $\mu g/m^3$
	24-hour	1.2	0.07	35 $\mu g/m^3$(6)		2 $\mu g/m^3$	9 $\mu g/m^3$
PM_{10}	annual	1.0	0.2			4 $\mu g/m^3$	17 $\mu g/m^3$
	24-hour	5.0	0.3	150 $\mu g/m^3$(7)		8 $\mu g/m^3$	30 $\mu g/m^3$
TSP	7-day				110 $\mu g/m^3$		
	30-day				90 $\mu g/m^3$		
	annual	1.0			60$\mu g/m^3$		
	24-hour	5.0			150$\mu g/m^3$		
SO_2	annual	1.0	0.1		20 ppb(2)	2 $\mu g/m^3$	20 $\mu g/m^3$
	24-hour	5.0	0.2		100 ppb(2)	5 $\mu g/m^3$	91 $\mu g/m^3$
	3-hour	25.0	1.0	500 ppb(1)		25 $\mu g/m^3$	512 $\mu g/m^3$
	1-hour	7.8		75 ppb(8)			

Standards converted from ppb to $\mu g/m^3$ use a reference temperature of 25° C and a reference pressure of 760 millimeters of mercury.
(1) Not to be exceeded more than once each year.
(2) Not to be exceeded.
(3) Annual mean.
(4) 98th percentile of 1-hour daily maximum concentrations, averaged over 3 years.
(5) annual mean, averaged over 3 years.
(6) 98th percentile, averaged over 3 years.
(7) Not to be exceeded more than once per year on average over 3 years.
(8) 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years.

TABLE 2: Standards for Which Modeling Is Not Required.

Standard not Modeled	Surrogate that Demonstrates Compliance
CO 8-hour NAAQS	CO 8-hour NMAAQS
CO 1-hour NAAQS	CO 1-hour NMAAQS
NO_2 annual NAAQS	NO_2 annual NMAAQS
NO_2 24-hour NMAAQS	NO_2 1-hour NAAQS
O_3 8-hour	Regional modeling
TSP 7-day NMAAQS	TSP 24-hour NMAAQS
SO_2 annual NMAAQS	SO_2 1-hour NAAQS
SO_2 24-hour NMAAQS	SO_2 1-hour NAAQS
SO_2 3-hour NAAQS	SO_2 1-hour NAAQS

2.1 DISPERSION MODEL SELECTION

The dispersion modeling will be conducted using the American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee Dispersion Model (AERMOD), Version 15181. This model is recommended by EPA for determining Class II impacts within 50 km of the source being assessed. Additionally, AERMOD was developed to handle complex terrain. In this analysis, AERMOD will be used to estimate pollutant ambient air concentrations of NO_2, CO, SO_2, TSP, PM_{10}, and $PM_{2.5}$ from Mesa Verde's proposed revision of the La Luz Aggregate Plant Facility emission sources operating under Permit 3295-M1.

AERMOD is a Gaussian plume dispersion model that is based on planetary boundary layer principles for characterizing atmospheric stability. The model evaluates the non-Gaussian vertical behavior of plumes during convective conditions with the probability density function and the superposition of several Gaussian plumes. AERMOD modeling system has three components: AERMAP, AERMET, and AERMOD. AERMAP is the terrain preprocessor program. AERMET is the meteorological data preprocessor. AERMOD includes the dispersion modeling algorithms and was developed to handle simple and complex terrain issues using improved algorithms. AERMOD uses the dividing streamline concept to address plume interactions with elevated terrain.

AERMOD will be run using all the regulatory default options including use of:

- Gradual Plume Rise
- Stack-tip Downwash
- Buoyancy-induced Dispersion
- Calms and Missing Data Processing Routine
- Upper-bound downwash concentrations for super-squat buildings
- Default wind speed profile exponents
- Calculate Vertical Potential Temperature Gradient
- No use of gradual plume rise
- Rural Dispersion

Beta version options for AERMOD include the use ARM2 for 1-hour NO_2 dispersion modeling analysis. The ARM2 beta version is approved for use in determining 1-hour NO_2 concentrations by both the NMED AQB Modeling Guidelines and EPA Modeling Clearinghouse. Additional beta options will include horizontal stack releases for point sources. Finally, since the highest impacts for particulate emissions will be at the boundary, all volume sources will be modeled in "Flat" terrain mode.

2.2 BUILDING WAKE EFFECTS

No buildings are located near point sources, so no building downwash will be included.

2.3 METEOROLOGICAL DATA

Dispersion model meteorological input file to be used in this modeling analysis are year 1995 Holloman Air Force Base met data available from the NMED AQB website.

2.4 RECEPTORS AND TOPOGRAPHY

Modeling will be completed using as many receptor locations to ensure that the maximum estimated impacts are identified. Because of the nature of the emissions from the site, it is expected the maximum concentrations will be on or near the site fenceline.

The refined receptor grid will include receptors located at 50 meters apart out to 500 meters from the property line, 100 meters apart from 500 meters out to 1000 meters, 250 meters apart from 1000 meters out to 3000 meters, and 500 meters apart from 3000 meters out to the radius of impact (ROI). Fenceline receptor spacing will be 50 meters.

All refined model receptors will be preprocessed using the AERMAP software associated with AERMOD. The AERMAP software establishes a base elevation and a height scale for each receptor location. The height scale is a measure of the receptor's location and base elevation and its relation to the terrain feature that has the greatest influence in dispersion for that receptor. AERMAP will be run using U.S. Geological Survey (USGS) national elevation data (NED) data. Output from AERMAP will be used as input to the AERMOD runstream file for each model run.

2.5 MODELED EMISSION SOURCES INPUTS

For the facility, the proposed operating time for the La Luz Aggregate Plant will be daylight hours (see Table 4), 7 days per week, and 4380 hours per year. The hourly throughput for each plant is listed in the following table.

TABLE 3: Modeled Operational Throughputs

Plant	Tons Per Hour
Main Plant	800
Wash Plant	600
New Aggregate Plant	540
Crushing Plant	300

TABLE 4: Modeled Hours of Operation (MST)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
12:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
1:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
2:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
3:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
4:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
5:00 AM	0	0	0	1	1	1	1	1	0.5	0	0	0
6:00 AM	0	0.5	1	1	1	1	1	1	1	1	0.5	0
7:00 AM	1	1	1	1	1	1	1	1	1	1	1	1
8:00 AM	1	1	1	1	1	1	1	1	1	1	1	1
9:00 AM	1	1	1	1	1	1	1	1	1	1	1	1
10:00 AM	1	1	1	1	1	1	1	1	1	1	1	1
11:00 AM	1	1	1	1	1	1	1	1	1	1	1	1
12:00 PM	1	1	1	1	1	1	1	1	1	1	1	1
1:00 PM	1	1	1	1	1	1	1	1	1	1	1	1
2:00 PM	1	1	1	1	1	1	1	1	1	1	1	1
3:00 PM	1	1	1	1	1	1	1	1	1	1	1	1
4:00 PM	1	1	1	1	1	1	1	1	1	1	1	1
5:00 PM	0.5	1	1	1	1	1	1	1	1	1	0	0
6:00 PM	0	0	0	1	1	1	1	1	0.5	0	0	0
7:00 PM	0	0	0	0	0	0.5	0.5	0	0	0	0	0
8:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
9:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
10:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
11:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
Total	10.5	11.5	12	14	14	14.5	14.5	14	13	12	10.5	10

2.5.1 Mesa Verde La Luz Aggregate Plant Road Vehicle Traffic Model Inputs

The access road fugitive dust for truck traffic will be modeled as a line of volume sources. The NMED AQB's approved procedure for Modeling Haul Roads will be followed to develop modeling input parameters for haul roads. Volume source characterization followed the steps described in the NMED AQB Guidelines.

2.5.2 Mesa Verde La Luz Aggregate Plant Material Handling Volume Source Model Inputs

Particulate emissions from material handling and process from La Luz Aggregate Plant will be modeled as volume sources. Model input parameters for feeders, crushers, screens, and transfer points follow the NMED AQB model guidelines Table 23.

2.5.3 Mesa Verde La Luz Aggregate Plant Point Source Model Inputs

Emissions from exhaust stacks from La Luz Aggregate Plant will be modeled as point sources. Model input parameters are based on release height, release diameter, release velocity or flow rate, and release temperature. For exhaust releases at ambient temperature, the modeled temperature

input will be zero Kelvin. For horizontal or raincap releases, the AERMOD beta version for horizontal and raincap releases will be used with actual release parameters.

The La Luz Aggregate Plant will consist of four diesel-fired generators for power production, one 770 hp main plant generator, one 430 hp jaw crusher engine, one 550 hp crushing plant engine, and one 770 hp new aggregate plant generator operating during normal hours of production.

2.6 PARTICLE SIZE DISTRIBUTION

TSP and PM_{10} emissions are modeled using plume depletion. Plume deposition simulates the effect of gravity as particles '"fall-out" from the plume to the ground as the plume travels downwind. Therefore, the farther the plume travels from the emission point to the receptor, the greater the effect of plume deposition and the greater the decrease in modeled impacts or concentrations. Particle size distribution, particle mass fraction, and particle density are required inputs to the model to perform this function.

The particle size distribution data used in the modeling for aggregate handling (aggregate) is based upon data obtained from the City of Albuquerque AQB's "Air Dispersion Modeling Guidelines for Air Quality Permitting", revised 06/18/15, Table 1. Particle size distribution for fugitive road dust was obtained from the particle size *k* factors found in the AP-42 13.2.2 emission equations for unpaved roads (ver. 11/06). Silo loading baghouse emission sources (mineral filler) particle size distribution came from NMED AQB accepted. Particle size distribution for HMA baghouse stack emissions was obtained from New Mexico Environmental Department (NMED) Air Quality Bureau accepted values for hot mix asphalt plant stack particle size distributions. Particle size distribution for combustion stack emissions assumes all particulate is less than 2.5 microns.

The mass-mean particle diameter was calculated using the formula:

$$d = ((d^3_1 + d^2_1 d_2 + d_1 d^2_2 + d^3_2) / 4)^{1/3}$$

Where: d = mass-mean particle diameter
d_1 = low end of particle size category range
d_2 = high end of particle size category range

Representative average particle densities for particle types emitted in the modeling analysis were obtained from NMED accepted values. The list below summarizes these values.

Material	Bulk Density (g/cm^3)	Density Information Source
Lime (Mineral Filler)	3.3	NMED
Aggregate, Road Dust	2.5	NMED
Soot (Exhaust)	1.5	NMED
Asphalt Exhaust	1.5	NMED
Cement/Fly Ash Combined	1.95	NMED Ave

The densities and size distribution for TSP emission sources are presented in Tables 5, 6, 7, 8, 9, 10, and 11.

TABLE 5: Aggregate Handling Fugitive Source Depletion Parameters

Particle Size Category (μm)	Mass Mean Particle Diameter (μm)	Mass Weighted Size Distribution (%)	Density (g/cm^3)
TSP			
2.5 – 5	3.88	6.0	2.5
5 – 10	7.77	20.5	2.5
10 – 15	12.66	16.0	2.5
15 – 20	17.62	17.5	2.5
20 – 30	25.33	22.5	2.5
30 – 45	38.00	17.5	2.5
PM10			
2.5 – 5	3.88	22.6	2.5
5 – 10	7.77	77.4	2.5

Parameters based on values from the Albuquerque Air Quality Division Modeling Guidelines.

TABLE 6: Combustion Depletion Parameters

Particle Size Category (μm)	Mass Mean Particle Diameter (μm)	Mass Weighted Size Distribution (%)	Density (g/cm^3)
TSP and PM10			
0 – 2.5	1.57	100.0	1.5

TABLE 7: Vehicle Fugitive Dust Depletion Parameters

Particle Size Category (μm)	Mass Mean Particle Diameter (μm)	Mass Weighted Size Distribution (%)	Density (g/cm^3)
TSP			
0 – 2.5	1.57	2.6	2.5
2.5 – 10	6.92	22.9	2.5
10 – 30	21.54	74.5	2.5
PM10			
0 – 2.5	1.57	25.0	2.5
2.5 – 10	6.92	75.0	2.5

Based on AP-42 Section 13.2.2 k factors

TABLE 8: Neighbor CBP Cement/Fly Ash Silo Baghouse Source Depletion Parameters

Particle Size Category (μm)	Mass Mean Particle Diameter (μm)	Mass Weighted Size Distribution (%)	Density (g/cm^3)
TSP			
	1.5	0.11	1.95
	3	0.11	1.95
	6	0.21	1.95
	12	0.26	1.95
	24	0.23	1.95
	30	0.08	1.95
PM10			
	1.5	0.26	1.95
	3	0.25	1.95
	6	0.48	1.95

TABLE 9: Neighbor CBP Truck Loading Source Depletion Parameters

Particle Size Category (μm)	Mass Mean Particle Diameter (μm)	Mass Weighted Size Distribution (%)	Density (g/cm^3)
TSP			
2.5 – 5	3.88	6.0	1.95
5 – 10	7.77	20.5	1.95
10 – 15	12.66	16.0	1.95
15 – 20	17.62	17.5	1.95
20 – 30	25.33	22.5	1.95
30 – 45	38.00	17.5	1.95
PM10			
2.5 – 5	3.88	22.6	1.95
5 – 10	7.77	77.4	1.95

Parameters based on values from the Albuquerque Air Quality Division Modeling Guidelines.

TABLE 10: Neighbor HMA Mineral Filler Silo Baghouse Source Depletion Parameters

Particle Size Category (μm)	Mass Mean Particle Diameter (μm)	Mass Weighted Size Distribution (%)	Density (g/cm^3)
TSP			
0 – 2.5	1.57	17.4	3.3
2.5 – 10	6.91	52.1	3.3
10 – 30	21.54	30.5	3.3
PM10			
0 – 2.5	1.57	25.0	3.3
2.5 – 10	6.91	75.0	3.3

TABLE 11: Neighbor HMA Drum Baghouse Stack Depletion Parameters

Particle Size Category (μm)	Mass Mean Particle Diameter (μm)	Mass Weighted Size Distribution (%)	Density (g/cm^3)
TSP			
0-1.0	0.63	15.0	1.5
1.0-2.5	1.85	6.0	1.5
2.5-10	6.92	9.0	1.5
10.0-15.0	12.66	5.0	1.5
15.0-30.0	23.3	65.0	1.5
PM10			
0-1.0	0.63	50.0	1.5
1.0-2.5	1.85	19.0	1.5
2.5-10	6.92	31.0	1.5

Based on AP-42 Section 11.1 Tables 11.1-3 and 11.1-4.

2.7 $PM_{2.5}$ SECONDARY EMISSIONS MODELING

The form of the $PM_{2.5}$ 24 hour design value is based on the 98th percentile or the highest 8th high result. Calculated $PM_{2.5}$ combustion emission rates included into the model consist of both filterable and condensable components. Secondary $PM_{2.5}$ emissions from combustion sources are created by the conversion to nitrates and sulfates as the exhaust plume travels away from the source and mixes with ambient air. Fugitive dust emission sources do not consist of a condensable component and will not create secondary emissions of $PM_{2.5}$.

$PM_{2.5}$ secondary emission concentration analysis will follow EPA guidelines and EPA Appendix W. Based on preliminary emission rate estimations, Tier 3 analysis will be used since direct $PM_{2.5}$

emissions are greater than 10 tpy, and NOx emission are greater than 40 tpy. The impacts for secondary emissions will be based on the model analysis for NOx and direct $PM_{2.5}$ results. Since time is a factor in creation of secondary pollutants, the analysis will look at the receptor concentrations of NOx and direct $PM_{2.5}$ as you travel from the model boundary. If the highest concentrations are at the boundary where there is not time to convert to secondary pollutants and concentration drop-off is significant as you travel away from the site, then qualitatively you are not going to find higher concentrations then what is seen at the model boundary. If this is true, then $PM_{2.5}$ concentrations will only be from direct emission contribution and not secondary emissions contribution and the comparison with the $PM_{2.5}$ 24 hour NAAQS will be based on the 98th percentile or highest 8th high.

2.8 NO_2 DISPERSION MODELING ANALYSIS

The AERMOD model predicts ground-level concentrations of any generic pollutant without chemical transformations. Thus, the modeled NO_X emission rate will give ground-level modeled concentrations of NO_X. NAAQS and NMAAQS values are presented as NO_2. If modeling shows exceedance with NO_2 1-hour and annual SILs, CIA modeling will be performed.

EPA has a three-tier approach to modeling NO_2 concentrations.

- Tier I – total conversion, or all NOx = NO_2
- Tier II – use a default NO_2/NOx ratio, 1 hour = 80%; Annual = 75% or Ambient Ratio Method 2[1] (ARM2) modeling.
- Tier III – case-by-case detailed screening methods, such as OLM (Ozone Limiting Method) and Plume Volume Molar Ratio Method (PVMRM)

Initial modeling will be performed using both Tier I and Tier II methodologies. If these modeling iterations demonstrate that less conservative methods for determining 1-hour NO_2 compliance would be needed for this project, then ambient impact of 1-hour NOx predicted by the model will use Tier III – OLM or PVMRM.

Tier III NO_2 modeling approach, OLM or PVMRM, consider the basic chemical assumptions, the titration of NO by ozone to form NO_2. Both use the NO_2/NO_X in-stack ratio (ISR) and information about the ambient ozone in the determination of the amount of titration that will occur in the plume. The primary difference between the two methods is the way in which the amount of ozone available for conversion of NO to NO_2 is determined. OLM assumes that all the ambient ozone is available for NO titration (i.e., instantaneous complete mixing with background air), regardless of the source or plume characteristics. In contrast, PVMRM determines the amount of ozone within the plume volume (computed from the source to the receptor) and limits the conversion of NO to NO_2 based on the ozone entrained in the plume. The calculation of the plume volume is done for an individual source or group of sources and on an hourly basis for each source/receptor combination, taking into

[1] Memo: "Clarification on the Approval Process for Regulatory Application of the AERMOD Modeling System Beta Options" Richard A. Wayland, Director, Air Quality Assessment Division (C304-02), dated December 10, 2015.

account the plume dispersion for that hour. For this modeling analysis, if the Tier III methodology is required, PVMRM will be selected.

For PVMRM, three inputs can be selected in the model, the ISR, the NO_2/NO_X equilibrium ratio for the ambient air, and the ambient ozone concentration. The ISR will be determined for each source or group of sources. The NO_2/NO_X equilibrium ratio will be the EPA default of 0.90. Ozone input will be from monitored ozone data collected from Carlsbad (Monitor ID 5ZR), which is the most representative monitoring site nearest to the project.

In-Stack Ratio (ISR)

It is evident that at distances close to a modeled source, the modeled NO_2/NO_X ratio (and, thus, the NO_2 concentration) is highly dependent upon the assumed ISR. The use of the default ratio of 0.5 can result in large over predictions at a facility fence line. References are available for similar equipment categories (diesel-fired RICE and gas combustion) with actual in-stack data from EPA's ISR database summarized in Table 12. The main plant engine considered for this site will be similar to a Caterpillar 3512.

TABLE 12: EPA's ISR Database - Diesel-fired RICE[2]

Equipment class	Equipment manufacturer & model	Equipment capacity	Control Equipment	Load (% of capacity)	Avg. NO2	Avg Nox	Ratio
Reciprocating IC Engine	Caterpillar 3512	810 kW	Uncontrolled	99	146.5	1842	0.0795
Reciprocating IC Engine	Caterpillar 3512	810 kW	Uncontrolled	84	155	1875	0.0827
Reciprocating IC Engine	Caterpillar 3512	810 kW	Uncontrolled	69	163.9	1857	0.0882
Reciprocating IC Engine	Caterpillar 3512	810 kW	Uncontrolled	49	171.5	1789	0.0959
Reciprocating IC Engine	Caterpillar 3516	1,100 kW	Uncontrolled	47	164.2	1665	0.0986
Reciprocating IC Engine	Caterpillar 3516	1,100 kW	Uncontrolled	65	165.2	1860	0.0888
Reciprocating IC Engine	Caterpillar 3516	1,100 kW	Uncontrolled	78	154.7	1882	0.0822
Reciprocating IC Engine	Caterpillar 3516	1,100 kW	Uncontrolled	96	138.1	1833	0.0753
Reciprocating IC Engine	Caterpillar 3606	1,500 kW	Uncontrolled	100	147	1861	0.0790
Reciprocating IC Engine	Caterpillar 3606	1,500 kW	Uncontrolled	80	146.8	1869	0.0785
Reciprocating IC Engine	Caterpillar 3606	1,500 kW	Uncontrolled	66	141.1	1799	0.0784
Reciprocating IC Engine	Caterpillar 3606	1,500 kW	Uncontrolled	47	129.8	1674	0.0775
Reciprocating IC Engine	Caterpillar 3512C	1,050 kW	Uncontrolled	30	15	415	0.0361
Reciprocating IC Engine	Caterpillar 3512C	1,050 kW	Uncontrolled	60	12.3	559	0.0220
Reciprocating IC Engine	Caterpillar 3512C	1,050 kW	Uncontrolled	90	19.4	726	0.0267
Reciprocating IC Engine	Caterpillar 3516	1,135 kW	Uncontrolled	40	128.4	1534	0.0837
Reciprocating IC Engine	Caterpillar 3516	1,135 kW	Uncontrolled	60	148.2	1986	0.0746
Reciprocating IC Engine	Caterpillar 3516	1,135 kW	Uncontrolled	90	123.4	1963	0.0629
Reciprocating IC Engine	Caterpillar 3516	440 kW	Uncontrolled	30	79.9	1186	0.0674
Reciprocating IC Engine	Caterpillar 3516	440 kW	Uncontrolled	70	133.3	1914	0.0696
Reciprocating IC Engine	Caterpillar 3516	440 kW	Uncontrolled	100	167	2241	0.0745
Reciprocating IC Engine	Caterpillar 3516B	1,285 kW	Uncontrolled	30	54.7	901	0.0607
Reciprocating IC Engine	Caterpillar 3516B	1,285 kW	Uncontrolled	50	78.7	1183	0.0665
Reciprocating IC Engine	Caterpillar 3516B	1,285 kW	Uncontrolled	80	76.2	1128	0.0676
						Ave	0.072
						Max	0.099
						Min	0.022

Based on EPA's ISR databases, a proposed conservative NO_2/NOx ISR ratio for Diesel-fired RICE is 0.10. No data could be found for the neighboring Mesa Verde hot mix asphalt drum, so to be conservative the EPA default ISR of 0.50 will be used. For neighboring sources, since the ISR has a diminishing impact on ambient NO2/NOx ratios as a plume is transported farther downwind due to mixing and reaction towards background ambient NO_2/NO_X ratios, a default ISR of 0.20[3] in lieu of source specific data will be used.

[2] EPA's NO2/NOx ISR Database http://www3.epa.gov/ttn/scram/no2_isr_database.htm

[3] Technical support document (TSD) for NO2-related AERMOD modifications, EPA- 454/B-15-004, July 2015

NO_2/NO_X Ambient Equilibrium Ratio
Following EPA guidelines, the ambient equilibrium ratio of 0.90 (EPA Default) will be used.

Model Ozone Data
For PVMRM, modeling of the project-generated 1-hour NO_2 concentrations requires use of ambient monitored O_3 concentrations. Background ambient O_3 concentrations for the area will be based on Carlsbad, which is the most representative monitoring site nearest to the project.

2.9 REGIONAL BACKGROUND CONCENTRATIONS

Ambient background concentrations represent the contribution of pollutant sources that are not included in the modeling analysis, including naturally occurring sources. If the modeled concentration of a criteria pollutant is above the modeling significance level, the background concentration for each criteria pollutant will be added to the maximum modeled concentration to calculate the total estimated pollutant concentration for comparison with the AAQS. For neighboring sources within 65 kilometers of the La Luz Aggregate Plant, the latest neighboring sources will be obtained from the NMED Air Quality Bureau, Modeling Section.

For particulate background no state monitor is located near La Luz, NM that is representative of the area. The closes monitoring stations are in Las Cruces, NM. These monitors, while the closest, are directly influenced by emissions generated in El Paso and Mexico with prevailing winds from the south-southeast up the Rio Grande Valley. The terrain around the La Luz Aggregate Plant includes the Lincoln National Forest and Sacramento Mountains to the east. This terrain is similar to what is found around Santa Fe, NM. While Santa Fe has a larger population then both La Luz and Alamogordo, NM, it should be representative of type of particulate sources found in the monitored background around La Luz. For this reason Santa Fe particulate monitoring is selected. For $PM_{2.5}$, PM_{10} and TSP, refined backgrounds from Santa Fe NMED (Monitor ID 3HM) will be used.

For NO_2, background concentrations from Outside Carlsbad (Monitor ID 5ZR) will be used as it is the closest representative monitor near La Luz, NM. For SO_2, background concentrations from Bloomfield (Monitor ID 1ZB) will be used. For CO, the background value will be the default for the rest of the state of New Mexico. For Ozone, background concentrations from Carlsbad (Monitor ID 5ZR) will be used.

	1 Hour ($\mu g/m^3$)	**3 Hour ($\mu g/m^3$)**	**8 Hour ($\mu g/m^3$)**	**24 Hour ($\mu g/m^3$)**	**Annual ($\mu g/m^3$)**
NO_2	48.263				4.617
CO	1787.865		1183.006		
SO_2	13.9656				
Ozone	155.643				
$PM_{2.5}$				9.45	4.32
PM_{10}				20.67	
TSP				23.00	8.96

2.10 CLASS II PSD INCREMENT ANALYSIS

If the results of the ROI analysis show an exceedence of the significance levels, Class II PSD increment analysis will be conducted. The PSD analysis will be conducted including all PSD increment consuming sources with the surrounding area within 50 km plus the ROI or 65 km of the facility (whichever is greater). Unlike the CIA, a predicted maximum concentration will be compared with the Class II PSD standards.

Modeled emissions will include emission increases to the site since the PSD PM_{10} minor source baseline date was triggered. Removed emission sources operating at the site at the time of the minor source baseline trigger date will be include as PSD increment expanding sources in the PSD PM_{10} Increment analysis. Prior to Permit 3295-M1 operating at the site and at the time when the PM_{10} minor source baseline date was triggered, Permits 2079 and 503-M1 were operating at the site. These sources were removed after the PSD PM_{10} minor source baseline date was triggered and before Permit 3295-M1 and will be included in the model as PM_{10} increment expanding sources.

Mesa Verde Enterprises also operates the property directly south of the site across Alamo Street (see Figure 1). At this site is located a concrete batch plant (CBP) operating under GCP-5-3560, a hot mix asphalt (HMA) plant operating under Permit 941, and an aggregate plant operating under Permit 2116-M2-R1. For the CBP and HMA plant these source will remain in operation. The HMA plant was operating prior and after to the minor source baseline date for PM_{10} and will not be included in the PM_{10} increment analysis. For the CBP, it was installed after the PM_{10} minor source baseline date and will be include in the PM_{10} increment analysis. For Permit 2116-M2-R1, this permit will be relocated, suspended, or withdrawn. At the time of the PSD PM_{10} minor source baseline date, the aggregate plant was operating under Permit 2116 and these emission sources will be include as increment expanding sources in the PSD Increment analysis.

2.11 CLASS I AREA ANALYSIS

The National Park Service (NPS) requires an impact analysis be performed for any Class I area located within 300 km of a proposed project and the United States Forest Service (USFS) requires an impact analysis for Class I areas within 100 km of a proposed project. There are several Class I areas within this region, with the White Mountain Wilderness Area being the closest at approximately 45 km from the facility.

The NPS, the USFS, and the US Fish & Wildlife Service have developed guidance for performing impact analyses in Class I areas.[4] Following this guidance La Luz Aggregate Plant will demonstrate compliance with Class I PSD standards.

[4] NPS, et al. *2010 Federal Land Managers' Air Quality Related Values Work Group (FLAG) Phase I Report – Revised (2010).*