Air Quality Review and Comments:

Syar Napa Quarry Expansion EIR

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Introduction

At the request of the Napa citizens' group Stop Syar Expansion, I reviewed the air quality and health risk analysis (HRA) provided in the Syar Napa Quarry Expansion Environmental Impact Report (EIR). In the following sections, I present my findings regarding the EIR's outdated modeling practices, inappropriate meteorological data, and failure to include any modeling of PM_{10} emissions from the proposed expansion project.

I hold an M.A. (2012) degree in Geography from California State University, Northridge, where I specialized in GIS and air dispersion modeling. My thesis, titled "Diesel Trucks: Health Risk and Environmental Equity," involved the use of USEPA's AERMOD model to determine concentrations of diesel particulate matter (DPM) around several Southern California freeways, focusing on pollution from port-related diesel truck traffic. In addition, I performed population analyses, examining inequities related to race and income groups exposed to DPM.

I also have broad experience as a consultant providing litigation support. I have performed numerous air quality modeling analyses using air dispersion models such as AERMOD, prepared meteorological data using AERMET, performed health risk assessments, and created many detailed maps and graphics. I have experience preparing analyses of various emission types from many sources and facilities including coal-fired power plants, agricultural fields, and mobile sources.

The Syar EIR finds that PM_{10} emissions from the project expansion will be less than the 15 tons per year significance criterion for this pollutant (DEIR, p. 37). This finding is only made possible by assuming the project expansion will use roadway fugitive dust emission controls that are much more effective than Syar's current practices. Syar could be using the proposed roadway fugitive dust emission controls now, which would reduce the current air quality impacts from the Syar facility.

A major flaw in the EIR is the complete lack of any PM_{10} air quality impact analysis for the project expansion. PM_{10} is a significant public health concern as these small particulates (less than 10 micrometers in size) can cause or exacerbate a number of conditions. From USEPA:

> Major concerns for human health from exposure to PM-10 include: effects on breathing and respiratory systems, damage to lung tissue, cancer, and premature death. The elderly, children, and people with chronic lung disease, influenza, or asthma, are especially sensitive to the effects of particulate matter.[1]

California has a long-established ambient air quality standard for PM_{10}. The 24-hour California Ambient Air Quality Standards (CAAQS) for PM_{10} is 50 $\mu g/m^3$. The 24-hour National Ambient Air Quality Standards (CAAQS) for PM_{10} is 150 $\mu g/m^3$. These health-based standards apply to areas of ambient air, which is any area outside the Syar facility fenceline.

[1] http://www3.epa.gov/airtrends/aqtrnd95/pm10.html

Given the EIR deficiencies, I performed a detailed PM_{10} air dispersion modeling analysis, based on current USEPA modeling guidelines. My analysis shows that the mitigated Syar expansion will cause 24-hour PM_{10} impacts in excess of 500 $\mu g/m^3$. This offsite air impact greatly exceeds both the 24-hour CAAQS and NAAQS for PM_{10}. Furthermore, the area where Syar's mitigated project expansion will cause 24-hour PM_{10} impacts exceeding the 24-hour PM_{10} CAAQS extends well into the city of Napa, and covers many residential and sensitive population locations. These are significant air quality impacts that the EIR failed to identify.

Because of the HRA and PM_{10} deficiencies in the EIR, the proposed project expansion must be denied.

I. Sespe Performed the Health Risk Analysis Using Outdated Modeling Practices

The EIR HRA and associated air dispersion modeling was performed by Sespe Consulting, Inc. In their HRA modeling, Sespe used the ISCST3 dispersion model (Version 02035). ISCST3 has not been in general use for roughly 10 years.

In 2005, the USEPA adopted AERMOD as the preferred air dispersion model for determining air impacts within 50 kilometers of air pollution emission sources, replacing the ISCST3 model.[2] Sespe's use of ISCST3 is inappropriate, and the entire HRA needs to be revised to include current modeling practices.

II. Sespe Failed to Use Appropriate Meteorological Data

Sespe used meteorological data provided by GHD for the years 1994, 1995, 1997, 2000, and 2001 from the Napa County Airport (DEIR Appendix I, Page 32). USEPA's definition of preferred meteorological data includes the most recent five years of National Weather Service (NWS) data. Currently, this condition is satisfied using 2010 through 2014 Automated Surface Observing Station (ASOS) data collected at the Napa County Airport. From Section 8.3.1.2 of the Guideline on Air Quality Models:

> a. Five years of representative meteorological data should be used when estimating concentrations with an air quality model. Consecutive years from the most recent, readily available 5-year period are preferred. The meteorological data should be *adequately representative*, and may be site specific or from a nearby NWS station. Where professional judgment indicates NWS-collected ASOS (automated surface observing stations) data

[2] USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, November 9, 2005. http://www.epa.gov/scram001/guidance/guide/appw_05.pdf.

> are inadequate [for cloud cover observations], the most recent 5 years of NWS data that are observer-based may be considered for use.
>
> The use of 5 years of NWS meteorological data or at least 1 year of site specific data is required. If one year or more (including partial years), up to five years, of site specific data is available, these data are preferred for use in air quality analyses. Such data should have been subjected to quality assurance procedures as described in subsection 8.3.3.2. (Italics in original.)[3]

More importantly, pre-2006 meteorological data are usually based on airport wind measurements that include an over-stated number of calm conditions. To address this issue, the meteorological data should be supplemented with one-minute ASOS data processed with USEPA's AERMINUTE program (v. 14337) to reduce the number of calm hours.

At the 10th Conference on Air Quality Modeling, held in March 2012, EPA stated that the purpose of the revised AERMET and AERMINUTE programs is "not to introduce conservatism" into the model, but rather to "Reclaim data that was "lost" due to coding, making station more representative."[4] Furthermore, EPA "recommends that AERMINUTE should routinely be used to supplement the standard NWS data with hourly-averaged winds based on the 1-minute ASOS wind data (when available)."[5]

These recommendations have also been presented in a March 2013 Clarification Memo from EPA:[6]

> Given the limitations and significant concerns regarding the adequacy of standard ASOS data, and considering the relevant recommendations in the *Guideline* related to these concerns, we recommend that AERMINUTE be routinely used to supplement the standard ASOS data with hourly-averaged wind speed and direction to support AERMOD dispersion modeling. Since the 1-minute ASOS wind data used as input to AERMINUTE are freely available to the public, this recommendation should not impose any significant burden on permit applicants applying the AERMOD model.[7]

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[3] *Id.*, p. 68244.

[4] James Thurman, EPA/OAQPS, AERMINUTE, 10th Conference on Air Quality Modeling. http://www.epa.gov/ttn/scram/10thmodconf/presentations/1-7-aerminute_update.pdf.

[5] Roger Brode, EPA/OAQPS, Appendix W: Clarification Memoranda, 10th Conference on Air Quality Modeling. http://www.epa.gov/ttn/scram/10thmodconf/presentations/1-4-Brode_10thMC_AppW_ClarificationMemos_03-13-2012.pdf.

[6] EPA, Use of ASOS Meteorological Data in AERMOD Dispersion Modeling, March 8, 2013. http://www.epa.gov/ttn/scram/guidance/clarification/20130308_Met_Data_Clarification.pdf.

[7] *Id.*, p. 12.

EPA summarizes the recommended use of ASOS meteorological data as follows:

- EPA has developed the AERMINUTE processor to calculate hourly average winds from 1-minute ASOS winds, whose purpose is to replace the single 2-minute winds that represent an hour with an hourly-averaged wind that is reflective of actual conditions and more appropriate for input for dispersion modeling.
- EPA recommends that AERMINUTE be routinely used in general practice in AERMOD modeling as the hourly average winds better reflect actual conditions over the hour as opposed to a single 2-minute observation.
- EPA has also implemented a threshold option in AERMET to treat winds below the threshold as calms, with a recommended minimum wind speed of 0.5 m/s, consistent with the threshold required for site-specific data.[8]

For these reasons, all modeling included in the EIR's HRA needs to be revised using the USEPA AERMOD air dispersion model and the most recent five years of available meteorological data from the Napa County Airport. To ensure an accurate representation of actual conditions, the hourly wind data must also be supplemented with 1-minute ASOS wind data processed with AERMINUTE.

III. The Syar Napa Quarry Expansion Project with Proposed Mitigation Causes Significant24-Hour PM_{10} CAAQS Violations

The EIR claims that "Implementation of Mitigation Measure 4.3-2B will reduce PM10 and PM2.5 emissions to less than the respective 15-ton per year and 10-ton per year significance thresholds as shown in Table 4.3-11." (DEIR, p. 37) The assumption is made that with mitigation measures, PM_{10} impacts will be less than those under current practices, and therefore modeling of PM_{10} impacts is unnecessary and not included in the EIR. However, this assumption is problematic.

First, the proposed mitigation practices are unenforceable. Should they not be implemented as described, the resulting impacts from fugitive dust would be higher than estimated.

Furthermore, there are no PM_{10} monitors within a reasonable distance of the Syar Napa Quarry. It is probable that the current emissions from the quarry are in violation of the California Ambient Air Quality Standard (CAAQS), and are going undetected. If this is the case, it is not a viable assumption that project emissions with mitigation would be in compliance with standards.

[8] *Id.,* p. 13.

To test this theory, I performed an air dispersion modeling analysis of PM_{10} impacts, with results showing violations of the CAAQS. The CAAQS for PM_{10} (50 $\mu g/m^3$) is based on highest modeled 24-hour impacts. This level must never be equaled or exceeded. The following is a description of my analysis and results. Modeling output files are available upon request.

a. Modeling Methodology

This section describes the modeling methodology I used for verifying whether the Syar Napa Quarry Expansion Project causes violations of the 24-hour PM_{10} CAAQS.

Dispersion Model

I performed 24-hour PM_{10} modeling with USEPA's AERMOD program, v. 15181, obtained from the Support Center for Regulatory Atmospheric Modeling (SCRAM) website. Version 15181 is the latest version of the AERMOD model, which was completed on June 30, 2015. As stated in Section I., AERMOD is the preferred air dispersion model for determining air impacts within 50 kilometers of air pollution emission sources.[9]

Geographical Inputs

The "ground floor" of all air dispersion modeling analyses is establishing a coordinate system for identifying the geographical location of emission sources and receptors. These geographical locations are used to determine local characteristics (such as land use and elevation), and also to ascertain source to receptor distances and relationships.

I used the Universal Transverse Mercator (UTM) NAD83 zone 10 coordinate system for identifying the easting (x) and northing (y) coordinates of the modeled sources and receptors. I obtained the source locations from modeling files included with the EIR (DEIR, Appendix M). I verified the source coordinates using Google Earth Pro orthoimagery, which ensures consistency with the UTM NAD83 coordinate system.

Receptors

I created a grid of 2,806 receptors in 200 meter increments covering the Syar Quarry and surrounding areas. I also modeled the sensitive and fenceline receptors identified in the EIR.

[9] USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, November 9, 2005.

Sespe's modeling analysis included in EIR Appendix I assumes flat terrain for all sources and receptors. However, this approach is only appropriate for scenarios with stable downslope flow, which are limited to certain conditions occurring during nighttime hours only. In the case of Syar Napa Quarry, modeling with flat terrain would actually overestimate impacts. For more accurate results, I modeled source and receptor locations with terrain elevation data, in meters above sea level. I obtained terrain elevation data for these locations using National Elevation Dataset (NED) GeoTiff data for the area encompassing the Syar facility and the modeled receptors. GeoTiff is a binary file that includes data descriptors and geo-referencing information necessary for extracting terrain elevations. I extracted terrain elevations from the NED files using USEPA's AERMAP program, v. 11103, with 1/3rd arc-second (10 meter horizontal) resolution.

Source Parameters and Emission Rates

I modeled using source parameters consistent with modeling provided in the EIR. The following table, from DEIR page 20 of Appendix H of Appendix I, includes the modeled sources:

Recommended Model Sources

Link	Description	Surface	On or Off Road	Length (ft)	Length (mi)
A	Fork to Rail Loading	Paved	Off	3,370	0.64
B	Fork to Scalehouse	Paved	Both	1,135	0.21
C	Fork to Freeway	Paved	On	800	0.15
D	Rail Loading to Barge Loading	Paved	Off	1,415	0.27
E	Barge Loading Onsite	Unpaved	Off	400	0.076
F	Scalehouse to AC Plants	Unpaved	On	900	0.17
G	Scalehouse to Sand Plant	Unpaved	On	1,650	0.31
seperated	Scalehouse to Rip Rap	Unpaved	On	5,450	1.00
H	Scalehouse to Pit Road	Unpaved	Both	2,040	0.39
I	Pit Road to AB Plant	Unpaved	On	3,960	0.75
J	Fork Near Pits to Grey Pit Roa	Unpaved	Both	1,990	0.38
K	Blue/Snake Pit Split to Blue Pi	Unpaved	Off	3,805	0.72
L	Blue/Snake Pit Split to Snake	Unpaved	Off	3,605	0.68
M	Plant Feed Approach to Blue/S	Unpaved	Off	2,250	0.43
N	Plant Feed Approach	Unpaved	Off	615	0.12
O	Plant Feed Approach to Grey I	Unpaved	Off	650	0.12
P	Grey Pit Road to Rip Rap	Unpaved	Both	1,420	0.27
Q	Rip Rap to Grey Pit	Unpaved	Off	680	0.13
R	Napa Vallejo Highway North	Paved	On	5,800	1.10
S	Napa Vallejo Highway South	Paved	On	3,715	0.70
Avg. (F,G)	Scalehouse to main plant area	Unpaved	On	1,275	0.24

I modeled using PM_{10} emission rates also obtained from the EIR, taken from pages 3-7 of the section titled "Fugitive Dust and Blasting Emissions," found in Appendix I of Appendix I. It should be noted that I modeled emissions from fugitive dust only, and did not include combustion emissions in my modeling, which would cause even higher impacts. I modeled these emission releases from 6:00 a.m. through 6:00 p.m., with the remaining hours having emission rates of 0. The following table details the emission rates I used for modeling:

Source	ID	NSRC	Onroad PM10 lb/hr	Offroad PM10 lb/hr	Other PM10 lb/hr	g/s	Surface	On or Off Road
On- and Offroad Travel Fork to Scalehouse	B	11	1.18	0.40		1.81E-02	Paved	Both
Onroad Travel Fork to Freeway	C	8	0.84			1.32E-02	Paved	On
On- and Offroad Travel Scale to Plant Area	avg (F,G)	17	9.90	3.15		9.67E-02	Unpaved	On
Onroad Travel Scalehouse to Fork	H	20	6.92			4.36E-02	Unpaved	Both
Onroad Travel Scalehouse to AB Plant	I	38	11.09			3.68E-02	Unpaved	On
Offroad Travel Onsite	n/a							
Fork to Grey Pit Haul Road	J	19	1.12	1.60		1.80E-02	Unpaved	Both
Blue Pit Haul Road	K	37		17.80		6.06E-02	Unpaved	Off
Snake Pit Haul Road	L	36		16.80		5.88E-02	Unpaved	Off
Plant Feed Approach to Blue/Snake Pits	M	21		21.30		1.28E-01	Unpaved	Off
Plant Feed Approach	N	7		7.40		1.33E-01	Unpaved	Off
Plant Feed Approach to Grey Pit Haul Road	O	7		0.70		1.26E-02	Unpaved	Off
Grey Pit Haul Road to Rip Rap	P	14	0.80	1.60		2.16E-02	Unpaved	Both
End of Grey Pit Haul Road	Q	6		0.80		1.68E-02	Unpaved	Off
Offroad Travel to Rail/Barge	A	33		1.22		4.66E-03	Paved	Off
Offroad Travel to Barge	D	14		0.37		3.33E-03	Paved	Off
Offroad Travel to Barge Site	E	5		0.71		1.79E-02	Unpaved	Off
Offroad Excavations					1.96			
Offroad in Grey Pit (23.7%)	03	1			0.46	5.86E-02		
Offroad in Blue Pit (21.6%)	01	1			0.42	5.34E-02		
Offroad in Snake Pit (54.7%)	02	1			1.07	1.35E-01		
Offroad in Processing Area	04	1			1.96	2.47E-01		
Rail Loading	10	1				0.00E+00		
Barge Unloading	11	1				0.00E+00		
Blue Plant (emissions attributed to Source 4)	n/a							
Asphalt Plants (emissions calculated elsewhere)	08, 09							
AB Plant	06	1				0.00E+00		
Napa Vallejo Highway North	R	56	0.10			2.25E-04	Paved	On
Napa Vallejo Highway South	S	36	0.40			1.40E-03	Paved	On

Methods Used to Prepare 2010 – 2014 Meteorological Data

The meteorological data required by AERMOD is prepared by AERMET. Required data inputs to AERMET are: surface meteorological data, twice-daily soundings of upper air data, and the

micrometeorological parameters surface roughness, albedo, and Bowen ratio.[10] AERMET creates the model-ready surface and profile data files required by AERMOD. Using AERMET v. 15181, I created an AERMOD-ready meteorological data set to model the proposed Syar Napa Quarry expansion. This data set covers five years, 2010 through 2014, and is summarized as follows:

Meteorological data used for modeling the Syar Napa Quarry:

Surface data: Napa County Airport (KAPC);

Upper air data: Oakland International Airport (KOAK).

Surface Meteorological Data

I used 2010 through 2014 Integrated Surface Hourly (ISH) data obtained from the National Climatic Data Center (NCDC). From the ISH dataset, I extracted ASOS data from the Napa County Airport.

I also obtained 2010 through 2014 one-minute ASOS wind data from the Napa County Airport, which I processed with AERMINUTE v. 14337. I downloaded these one-minute data from the NCDC.[11] I input the ice-free wind instrument start date (March 18, 2008) and used default settings with AERMINUTE. As a quality assurance measure, I compared values developed from the one-minute data with the corresponding ISH data file.

I processed the ISH data through AERMET Stage 1, which performs data extraction and quality control checks. I merged the AERMINUTE output files with the processed AERMET Stage 1 ISH and upper air data in AERMET stage 2.

Upper Air Meteorological Data

I used 2010 through 2014 upper air data from twice-daily radiosonde measurements obtained

[10] Albedo is the fraction of total incident solar radiation reflected by the surface back to space (whiter surfaces have higher albedo). The Bowen ratio is an indicator of surface moisture. It is the ratio of sensible heat flux to latent heat flux and drier areas have a higher Bowen ratio. Surface roughness, shown in shorthand as ("z_0"), is an essential parameter in estimating turbulence and diffusion. Technically, it's the height above the ground that the log wind law extrapolates to zero. For our purposes, z_0 can be thought of as a measure of how much the surface characteristics interfere with the wind flow. Very smooth surfaces, like short grass or calm ponds, have very low values of z_0 -- on the order of 0.01 meter or less. Tall and irregular surfaces, which are a greater obstacle to wind flow, have higher values of z_0 – up to 1.0 meter or more for forests.

[11] See: ftp://ftp.ncdc.noaa.gov/pub/data/asos-onemin/

from Oakland International Airport. These data are in Forecast Systems Laboratory (FSL) format which I downloaded in ASCII text format from NOAA's FSL website.[12] I downloaded and processed all reporting levels with AERMET.

Upper-air data are collected by a "weather balloon" that is released twice per day at selected locations. As the balloon is released, it rises through the atmosphere, and radios the data back to the surface. The measuring and transmitting device is known as either a radiosonde, or rawindsonde. Data collected and radioed back include: air pressure, height, temperature, dew point, wind speed, and wind direction. I processed the FSL upper air data through AERMET Stage 1, which performs data extraction and quality control checks.

AERSURFACE and Final Processing

I used AERSURFACE v. 13016 to develop surface roughness, albedo, and daytime Bowen ratio values in a region surrounding the meteorological data collection site (Napa County Airport). Using AERSURFACE, I extracted surface roughness in a one kilometer radius surrounding the data collection site. I also extracted Bowen ratio and albedo for a 10 kilometer by 10 kilometer area centered on the meteorological data collection site. I processed these micrometeorological data for seasonal periods using 30-degree sectors.

I applied the AERSURFACE outputs in Stage 3 AERMET processing. At this point, I also incorporated a 0.5 meter/second threshold velocity for one-minute ASOS winds that had been processed with AERMINUTE. I did not fill missing hours in the meteorological data sets as the data files exceed USEPA's 90% data completeness requirement.[13]

b. Modeling Results

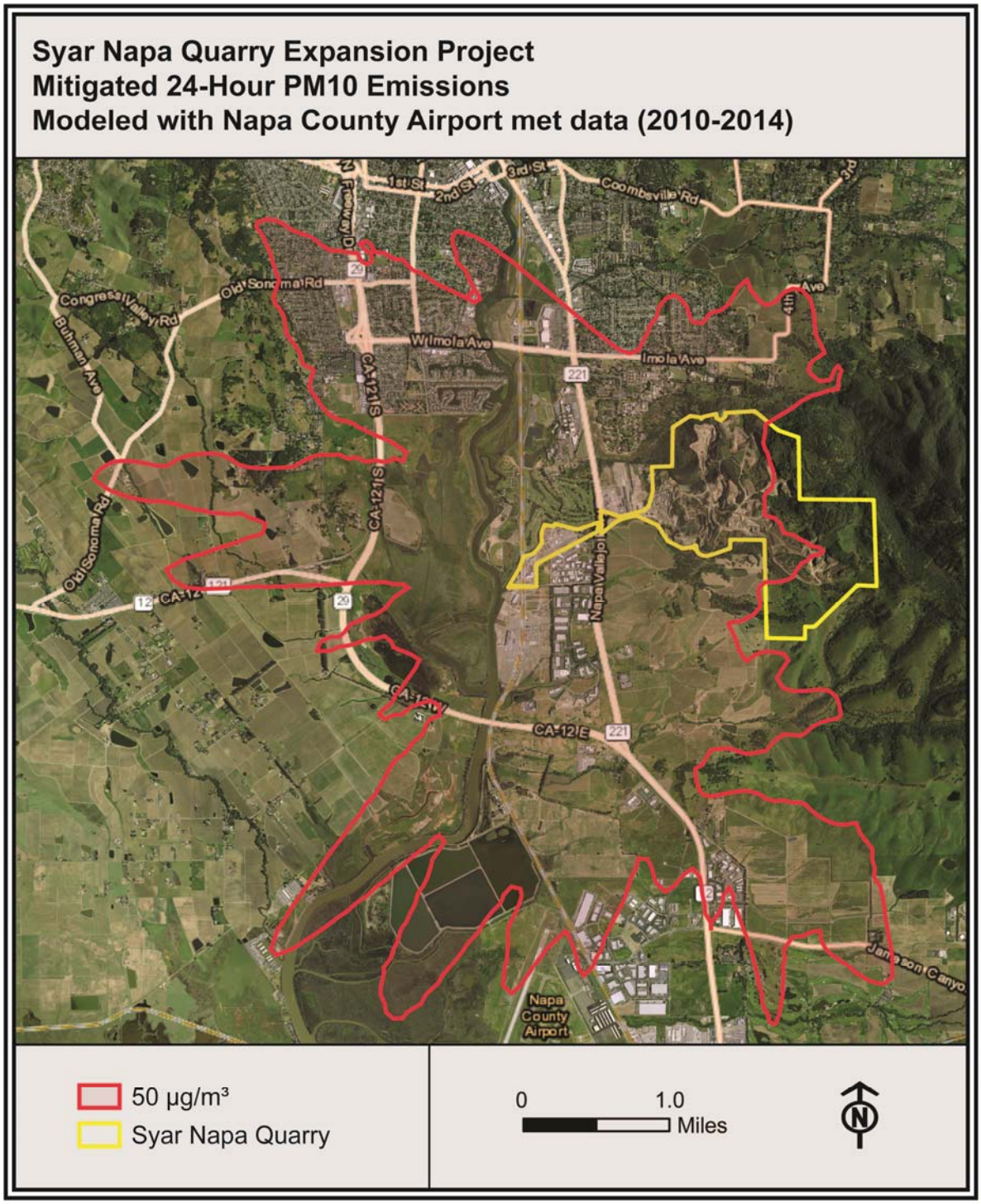
The 24-hour PM_{10} CAAQS (50 µg/m^3) is based on highest modeled 24-hour impacts. My modeling analysis indicates that the 24-hour PM_{10} impacts from the Syar Napa Quarry Expansion Project, with proposed mitigation, will exceed this regulatory design concentration by over a factor of ten. The modeled impacts would also grossly violate the 24-hour PM_{10} NAAQS (150 µg/m^3). The highest modeled 24-hour average PM_{10} concentration from the mitigated project is shown in the following table:

[12] Available at: http://esrl.noaa.gov/raobs/

[13] USEPA, Meteorological Monitoring Guidance for Regulatory Modeling Applications, EPA-454/R-99-05, February 2000, Section 5.3.2, pp. 5-4 – 5-5. http://www.epa.gov/ttn/scram/guidance/met/mmgrma.pdf

Years of Meteorological Data	Highest 1st High 24-hr PM_{10} Concentration ($\mu g/m^3$)	Easting Coordinate (meters)	Northing Coordinate (meters)
2010-2014	522.16	564332.36	423556.80

The following map illustrates the modeled area in violation of the CAAQS. To create the map, I generated an isopleth depicting the area in violation of the CAAQS, with 24-hour PM_{10} concentrations equaling or exceeding 50 $\mu g/m^3$, using Golden Software, Inc.'s Surfer Version 10. I exported the isopleth as a shapefile and created a map using ESRI's ArcGIS geographic information system (ArcMap v. 10). The isopleths is overlaid on USGS 1-meter orthoimagery obtained from ArcGIS online.


Syar Napa Quarry Expansion Project
Mitigated 24-Hour PM10 Emissions
Modeled with Napa County Airport met data (2010-2014)
1st St
2nd St
3rd St
Coombsville Rd
Old Sonoma Rd
Congress Valley Rd
Buhman Ave
Wilmot Ave
Imola Ave
4th Ave
CA-121 S
CA-12 E
Napa County Airport
50 µg/m³
Syar Napa Quarry
0
1.0
Miles
N

It should be noted that the modeling scenario that I have presented is based on emission rate assumptions made in the EIR, and even so, results are in violation of the CAAQS. The CAAQS levels are never to be equaled or exceeded.

Since the EIR indicates that mitigated project PM_{10} emissions would be less than current emissions from the Syar Napa Quarry, it can be inferred that the Syar Napa Quarry's current emissions are already in violation of the CAAQS. These impacts are visible in photos taken by Sandra Booth over the past several years. [14]

These significant impacts were not identified in the EIR because of false assumptions that the PM_{10} emissions under mitigated project circumstances would be lower than emissions under current practices, and therefore would be in compliance with the CAAQS. My modeling analysis shows that this is flawed logic, as PM_{10} impacts from the proposed Syar Napa Quarry Expansion would indeed violate the CAAQS and therefore the proposed expansion must not be permitted.

Conclusion

The Syar Napa Quarry Expansion EIR is seriously flawed in that all air quality modeling was performed using defunct practices. The air dispersion model used, ISCST3, was replaced in 2005. The meteorological data used in all modeling analyses is far outdated, and does not include the supplementation of 1-minute wind data which would provide a more accurate meteorological representation. All air quality modeling presented in the EIR needs to be revised to amend these issues.

The EIR also completely fails to include any modeling of PM_{10} emissions, citing the flawed assumption that less-than-current impacts would equate to insignificant impacts. The modeling analysis I prepared, using current modeling practices and based on emission rate assumptions made in the EIR, indicates that impacts for the proposed expansion with mitigation would violate both the 24-hour PM_{10} NAAQS and the CAAQS. Based on these findings, the proposed Syar Napa Quarry Expansion is causing a significant air quality impact that the EIR failed to assess and identify. The EIR cannot be certified under this condition.

[14] Comment letter from Sandra Booth to Donald Barella, available at: Syar Correspondence from 9-13 to 9-17 2015 http://www.countyofnapa.org/syar/