1-HOUR NO_2 MODELING ASSESSMENT

For the:

LOS ESTEROS CRITICAL ENERGY FACILITY AMMENDMENT

Prepared for:

Los Esteros Critical Energy Facility, LLC.
3875 Hopyard Road, Suite 345
Pleasanton, California 94588

Prepared by:

Atmospheric Dynamics, Inc.
Torres 3 SW of Mountain View
P.O. Box 5907
Carmel-by-the-Sea, CA. 93921-5907

November 2010

Lost Esteros Critical Energy Facility–1-Hour NO_2 Air Quality Impact Assessment

This report describes the Los Esteros Critical Energy Facility (LECEF) air quality modeling results for the comparison to the new Federal 1-hour standard of 188 ug/m^3. Potential air quality impacts were evaluated based on air quality dispersion modeling, as described herein. With the exception of the binary data files, all input and output modeling files are contained on a CD-ROM disk provided with this report. The modeling analyses were performed using the techniques and methods outlined by the EPA in the June 2010 "*Guidance Concerning the Implementation of the 1-hour NO_2 NAAQS for the Prevention of Significant Deterioration Program*" (EPA, June 2010).

DISPERSION MODELING

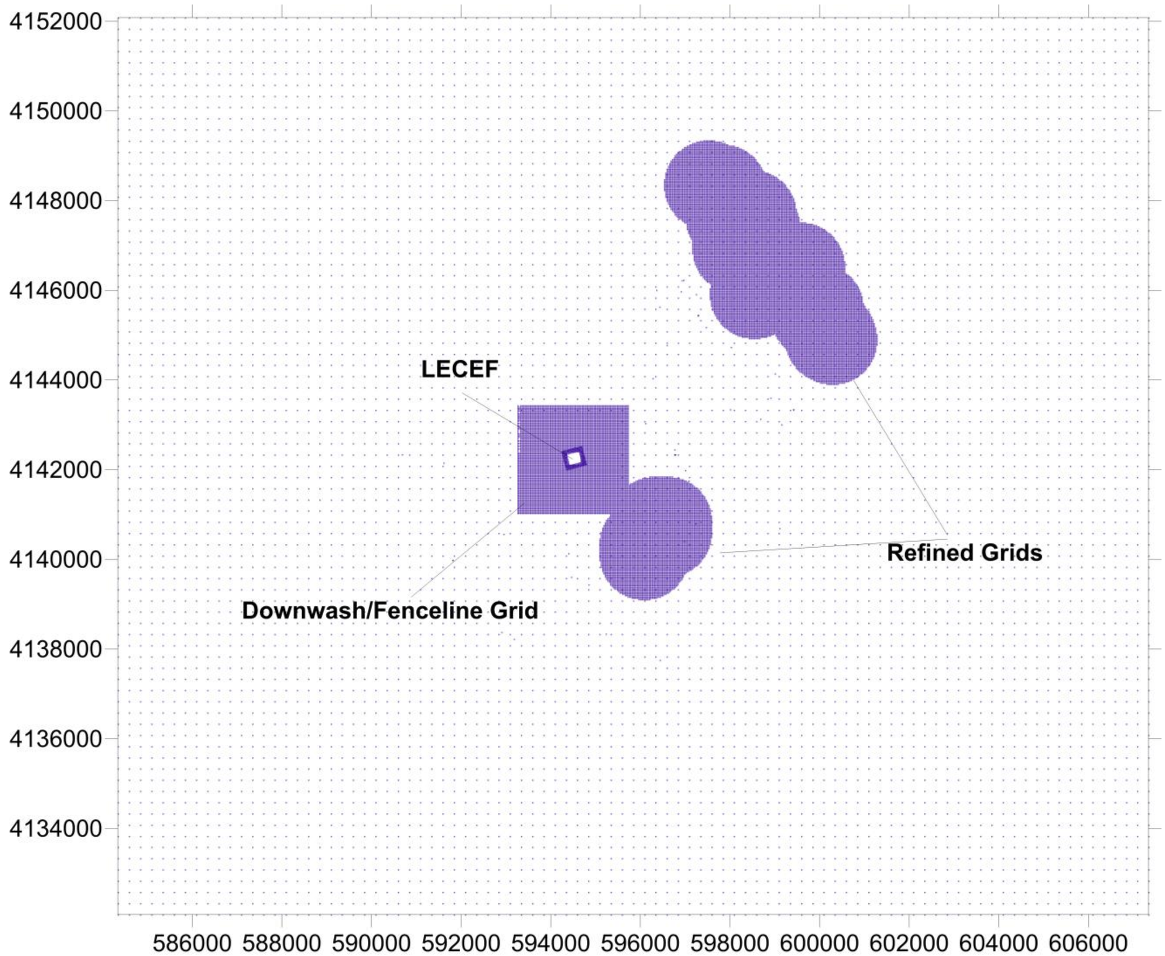
For modeling the potential impact of LECEF in terrain that is both below and above stack top (defined as simple terrain when the terrain is below stack top and complex terrain when it is above stack top), the USEPA guideline model AERMOD (version 09292) was used with the Plume Volume Molar Ratio Method for comparison with the new Federal 1-hour NO_2 standard. The meteorological and receptor data sets used in this revised analysis were based on the data used in the May 2005 Phase 2 Assessment. However, the Phase 2 Assessment used the dispersion model called the Industrial Source Complex Short Term Version 3 (ISCST3), which is the previous generation of a dispersion model used to assess air quality impacts. AERMOD has replaced ISCST3 as the recommended model for use in regulatory dispersion modeling applications. As such, the new meteorological and receptor data requirements have been incorporated into this analysis.

The purpose of the revised AERMOD modeling analysis is to evaluate compliance with the new federal 1-hour NO_2 air quality standard. As discussed with CEC Staff, the maximum 1-hour NO_2 modeled concentration was added to the monitored background 98^{th} percentile concentration.

Two operating profiles were assessed for compliance with the 1-hour NO_2 standard: (1) four turbines in base load operation with a 1-hour weekly test of the fire pump and (2) four turbines in a simultaneous 1-hour cold startup mode but without the concurrent operation of the weekly 1-hour fire pump test. The fire pump will not be tested during periods when the turbines are in a startup. The fire pump testing period was based on daylight hours only. The stack parameters were those used in the LECEF Phase 2 application.

The receptors used in the analysis were based on 30-meter DEM data and had a 25-meter resolution which extended from the fence line outwards to 100 meters. The receptor resolution was then based on 100 meter resolution which was extended to 1000 meters. A 250 meter coarse grid was also used which extended out to 10 kilometers from the project fence line in all directions. Areas on the coarse grid where the maximum impacts occurred were then assessed with a 25 meter resolution grid(s). This resulted in 36,136 coarse and refined grid receptors used in the AERMOD modeling analysis. The receptor grids used in the modeling analysis are presented in Figure 1.

Figure 1 Receptor Grids used in AERMOD



AERMET METEOROLOGICAL DATA

The Bay Area Air Quality Management District (BAAQMD) supplied meteorological data for the Alviso monitoring site maintained by the District for calendar years 1997 through 2000. The Alviso data consist of hourly averages of wind speed, wind direction, sigma theta, temperature, and solar insolation. These data were processed with the United States Environmental Protection Agency (USEPA) AERMOD preprocessor program AERMET (version 06341) based on BAAQMD recommendations. In order to perform deposition calculations, Automated Surface Observing Systems (ASOS) data from the San Jose International Airport (also supplied by BAAQMD) for relative humidity, dew point temperature, and precipitation were added to the final AERMET files. Since San Jose Airport data were missing for the first six hours of each day from

1997 until February 1998, only meteorological data for calendar years 1999 and 2000 were processed. Upper air data were downloaded from the National Oceanic and Atmospheric Administration radiosonde website for Oakland International Airport for the same time period for input to AERMET to determine wind profile characteristics.

AERSURFACE (version 08009) uses U.S. Geological Survey (USGS) National Land Cover Data 1992 archives (NLCD92) to determine the midday albedo, daytime Bowen ratio, and surface roughness length representative. Bowen ratio is based on a simple unweighted geometric mean for the 10x10 km square area centered on the selected location while albedo is based on a simple unweighted arithmetic mean for the 10x10 km square area centered on the selected location (i.e., no direction or distance dependence for either parameter). Surface roughness length is based on an inverse distance-weighted geometric mean for upwind distances up to one (1) km (based on recent USEPA guidance) from the selected location. The circular surface roughness length area (1-km radius) can be divided into any number of sectors as appropriate (USEPA recommends that no sector be less than 30° in width).

The Alviso meteorological monitoring site location (592,747 meters east and 4,143,414 meters north in UTM Zone 10, North American Datum 1927 (NAD27) coordinates) was used for surface characteristics based on USEPA recommendations (i.e., *AERMOD Implementation Guide*, revised January 9, 2008, and the *AERSURFACE User's Guide* [EPA-454/B-08-001]). The Alviso meteorological monitoring site is 2.1 kilometers and 303° (WNW/NW) of the project site and has similar surrounding land uses as shown later. The moisture conditions were specified by BAAQMD for each month of the years processed using the San Jose NOAA cooperative site and the percentile method specified in the AERSURFACE User's Guide. Months were assigned to each season according to BAAQMD defaults as follows: spring = February and March; summer = April through July; autumn = August through October; and winter (no snow cover) = November through January. Based on the uniformity of land uses surrounding the meteorological monitoring and project sites, only one sector (0°-360°) was used to define surface roughness lengths. These AERSURFACE input/output parameters are shown in the following table:

AERSURFACE Inputs/Outputs for Use in AERMET

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Seasonal Assignments and Other Assumptions												
Season	**Winter**	**Spring**	**Spring**	**Summer**	**Summer**	**Summer**	**Summer**	**Autumn**	**Autumn**	**Autumn**	**Winter**	**Winter**
Snow	No	—	—	—	—	—	—	—	—	—	No	No
Arid	No	No	No	No	No	No	No	No	No	No	No	No
Airport	No	No	No	No	No	No	No	No	No	No	No	No
Moisture Conditions for each Month/Year (Used for Bowen Ratio)												
1999	Avg	Avg	Avg	Wet	Avg	Wet	Wet	Dry	Avg	Avg	Dry	Dry
2000	Avg	Wet	Dry	Avg	Avg	Wet	Dry	Wet	Avg	Wet	Dry	Dry
Surface Characteristics: Surface Roughness (SR, in meters), Midday Albedo, and Bowen Ration (BR, depends on moisture conditions)												
SR	0.057	0.081	0.081	0.134	0.134	0.134	0.134	0.133	0.133	0.133	0.057	0.057
Albedo	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.16	0.16
1999BR	0.51	0.40	0.40	0.34	0.45	0.34	0.34	0.93	0.51	0.51	0.93	0.93
2000BR	0.51	0.31	0.76	0.45	0.45	0.34	0.84	0.36	0.51	0.36	0.93	0.93

AERSURFACE Inputs/Outputs for Use in AERMET

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec

The use of the meteorological data collected at the Alviso monitoring location would satisfy the definition of on-site data. USEPA defines the term "on-site data" to mean data that would be representative of atmospheric dispersion conditions at the source and at locations where the source may have a significant impact on air quality. Specifically, the meteorological data requirement originates from the Clean Air Act in Section 165(e)(1), which requires an analysis "of the ambient air quality at the proposed site and in areas which may be affected by emissions from such facility for each pollutant subject to regulation under [the Act] which will be emitted from such facility." This requirement and USEPA's guidance on the use of on-site monitoring data are also outlined in the On-Site Meteorological Program Guidance for Regulatory Modeling Applications (USEPA, 1987). The representativeness of meteorological data is dependent upon: (a) the proximity of the meteorological monitoring site to the area under consideration; (b) the complexity of the topography of the area; (c) the exposure of the meteorological sensors; and (d) the period of time during which the data are collected.

First, the meteorological monitoring site and Project location are in close proximity, at approximately the same elevation and with exactly the same topography surrounding each location. Second, the meteorological monitoring site and Project location are located roughly about the same distance and in the same orientation to significant terrain features that might influence wind flow patterns. In addition, there are no nearby (localized) significant terrain features between or surrounding the Project site and/or the meteorological monitoring site that would limit the use of the meteorological data for the proposed Project. Third, as discussed below, the surface characteristics roughness length, Bowen ratio, and albedo are relatively consistent throughout the area and are nearly identical between the Project site and the meteorological monitoring location.

Representativeness is defined in the document "Workshop on the Representativeness of Meteorological Observations" (Nappo et. al., 1982) as "the extent to which a set of measurements taken in a space-time domain reflects the actual conditions in the same or different space-time domain taken on a scale appropriate for a specific application." Judgments of representativeness should be made only when sites are climatologically similar, as is the case with the meteorological monitoring site and the Project location. In determining the representativeness of the meteorological data set for use in the dispersion models at the Project site, the consideration of the correlation of terrain features to prevailing meteorological conditions, as discussed earlier, would be nearly identical to both locations since the orientation and aspect of terrain at the Project location correlates well with the prevailing wind fields as measured by and contained in the meteorological dataset. In other words, the same mesoscale and localized geographic and topographic features that influence wind flow patterns at the meteorological monitoring site also influence the wind flow patterns at the Project site.

Running AERSURFACE at both the Alviso monitoring and proposed site locations (594,513 meters east and 4,142,265 meters north in UTM Zone 10 NAD27 coordinates) produced similar results for Bowen ratio and albedo, based on the 10-km square area around each location, and surface roughness lengths, based on a 1-km radius. It is our assessment that the meteorological data collected at the Alviso monitoring site are identical to the dispersion conditions at the Project site and to the regional area.

LECEF MET/PROJECT SITES LAND USE/LAND COVER COUNTS **Land Cover Categories**	Alviso Met.Site	LECEF Project
11 Open Water:	16.9%	6.5%
12 Perennial Ice/Snow:	0.0%	0.0%
21 Low Intensity Residential:	3.1%	3.3%
22 High Intensity Residential:	0.0%	0.0%
23 Commercial/Industrial/Transp:	14.5%	9.2%
31 Bare Rock/Sand/Clay:	8.3%	1.5%
32 Quarries/Strip Mines/Gravel:	0.0%	0.0%
33 Transitional:	0.0%	0.0%
41 Deciduous Forest:	0.1%	0.0%
42 Evergreen Forest:	0.2%	0.0%
43 Mixed Forest:	0.1%	0.0%
51 Shrubland:	2.1%	1.2%
61 Orchards/Vineyard/Other:	27.1%	53.8%
71 Grasslands/Herbaceous:	3.0%	1.8%
81 Pasture/Hay:	0.0%	0.0%
82 Row Crops:	13.3%	18.1%
83 Small Grains:	0.0%	0.0%
84 Fallow:	0.0%	0.0%
85 Urban/Recreational Grasses:	2.0%	2.1%
91 Woody Wetlands:	0.1%	0.0%
92 Emergent Herbaceous Wetlands:	9.4%	2.6%

LECEF MET/PROJECT SITES AERSURFACE OUTPUTS **Seasonal Characteristics**			Alviso Met.Site	LECEF Project
Surface		Winter	0.057	0.070
Roughness (m)		Spring	0.081	0.111
		Summer	0.134	0.210
		Fall	0.133	0.209
Albedo		Winter	0.16	0.17
		Spring	0.15	0.15
		Summer	0.15	0.16
		Fall	0.15	0.16
Bowen Ratio		Winter	0.51	0.69
	Avg. Months	Spring	0.40	0.52
		Summer	0.45	0.59
		Fall	0.51	0.69
Bowen Ratio		Winter	0.36	0.46
	Wet Months	Spring	0.31	0.39
		Summer	0.34	0.43
		Fall	0.36	0.46
Bowen Ratio		Winter	0.93	1.41
	Dry Months	Spring	0.76	1.11
		Summer	0.84	1.25
		Fall	0.93	1.41

PLUME VOLUME MOLAR RATIO METHOD

As with one of the existing techniques called the Ozone Limiting Method (OLM), the Plume Volume Molar Ratio Method (PVMRM) approach limits the conversion of NO to NO_2 based on the amount of ambient ozone available. The OLM involves an initial comparison of the estimated maximum NO_x concentration and the ambient ozone concentration to determine which is the limiting factor to NO_2 formation. If the ozone concentration is greater than the maximum NO_x concentration, total conversion is assumed. If the NO_x concentration is greater than the ozone concentration, the formation of NO_2 is limited by the ambient ozone concentration. In this case, the NO_2 concentration is set equal to the ozone concentration plus a correction factor that accounts for in-stack and near-stack thermal conversion. However, the PVMRM approach limits the conversion based on the amount of ozone within the volume of the plume. With PVMRM, the NO_2/NO_x conversion ratio is coupled with the dispersion of the plume. The PVMRM approach also incorporates a technique for merging plumes from nearby sources for purposes of calculating the NO_2/NO_x ratios.

The PVMRM was used with concurrent hourly 1-hour ozone concentrations to calculate the 1-hour NO_2 concentrations using the AERMOD PVMRM subroutine. Ozone data from the 4th Street Monitoring Station in San Jose for the same period as the meteorological data (1999-2000) were used for the PVMRM analyses. Missing ozone data for periods of 1 hour were interpolated from the 4th Street monitoring data before/after the missing period. Missing data for longer periods were replaced with data from nearest ozone monitoring station.

BACKGROUND 1-HOUR NO_2 AIR QUALITY MONITORING DATA

Each federal or state AAQS is comprised of two basic elements: (1) a numerical limit expressed as an allowable concentration, and (2) an averaging time which specifies the period over which the concentration value is to be measured. Table 1 presents the current federal and state AAQS for NO_2.

TABLE 1
State and Federal Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards Concentration	National Standards Concentration
Nitrogen dioxide (NO_2)	Annual Average	0.03 ppm (57 $\mu g/m^3$)	0.053 ppm (100 $\mu g/m^3$)
	1-hr	0.18 ppm (339 $\mu g/m^3$)	0.1 ppm (188 $\mu g/m^3$)

The nearest and most representative NO_2 air quality monitoring site is the San Jose 4th Street monitoring station. The BAAQMD and CEC have previously approved use of data from this monitoring station as appropriate for NAAQS compliance demonstration for LECEF. The San Jose 4th Street monitoring site is located in the center of northern Santa Clara Valley, in a commercial and residential part of downtown San Jose. San Jose is the largest city in the Bay Area with an estimated 2009 population of 1,023,083. This monitoring station is completely encircled by major freeways and has a large airport just to the northwest. The air quality in this location is representative of a large part of the valley due to the diurnal up valley and down valley air flow, which mixes the pollutants throughout the valley. Ambient monitoring data for this site for the most recent three (3) year period, as provided by the BAAQMD is summarized in Table 2.

Table 2 Monitoring Data Summary (First High Monitored Values)

Pollutant	Site	Avg. Time	2007	2008	2009
NO_2, ppb	San Jose 4th Street	1 Hr	65	80	69

The use of the San Jose 4th Street monitoring station also satisfies the Environmental Protection Agency's new requirements for the placement of NO_2 monitors near major roadways in urban areas in order to determine the highest concentrations in an area covered by a monitoring network. The new Federal 1-hour NO_2 standard requires that monitoring networks be designed to measure the expected highest concentrations. Each of the BAAQMD monitoring stations have unique objectives which are associated with a spatial scale for each site. These spatial scales are defined in 40 CFR Part 58, Appendix D. Additionally, the desired spatial scale of a monitoring site must conform to established criteria for the distance from roadways, based on traffic volumes as defined in 40 CFR Part 58, Appendix E. The goal in siting monitoring stations is to match the spatial scale with the desired monitoring objective.

The new Federal 1-hour NO_2 standard is focused on short-term peak concentrations, which may occur near roadways. As summarized in the 2009 BAAQMD Air Monitoring Network Report (July 2010), the San Jose 4th Street monitoring objective is population oriented (typical concentrations in areas of high population density in order to protect public health) and highest concentration (monitoring at locations expected to have the highest concentrations). Major roadways are located within 50 meters of the monitoring station. Thus, the use of the San Jose 4th Street NO_2 monitoring station satisfies the revised EPA population and highest concentration oriented monitoring station requirements for the new 1-hour standard.

Based on discussions with CEC Staff, compliance with the federal 1-hour NO_2 standard was based on a Tier 1 approach where the first high modeled concentration was added to the 98th percentile background concentration determined by the 3-year average of the 98th percentile of the yearly distribution of 1-hour daily maximum concentrations. Accordingly, the data from the San Jose 4th Street monitoring station were evaluated to identify the 98th percentile 1-hour NO_2 background concentration of 53.3 micrograms per cubic meter (ug/m^3).

AERMOD MODELING RESULTS

This section describes the results in magnitude and spatial extent of ground level concentrations, resulting from NO_2 emissions from the LECEF project. The 98th percentile maximum 1-hour background concentrations were added to the maximum (first high) modeled concentrations to calculate a total impact.

Table 3 summarizes maximum 1-hour modeled NO_2 concentration which demonstrates compliance with the new 1-hour federal NO_2 standard. The maximum modeled concentration occurred during routine operation of the turbines along with the weekly simultaneous 30 minute test of the fire pump.

TABLE 3
Maximum Modeled Criteria Pollutant Concentrations

Pollutant	Avg. Period	1st High Concentration (µg/m³)	Model Run-Start or Norm	98th Percentile Background (µg/m³)	Total (µg/m³)	Class II Significance Level (µg/m³)	BAAQMD SILs (µg/m³)	Ambient Air Quality CAAQS/NAAQS (µg/m³)	(µg/m³)
NO_2	1-hour	114.31[a]	Start	53.3	167.6	7.5	19	339	188
NO_2	1-hour	90.53[b]	Norm	53.3	143.8	7.5	19	339	188

[a] The project maximum 1-hour impact is from the simultaneous startup of four turbines during a 1-hour period. All 1-hour NO_2 modeled concentrations were calculated with plume molar ratio method .

[b] The normal operational impacts are due to the routine testing of the fire pump. The testing will not occur during turbine startup operations and will only occur during daylight hours.

CONCLUSION

The results of the revised LECEF modeling analysis, using AERMOD , demonstrates that the proposed project will safely comply with new federal 1-hour ambient air quality standard for NO_2.