DR-AIR-1

Information Required:

Please describe the types of activities that emit combustion and fugitive dust emissions on the site currently and the quantities of those emissions that occur from those activities.

Response:

The 3,995-acre Project Right-of-way is composed of undeveloped desert with naturally-vegetated areas; there are no existing structures or stationary emission sources on the Project site. Currently, there are few anthropogenic activities on this site that would create combustion or fugitive dust emissions, with the exception of off-road recreational vehicle use. The Bureau of Land Management does not currently monitor off-road recreational vehicle use, making it difficult to predict emissions from this activity. However, off-road vehicle use is believed to be frequent on this site.

The site is also subject to natural wind erosion effects which would cause fugitive dust emissions. Pre-project fugitive dust emissions from wind erosion are discussed and estimated in association with the response to DR-AIR-3.

DR-AIR-2

Information Required:

Please describe whether those activities will be permanently discontinued when the project is completed and estimate the reductions from the current onsite baseline emissions.

Response:

Off-road recreational vehicle use in the Project area is expected to decrease when the Project is completed, and any emissions associated with those activities will decrease as well. Wind erosion will continue following Project construction; however, the extent of wind erosion will decrease due to site compaction, the use of soil stabilizers, and the paving of various portions of the site. Post-project fugitive dust emissions from wind erosion are discussed and estimated in the response to DR-AIR-3.

DR-AIR-3

Information Required:

Please identify the increase or decrease in the acreage of non-stabilized disturbed land within the project site during operation and estimate the corresponding increase or decrease in wind erosion fugitive dust emissions at the site.

Response:

As described in the Soils Report in Attachment C of the RSPP Preliminary Geotechnical Investigation Report provided as Appendix B to the RSPP AFC, submitted to the CEC on September 1, 2009, this site has a high potential for wind erosion. The Wind Erosion Prediction System (WEPS) model was used to estimate the potential for wind erosion and soil loss at the RSPP site. The WEPS model is a process-

based, continuous, daily time-step model that simulates weather, field conditions, management and erosion. The model results are highly dependent upon the input parameters, which are supplied in Appendix B, Attachment C.4.2 of the AFC (for pre-Project and post-Project scenarios) and in the Soils response of the Data Adequacy Supplement (for the operation scenario), submitted to the CEC on October 26, 2009. The model was created with climate data and surface elevations from the nearest climate and weather stations, representative soil profiles for the site, and a representative area for the Project. Since the WEPS model treats the field input as an idealized rectangle, the Project area was conservatively taken as a larger area calculated with the widest site dimensions and does not match the area of the exact Project outline.

Desert Glaze (also known as "Desert Pavement" and "Desert Varnish") was not applied to the pre-Project wind erosion estimates for the RSPP because Desert Glaze was not observed during the geologic surveys conducted at the site, and because the soils were determined to be inconsistent with this phenomenon. The average of the six textural analyses concluded that the soils on the RSPP site are predominantly characterized as sandy loam. This characterization is consistent with field observations and the published descriptions for the Wasco-Rosamond-Cajon Association, which is mapped across 95 percent of the RSPP site in the General Soil Map of California. The Wasco sandy loam is the predominant soil series present at the RSPP site and was chosen as the representative soil type in the WEPS model to predict wind erosion for RSPP. A more detailed analysis can be found in Attachment C, Water and Wind Erosion Modeling, of the Geotechnical Report in Appendix B of the AFC.

The WEPS model predicted that the fugitive Particulate Matter emissions of 10 microns or less (PM10) emission rate for the entire undisturbed site is 8.767 tons per acre-year. The WEPS model PM10 emission rate was multiplied by the total Project area of 3,995 acres to calculate the annual wind erosion of the Project site according to Equation AQ-1. This calculation yields a baseline (i.e., pre-Project) mass emission rate of 35,024 tons per year (tpy) of fugitive PM10 due to wind erosion on the currently undisturbed Project site.

$$\textbf{Total PM} = WEPS_u * Area_P \qquad \text{(Eq. AQ-1)}$$

Where: Total PM = PM10 emissions from the entire undisturbed site (Total PM = 35,024 tpy)

$WEPS_u$ = undisturbed PM10 emission factor from the WEPS model
($WEPS_u$ = 8.7 tons per acre-year)

$Area_P$ = Total Project site area ($Area_P$ = 3,995 acres)

Wind erosion will obviously continue following Project construction; however, the extent of wind erosion will decrease due to site compaction, the use of soil stabilizers and the paving of various portions of the site.

Similar to the undisturbed site, the WEPS model was used to predict the wind erosion from the planned disturbed site. Because of the reconfigured site plan, the total predicted disturbance area and the area notated as the facility footprint have slightly increased from the initial project layout submitted in the AFC. The increase of disturbed surface area will affect the emissions associated with wind erosion; only the emissions associated with the new site layout are discussed in this response. The total predicted disturbance area for the Project plant site is 1,944 acres during the construction phase of the Project, which is approximately 50 percent of the total Project area. The closest approximation to the site management practices at the RSPP available in the WEPS input parameters are the management operations that describe the conditions expected in the aftermath of grazing with complete removal of crop residue. The decrease in wind erosion due to road paving and dust suppressants are not accounted for in the WEPS

model for the planned disturbed site and no distinction was made between the total disturbance area and the facility footprint. The WEPS model used an idealized rectangle with an area of 882 acres, which is the area of one solar field array, to calculate the wind erosion from the planned disturbed area. The WEPS model predicted that the uncontrolled fugitive PM10 emission rate for the planned disturbed site is 8.409 tons per acre-year.

To predict controlled emissions, the total area of the solar field and power block for both units was taken as the controlled area. This is a total area of 1,448 acres that is paved, covered with gravel, or treated with soil stabilizers. This area is notated as the facility footprint. Soil stabilizers (dust suppressants) are assumed to provide 80 percent control efficiency compared to untreated soil. Gravel and paving would have a higher control efficiency; however, the lower value of 80 percent is used in the calculations to ensure that emissions are not underestimated. With these two assumptions, the controlled PM10 emissions from the Project site following construction can be calculated using Equation AQ-2.

$$\textbf{Project PM}_{\mathbf{C}} = (WEPS_u * (Area_P - Area_d)) + (WEPS_d * (Area_d - Area_F)) + (WEPS_d * Area_F\,(1 - CE)) \qquad \text{(Eq. AQ-2)}$$

Where: Project PM_C = Controlled, Post Project PM10 emissions from the Project site (tpy)

$WEPS_u$ = undisturbed PM10 emission factor from the WEPS model
($WEPS_u$ = 8.7 tons per acre-year)

$WEPS_d$ = disturbed site PM10 emission factor from the WEPS model
($WEPS_d$ = 8.4 tons per acre-year)

$Area_P$ = Total Project site area ($Area_P$ = 3,995 acres)

$Area_d$ = Total disturbed facility footprint area ($Area_d$ = 1,944 acres)

$Area_F$ = Total controlled area of the solar fields and power blocks ($Area_F$ = 1,448 acres)

CE = Control Efficiency of soil stabilizer (CE = 80 percent)

Controlled, post-Project PM10 emissions are calculated to be 24,587 tpy. The net change in fugitive dust emissions due strictly to wind erosion is calculated by subtracting the controlled, post-Project emissions from the pre-Project, undisturbed emissions using Equation AQ-3.

$$\textbf{Emission Change} = \text{Total PM} - \text{Project } PM_C \qquad \text{(Eq. AQ-3)}$$

As shown in Table DR-AIR-3-1, there is a net reduction in fugitive PM10 emissions due to wind erosion following construction of the Project of 10,437 tpy. Note that this calculation does not include the emissions associated with operations of the solar facility (please see DR-AIR-5 for those calculations). The detailed wind erosion fugitive dust emission calculations are provided in Table E.2-18b in the spreadsheet with filename *Ridgecrest DR Operating Emissions* on the CD-ROM (Attachment DR-AIR-3, Air Emission Calculations).

Table DR-AIR-3-1 Fugitive PM10 Emissions from Wind Erosion

Site Condition	Annual PM10 Emissions (tpy)
Pre-Project Undisturbed Site	35,024
Controlled Post-Project	24,587
Net Emission Change	(10,437)

As noted, the wind erosion estimates for before and after construction of the RSPP were developed using WEPS, a sophisticated numerical model developed by the U.S. Department of Agriculture's Agricultural Research Service. The WEPS model was designed to simulate wind erosion potential in an agricultural setting. Because soil conditions would be different in an industrial setting such as a solar thermal power plant, the model was run making conservative assumptions to ensure that estimates of wind erosion were not underestimated. When used to estimate emissions during the operational phase of the Project, the model is expected to significantly overestimate the amount of particulate matter emissions from the solar field due to wind erosion. If the mass emission levels estimated by WEPS during operations were to actually occur, the blowing sand and dust would quickly pit the mirror surfaces, and would significantly degrade the efficiency of power production to unacceptable levels. However, the control measures to be implemented at the site, including initial site compaction, application of dust suppressant as needed, and regular application of water during mirror washing are sufficient to lower potential wind erosion to acceptable levels.

Several features of the RSPP compared to the scenario modeled point to a significant overestimate in estimated operational wind erosion. These attributes include:

- The whole solar array field is compacted during construction to a significant depth that will significantly alter the native soil characteristics assumed in the model. A 40 percent increase in soil density was assumed in the model run but this is only an unsupported assumption not based on any empirical data.

- Ongoing operations involving mirror washing, dust suppressant application, and water/dust suppressant trucks traffic through the solar array field will produce additional compaction and cementation of the soil, further altering the soil characteristics to become less erodible, compared to the soil simulated in the model.

Given the above differences between what was modeled and what is actually expected in the operation phase of the RSPP, the WEPS model estimates of wind erosion are expected to significantly overestimate the wind erosion during facility operation. However, the conservative (high) estimate of operational emissions results in a minimum estimate of the reduction in windblown dust emissions from the pre-construction baseline scenario to operational activities. In other words, the expected potential reduction in windblown dust by construction of the RSPP, estimated using the WEPS model, is a minimum value and the reduction in emissions from the pre- to post-Project will likely be much larger than presented.

DR-AIR-4

Information Required:

Please provide an analysis of the available onsite surface/near surface soil sieve data that identifies a defensible site specific soil silt content value.

Response:

The silt content used to estimate construction, operation and wind erosion emissions for this Data Response are based on the average silt content that was analyzed for grain size distribution according to method ASTM D422, which uses the 200-mesh sieve. The data were provided in Appendix B of the AFC. The average silt content that is used in the updated emissions calculations is 21 percent.

DR-AIR-5

Information Required:

Please provide an updated fugitive dust emission calculation for both construction and operations using the defensible soil silt content value.

Response:

The construction and operations fugitive dust emissions calculations were updated with a site-specific surface silt content of 21 percent as determined in response to DR-AIR-4. The updated construction emissions are presented in Tables DR-AIR-5-1 and DR-AIR-5-2 and the updated operating emissions are shown in Table DR-AIR-5-3. Detailed emission calculations are provided in the spreadsheet with filename *Ridgecrest DR Operating Emissions* on the CD-ROM (Attachment DR-AIR-3, Air Emission Calculations).

Table DR-AIR-5-1 Maximum Daily Construction Emissions

Phase of Construction	NOx (lb/day)	VOC (lb/day)	CO (lb/day)	SO_2 (lb/day)	PM10 (lb/day)	PM2.5 (lb/day)
Power Plant (on site)	788.50	86.90	427.09	1.73	904.14	209.64
Roadway (off site)	270.55	29.91	140.51	0.57	169.31	58.29
Transmission and Communication Line (offsite)	12.63	1.61	16.55	0.03	18.79	6.21

Notes: lb/day = pounds per day
NOx = Nitrogen oxide
VOC = volatile organic compounds
CO = Carbon Monoxide
SO_2 = Sulfur Dioxide
PM2.5 = Particulate Matter of 2.5 microns or less

Table DR-AIR-5-2 Maximum Annual Construction Emissions

Phase of Construction	NOx (tpy)	VOC (tpy)	CO (tpy)	SO_2 (tpy)	PM10 (tpy)	PM2.5 (tpy)
Power Plant (on site)	90.72	10.15	48.53	0.20	106.03	24.99

Table DR-AIR-5-3 Summary of Project Criteria Pollutant Emissions

Emissions	NOx	VOC	CO	SO_2	PM10	PM2.5
Hourly Emissions (lb/hr)	32.83	2.97	21.59	0.83	44.92	9.22
Daily Emissions (lb/day)	38.42	10.37	40.45	6.27	553.00	111.16
Annual Emissions (tpy)	1.25	1.18	1.89	0.42	19.78	2.64

Operating emissions were updated (compared to the emissions presented in the AFC) to address four issues:
1) Silt content of soils (impacts PM10 and PM2.5 emissions only) (per DR-AIR-4),
2) revisions to maintenance vehicle mileage (per DR-AIR-14, -15, -16, and -17).
3) Model year 2013 vehicle emission standards (all pollutants) (per DR-AIR-18), and
4) a larger diesel-fired emergency generator (all pollutants) (per DR-AIR-23).

The emissions shown in this table reflect the changes to emission from all four issues.
lb/hr = pounds per hour

DR-AIR-6

Information Required:

Please provide a revised PM10 and PM2.5 modeling analysis using the updated fugitive dust emission values.

Response:

The particulate modeling analyses based on the revised construction and operation emissions are provided in Attachment DR-AIR-6, Revised Air Quality Impacts Assessment.

DR-AIR-7

Information Required:

Please provide the spreadsheet version of the Appendix E-2 Construction Emission Worksheets with the embedded calculations intact.

Response:

Updated construction emission calculations are provided in the spreadsheet with filename *Ridgecrest DR Construction Emissions* on the CD-ROM (Attachment DR-AIR-3, Air Emission Calculations).

DR-AIR-8

Information Required:

Please identify whether all of the off-road equipment emission factors are based on Tier 3 engines, or if Tier 3 engines are only assumed for the engines listed with Tier 3 in the equipment name column.

Response:

All of the off-road equipment emission factors are based on engines that meet Tier 3 emission standards. Please see the response to DR-AIR-9 for a description of how the emission factors were derived.

Tier 3 engines were selected for predicting emissions because they have lower emissions than the other available options. A worst-case modeling scenario was selected which assumed the heavy earthwork equipment is operated in close proximity to the Project boundary, and based on AECOM's experience with modeling construction emissions for other solar energy projects, NOx emissions need to be as low as possible to ensure that the Project does not cause exceedances of the Nitrogen Dioxide (NO_2) 1-hour ambient air quality standard at the fence line. This potential impact is due to the low release height (stack height) of the construction equipment and the high concentration of equipment near the fence line assumed for the worst-case scenario used for modeling. Note that the worst-case scenario used for modeling purposes would be an infrequent occurrence given the extremely conservative assumptions used to develop the scenario. This situation is also not unique to RSPP; any construction project that would operate large numbers of heavy equipment near a fence line would have the potential for similar short-term high impacts.

DR-AIR-9

Information Required:

Please provide the input assumptions to obtain the OFF ROAD Model raw engine emission factors, the assumptions used to derive the equipment specific emission factors, and please provide the spreadsheets used to create the emission factors shown in Appendix E-1.

Response:

The OFFROAD2007 Model was run with the input options shown in Table DR-AIR-9-1.

Table DR-AIR-9-1 OFFROAD Model Options

Variable	Selected Option
Episode Period	Calendar Year: 2010 Averaging Days: Monday - Sunday Month or Season: Annual
Report Options	HC Emissions as Reactive Organic Gases (ROG) Report by Model Year: Exhaust, Evaporative and Toxics
Filter Options: Area	State
Filter Options: Equipment Categories	All
Filter Options: Fuel and Horsepower	Fuel: Diesel Horsepower Class: All horsepowers

The model produced a tab-delimited text file that contained annual average daily diesel equipment exhaust emissions, in tons per day, and average daily operating time, in hours per day, for calendar year 2010 by equipment type (e.g., rubber-tired loaders, cranes, etc.), horsepower range (e.g., 0 to 25 horsepower, 26 to 50 horsepower, etc.) for each equipment type, and model year for each equipment type and horsepower range. This information was listed for every combination of county, air district and air basin within the State. For example, one line of output listed average annual daily operating hours and daily exhaust emissions of ROG, CO, NOx, Carbon Dioxide (CO_2), SO_2, PM, Nitrous Oxide (N_2O) and Methane (CH_4) from model year 2008 air compressors with horsepower ratings from 26 to 50 horsepower in the portion of Kern County located within the Mojave Desert Air Basin that is in the Kern County Air Pollution Control District's (KCAPCD's) jurisdiction. The model output file was imported into a Microsoft Access database, and a query was used to calculate total emissions and operating hours by equipment type, horsepower range and model year. The equipment is not weighted in the OFFROAD model; the model calculates emission factors for each type of equipment and horsepower range individually.

Emission factors, in pounds per operating hour, were calculated by dividing the annual average daily emissions, converted from tons per day to pounds per day, by the annual average daily operating hours. These emission factors were calculated for each combination of equipment type, horsepower range and model year. The emission factors used to calculate exhaust emissions presented in the AFC were based on the model outputs for the portion of Kern County located within the Mojave Desert Air Basin that is in the KCAPCD's jurisdiction. However, in preparing the response to this Data Request, it was concluded that it is more appropriate to use statewide average emission factors because of the relatively small equipment populations within the local geographic area. Therefore, the emission factors and construction emission calculations have been revised.

The emission factors for the specific equipment shown in Appendix E.2, Table E.2-1 (of the AFC), are the emission factors calculated from the OFFROAD2007 Model output for the corresponding OFFROAD2007 Model equipment category, horsepower range that encompasses the specific equipment, and the model year that is the earliest model year required to comply with Tier 3 emission standards, which depends on engine horsepower.

The emission factors used for estimating construction emissions submitted with the Data Responses differ from the emission factors used for the construction emissions that were submitted with AFC the in the range of approximately five percent higher to five percent lower depending on the specific equipment and pollutant. The change varies according to equipment type and horsepower range. The percentage change in emission factors used for the AFC compared to the emission factors used for this data response is shown in Table DR-AIR-9-2.

The tab-delimited output file from the OFFROAD2007 Model and revised construction emission calculation spreadsheets, including tabs with the emission factor calculations, are provided in the spreadsheet with filename *Ridgecrest DR Construction Emissions* on the CD-ROM (Attachment DR-AIR-3, Air Emission Calculations). Revised maximum daily and annual construction emissions are provided in Data Response DR-AIR-5.

Table DR-AIR-9-2 OFFROAD Emission Factors: Difference between KCAPCD and CA Statewide Runs

Equipment Type	Fuel	Horsepower	Model Year	Air Resources Board Off-Road Model Category	CO (lb/hr)[a]	ROG (lb/hr)[a]	NOx (lb/hr)[a]	SOx (lb/hr)[a]	PM10 (lb/hr)[a]	PM2.5 (lb/hr)[b]
375 cfm Compressor	Diesel	20	2008	Air Compressors	-2%	-2%	-2%	-2%	-2%	-2%
Air Compressor Ingersol Rand, P65WK	Diesel	23.5	2008	Air Compressors	-2%	-2%	-2%	-2%	-2%	-2%
Backhoe, 450E	Diesel	124	2007	Tractors/Loaders/ Backhoes	0%	0%	0%	0%	0%	0%
Concrete Pump Rig, B50	Diesel	130	2007	Other Construction Equipment	-2%	-2%	-2%	-2%	-2%	-2%
Crane 20 Ton Grove, YB7722	Diesel	130	2007	Cranes	0%	0%	0%	0%	0%	0%
Dozer,Cat, D10T	Diesel	580	2006	Crawler Tractors	0%	0%	0%	0%	0%	0%
Excavator, 365C	Diesel	404	2006	Excavators	0%	0%	0%	0%	0%	0%
Folklift, DP45K	Diesel	124	2007	Forklifts	1%	1%	1%	1%	1%	1%
Generator, XQ400	Diesel	328	2006	Generator Sets	-1%	-1%	-1%	-1%	-1%	-1%
Grade-All, TL1055	Diesel	125	2007	Rough Terrain Forklifts	-1%	-1%	-1%	-1%	-1%	-1%
Loader, 972H	Diesel	287	2006	Rubber Tired Loaders	0%	0%	0%	0%	0%	0%
Motor Grader, 160M	Diesel	213	2006	Graders	0%	0%	0%	0%	0%	0%
Paving Machine, AP1055D	Diesel	224	2006	Pavers	5%	5%	5%	5%	5%	5%
Roller, CB-534D	Diesel	130	2007	Rollers	0%	0%	0%	0%	0%	0%
Scraper Cat, 657G	Diesel	564	2006	Scrapers	0%	0%	0%	0%	0%	0%
Scraper Cat, 657G, Blade Engine	Diesel	410	2006	Other Construction Equipment	1%	1%	1%	1%	1%	1%
Sheepsfoot, 825G	Diesel	315	2006	Rollers	0%	0%	0%	0%	0%	0%

Table DR-AIR-9-2 OFFROAD Emission Factors: Difference between KCAPCD and CA Statewide Runs

Equipment Type	Fuel	Horsepower	Model Year	Air Resources Board Off-Road Model Category	CO (lb/hr)[a]	ROG (lb/hr)[a]	NOx (lb/hr)[a]	SOx (lb/hr)[a]	PM10 (lb/hr)[a]	PM2.5 (lb/hr)[b]
Vibratory Roller, 825H	Diesel	354	2006	Rollers	0%	0%	0%	0%	0%	0%
Scraper Cat 623	Diesel	330	2006	Scrapers	0%	0%	0%	0%	0%	0%
Asphalt Paver, Cat AP1055B	Diesel	174	2007	Pavers	-1%	-1%	-1%	-1%	-1%	-1%
Backhoe, Cat, 430E	Diesel	97	2008	Tractors/Loaders/ Backhoes	0%	0%	0%	0%	0%	0%
175-250 kW Gen Set	Diesel	400	2006	Generator Sets	-1%	-1%	-1%	-1%	-1%	-1%
Light Tower 5 KW	Diesel	8	2008	Generator Sets	0%	0%	0%	0%	0%	0%
600 A Temp Power	Diesel	400	2006	Generator Sets	-1%	-1%	-1%	-1%	-1%	-1%
200 A Temp Power	Diesel	135	2007	Generator Sets	0%	0%	0%	0%	0%	0%
Compactor, Cat 826H	Diesel	410	2006	Rollers	0%	0%	0%	0%	0%	0%
185 cfm Compressor	Diesel	20	2008	Air Compressors	-2%	-2%	-2%	-2%	-2%	-2%
999 Manitiwoc	Diesel	390	2006	Cranes	0%	0%	0%	0%	0%	0%
2250 Manitiwoc 300 Ton-Upper engine	Diesel	450	2006	Cranes	0%	0%	0%	0%	0%	0%
2250 Manitiwoc 300 Ton - carrier engine	Diesel	460	2006	Cranes	0%	0%	0%	0%	0%	0%
Crane, 40-Ton, Grove, RT600	Diesel	173	2007	Cranes	0%	0%	0%	0%	0%	0%
Dozer, Cat D-9	Diesel	410	2006	Crawler Tractors	0%	0%	0%	0%	0%	0%
Dozer, Cat D-6	Diesel	150	2007	Crawler Tractors	0%	0%	0%	0%	0%	0%
Dozer, Cat 824	Diesel	354	2006	Rubber Tired Dozers	0%	0%	0%	0%	0%	0%

Table DR-AIR-9-2 OFFROAD Emission Factors: Difference between KCAPCD and CA Statewide Runs

Equipment Type	Fuel	Horsepower	Model Year	Air Resources Board Off-Road Model Category	CO (lb/hr)[a]	ROG (lb/hr)[a]	NOx (lb/hr)[a]	SOx (lb/hr)[a]	PM10 (lb/hr)[a]	PM2.5 (lb/hr)[b]
Loader, Cat, 972G	Diesel	275	2006	Rubber Tired Loaders	0%	0%	0%	0%	0%	0%
Motor Grader, Cat 140H	Diesel	150	2007	Graders	0%	0%	0%	0%	0%	0%
Diesel Welder 400 Amp	Diesel	31	2008	Welders	0%	0%	0%	0%	0%	0%
Hydro Crane 70-75 Ton RT	Diesel	275	2006	Cranes	0%	0%	0%	0%	0%	0%
Hydro Crane 30-35 Ton RT	Diesel	155	2007	Cranes	0%	0%	0%	0%	0%	0%
Tower Crane (Lieberr 630)	Diesel	275	2006	Cranes	0%	0%	0%	0%	0%	0%
Forklift 10000# RT	Diesel	100	2007	Forklifts	0%	0%	0%	0%	0%	0%
Forklift 30000#	Diesel	130	2007	Forklifts	1%	1%	1%	1%	1%	1%
CAT IT 28 Utility Loader	Diesel	50	2008	Rubber Tired Loaders	1%	1%	1%	1%	1%	1%
Truck Crane	Diesel	130	2007	Cranes	0%	0%	0%	0%	0%	0%
40'- 60' Manlift	Diesel	50	2008	Aerial Lifts	-4%	-4%	-4%	-4%	-4%	-4%
90' Manlift	Diesel	70	2008	Aerial Lifts	-5%	-5%	-5%	-5%	-5%	-5%
Scissor Lift	Diesel	50	2008	Aerial Lifts	-4%	-4%	-4%	-4%	-4%	-4%

Computation for percent change: (KCAPCD EF - CA EF)/(CA EF)*100

a. From Table 1.1 for diesel and Table 1.2 for gasoline.

b. Diesel PM2.5 emission factor [lb/hr] = PM10 emission factor [lb/hr] x PM2.5 fraction of PM10

PM2.5 Fraction of PM10 in Diesel Engine Exhaust = 0.920 and PM2.5 Fraction of PM10 in Gasoline Engine Exhaust =0.756 from Appendix A, Final–Methodology to Calculate Particulate Matter (PM) 2.5 and PM 2.5 Significance Thresholds, SCAQMD, October 2006

Emissions [pounds per day] = Emission factor [pounds per hour] x Number pieces of equipment x Operating time for each piece [hours per day]

DR-AIR-10

Information Required:

Please provide a defensible rationale as to why the locations for the area source emission inputs did not change from short-term to annual modeling, or please provide annual construction modeling that matches the extent of annual construction activities.

Response:

The choices of source location were intended to demonstrate the worst-case scenario for construction-phase modeling. Keeping the construction emission sources in the worst-case location for the entire year for the annual period model runs is a more conservative (worst-case) approach than to keep the sources in the worst-case location for a shorter period of time. By increasing the size of the area sources to cover the entire area to be worked over the course of a year and thus distributing the annual construction emissions over a much wider area, the modeled impacts would decrease substantially.

In response to this and other Data Requests, the annual construction-phase modeling was redone to be more realistic (less conservative). Although the annual impacts did decrease related to this factor, short-term impacts are greater due to the increased silt content (see DR-AIR-4), relocation of the power blocks and solar field, and other changes to the emissions. As noted above, the revised modeling results are provided in Attachment DR-AIR-6.

DR-AIR-11

Information Required:

Please provide a revised construction emissions NO2 modeling analysis that uses the NOx_OLM option with an OLM source group, and if necessary or desired, that uses actual hourly background NO2 data.

Response:

The air quality-impact analyses were revised to incorporate the updated emissions and more realistic modeling approaches as described in the Data Requests and responses above. The revised modeling results are provided in Attachment DR-AIR-6.

DR-AIR-12

Information Required:

Please provide a GHG emissions estimate for the project construction in CO2-equivalent tons for the entire construction period.

Response:

Greenhouse gas (GHG) emissions for the construction period are summarized in Table DR-AIR-12. A detailed explanation of the GHG emissions calculation procedure is provided as Attachment DR-AIR-12, Construction Greenhouse Gas Emission Calculations.

Table DR-AIR-12 Construction GHG Emissions

Aspect of Construction	Project Total (metric tons CO_2 equivalent)
Construction Equipment Total	27,558
Onsite Motor Vehicle Total	591
Offsite Motor Vehicle Total	15,108
Project Total	**43,257**
Annualized over Project Life (30 years)	**1,442**

DR-AIR-13

Information Required:

Please clarify the estimations and assumptions used in determining the number of mirror washing events per year.

Response:

The mirrors will be washed on an as-needed basis. For the purpose of estimating the wash truck vehicle mileage and wash water consumption, the Applicant assumes that the mirrors will be washed once monthly in the six months surrounding winter (assumed to be October through March) and twice monthly from mid-spring through mid-fall (assumed to be April through September). This schedule assumes 18 mirror washing events per year. The basis for this assumed mirror wash schedule is information provided to AECOM by the operations staff of the Kramer Junction Solar Energy Generating Station (SEGS) facility, a solar thermal facility in the Mojave Desert that uses a similar mirror technology. Each wash event is predicted to take 10 days to complete. However, as noted, the mirrors would be washed as-needed to maintain optimum performance.

DR-AIR-14

Information Required:

Please provide a clear and defensible explanation of why the amount of parabolic trough pipe length is equivalent to the mirror washing vehicle mileage for each washing cycle event, or revise this estimate as necessary to obtain a more reasonable total vehicle mileage estimate for mirror washing.

Response:

The vehicle travel distance has been revised to account for the additional distances required for refilling the water tank, refilling the soil stabilizer tank, refueling, and activity-specific considerations. The assumptions used to develop the revised travel distance for each of the required maintenance activities is explained briefly below and summarized in Table DR-AIR-14-1. Detailed step-by-step calculations are provided in Table E.2-20 in the spreadsheet with filename *Ridgecrest DR Operating Emissions.xlsx* on the CD-ROM in Attachment DR-AIR-3, Emission Calculations.

Mirror Wash Vehicle Travel

The total number of individual rows of mirrors is multiplied by the length of an individual row; added to this figure is the perpendicular length through the solar field to account for travel from row to row. This sum is the minimum travel distance in the solar field for a single pass. As the washing process is currently proposed, only one-half of each of the mirrors is washed per day. The mirror is stowed in the vertical upright position facing east and the bottom half of the mirror is washed on the first day. The following day, the mirror is stowed facing west and the other half is washed. Thus, the minimum travel distance is doubled to account for the actual physical washing process.

The mirror wash truck is assumed to have a capacity of 5,000 gallons of water, and the washing activity itself requires about 0.7 gallons per linear foot of mirror. Based on these values, the water truck can wash five full rows of mirrors before a truck refill is required. The average travel distance to refill the truck was calculated from the solar field back to the power block where the water storage tank is located. Each refill trip would require travel from the solar field to the power block and back to the solar field, thus for every refill trip, the average distance is doubled.

The travel distance through the solar field for washing is added to the travel distance for the refill trips to determine the total travel distance required for the mirror washing activity with water refill. It is assumed that the water wash truck would be refueled at the power block by a mobile fueling truck during a water refill stop, thus additional travel for fueling is not required. It was assumed that more than one water truck will be needed on site and that one mirror washing event can be completed in 10 days.

Weed Abatement Application

Weed abatement is performed on average four times per year. Similar to the travel for mirror washing, the total number of individual rows of mirrors is multiplied by the length of an individual row; added to this figure is the perpendicular length through the solar field to account for travel from row to row. Additional travel is assumed along the ends of the mirror rows. It is assumed that the weed abatement truck will not require refilling, as the herbicide would be applied to living plants only, and based on observations of the Kramer Junction SEGS facility, vegetation growth is minimal. Refueling is assumed to occur off site by the contractor prior to arrival at the site; thus no additional mileage for refueling is included in the distance estimate. It was assumed that one weed abatement application for the entire facility will take 10 days to complete.

Soil Stabilizer Application

Soil stabilizers are applied four times per year to the normal travel paths used by maintenance vehicles. Similar to the travel for mirror washing, the total number of individual rows of mirrors is multiplied by the length of an individual row; added to this figure is the perpendicular length through the field to account for travel from row to row. In addition to the travel in a single pass, it was also assumed that the perpendicular lengths would be stabilized a second time for stabilization of the path of travel required for header inspections.

The soil stabilizer truck is assumed to hold 5,000 gallons of solution, and the stabilizing activity itself requires about 0.8 gallons per linear foot of roadway. Based on these figures, the soil stabilizer truck can treat the roadway between four full rows of mirrors before a refill is required. The average distance of travel was calculated from the solar field back to the power block where the stabilizer supply is located.

Each refill trip would require travel from the solar field to the power block and back to the solar field, thus for every refill trip, the average distance is doubled.

The travel distance through the solar field for soil stabilizer application is added to the travel distance for the refill trips to determine the total travel distance required for the soil stabilizer application activity plus refill. It is assumed that the soil stabilizer truck will be refueled at the power block by a mobile fueling truck during a refill stop, thus additional travel for fueling is not required. It was assumed that one soil stabilizer application for the entire facility will take 10 days to complete.

Water Truck

Water truck travel distance is calculated based on the volume of reverse osmosis (RO) reject water generated per day that would be applied for dust suppression, and an application rate of three gallons per linear foot. RO reject water would be generated and applied to the solar field up to 365 days per year.

Maintenance Truck Travel

The piping headers will be physically inspected once per operating day, assumed to be 365 days per year; the distance traveled is equal to the piping length of the header itself, with some additional distance included to account for backtracking, as the heat transfer fluid (HTF) header is not a simple loop. In addition, the mirrors would have to be physically inspected following every high wind event. For the purpose of this estimate, 18 high wind events are assumed to occur per year, and the travel distance is equal to the minimum travel distance calculated for the solar field, as explained in the mirror wash description above. Maintenance vehicles are assumed to have the spare parts and supplies necessary to effect repairs without additional travel to the maintenance stores area at the power block. Refueling is assumed to occur off site; mileage is calculated based on the refueling frequency and the distance to the nearest off-site refueling facility. Similar to the weed abatement and soil stabilizer application, it was assumed that more than one maintenance vehicle will be required for the facility, and a full field inspection will require 10 days to complete.

Table DR-AIR-14 Maintenance Vehicle Travel Distance

Vehicle Use	Vehicle Type	Distance		
		Miles/task	Miles/day	Miles/year
Mirror Wash Truck	Water Trucks, Freightliner 5000 gallon	810	81	14,578
Weed Abatement	Water Trucks, Freightliner 5000 gallon	158	16	631
Soil Stabilizer Application	Water Trucks, Freightliner 5000 gallon	529	53	2,117
Water Trucks	Water Trucks, Freightliner 5000 gallon	1.5	1.5	536
Maintenance Vehicles	Onsite Pick Up Truck 1/2 Ton	---	171[1]	6,089

1. Daily mileage is based on the distance required for inspection of the entire solar field.

DR-AIR-15

Information Required:

Please provide the entire calculation to show how an annual mileage value of 438 miles was determined for the mirror washing vehicles.

Response:

As explained in the response to DR-AIR-14, the vehicle travel distance has been revised to account for the additional distances required for refilling the water tank, refueling, and activity-specific considerations. The assumptions used to develop the revised travel distance for each of the required maintenance activities is explained in the response to DR-AIR-14 and summarized in Table DR-AIR-14-1. Detailed calculations are provided in Table E.2-20 in the spreadsheet with filename *Ridgecrest DR Operating Emissions* on the CD-ROM (Attachment DR-AIR-3, Air Emission Calculations).

DR-AIR-16

Information Required:

Please explain how the annual mileage values were determined for the Soil Stabilizer Application and Weed Abatement trucks.

Response:

As explained in the response to DR-AIR-14, the vehicle travel distance has been revised to account for the additional distances required for refilling the tank trucks, refueling, and activity-specific considerations. The assumptions used to develop the revised travel distance for each of the required maintenance activities is explained in the response to DR-AIR-14 and summarized in Table DR-AIR-14. Detailed calculations are provided in Table E.2-20 in the spreadsheet with filename *Ridgecrest DR Operating Emissions* on the CD-ROM (Attachment DR-AIR-3, Air Emission Calculations).

DR-AIR-17

Information Required:

Please review the maintenance vehicle annual mileage estimates and revise the emission estimates and air dispersion modeling as necessary if corrections are found that increase the emission estimates.

Response:

As explained in the response to DR-AIR-14, the vehicle travel distance has been revised to account for the additional distances required for refilling the tank trucks, refueling, and activity-specific considerations. Daily mileage is based on the distance required for inspection of the entire solar field. The assumptions used to develop the revised travel distance for each of the required maintenance activities is explained in the response to DR-AIR-14 and summarized in Table DR-AIR-14. Detailed calculations are provided in Table E.2-20 in the spreadsheet with filename *Ridgecrest DR Operating Emissions* on the CD-ROM (Attachment DR-AIR-3, Air Emission Calculations).

DR-AIR-18

Information Required:

Please revise the emissions calculations for the onsite dedicated vehicle exhaust emissions assuming only new model year vehicles are used.

Response:

Exhaust emissions for gasoline powered maintenance trucks have been revised using model year 2013 emission factors, which will be the new model year as of start of operations. The specific emission factors used are shown in Table DR-AIR-18-1 and the corresponding emissions are shown in Table DR-AIR-18-2. The emission factors and emissions also appear in Tables E-3.7a and E-3.7c in the spreadsheet with filename *Ridgecrest DR Operating Emissions* on the CD-ROM (Attachment DR-AIR-3, Air Emission Calculations).

Table DR-AIR-18-1 Gasoline and Diesel Powered Maintenance Vehicle Emission Factors

Vehicle Type	NOx (lb/mi)	VOC (lb/mi)	CO (lb/mi)	SOx (lb/mi)	Exh. PM10 (lb/mi)	Tire + Brake PM10 (lb/mi)	Exh. PM2.5 (lb/mi)	Tire + Brake PM2.5 (lb/mi)
Gasoline	9.18E-05	4.16E-05	1.20E-03	1.07E-05	1.07E-05	4.59E-05	9.90E-06	1.64E-05
Diesel	4.16E-03	4.24E-04	2.12E-03	4.14E-05	1.19E-04	1.40E-04	1.09E-04	4.60E-05

Table DR-AIR-18-2 Maintenance Vehicle Emissions

Period	NOx	VOC	CO	SOx	PM10[1]	PM2.5[1]
Maximum Hourly Emissions (lb/hr)	0.049	0.005	0.037	0.001	0.001	0.001
Maximum Daily Emissions (lb/day)	0.359	0.042	0.381	0.005	0.0012	0.0011
Annual Emissions (tpy)	0.037	0.004	0.023	0.000	0.001	0.001

1. Emissions presented in this table do not include fugitive PM10 or fugitive PM2.5 emissions, as the model year emission factors do not impact the entrained dust or associated emissions.

DR-AIR-19

Information Required:

Please identify if the applicant would be willing to stipulate to a condition of certification that would require a review of available alternative low-emission vehicle technologies, including electric and hydrogen fueled vehicles, and use of those technologies to replace the proposed diesel and gasoline fueled vehicles used for operations maintenance if lower emission alternative technology vehicles are both available and not cost prohibitive.

Response:

The RSPP is not currently exploring using alternative-fuel vehicle technologies such as electric or hydrogen fueled vehicles. As shown in Table DR-AIR-18-2 above, vehicle (tailpipe) emissions during facility operations are estimated to be well below 0.01 ton per year of all criteria pollutants. While entrained road dust fugitive emissions are expected to exceed one ton per year, the use of alternative fueled vehicles would not reduce the fugitive dust emissions. As concluded in the AFC, the RSPP has not identified any direct or indirect significant adverse air quality impacts from the use of on-site vehicles and, therefore, mitigation as suggested in this data request is not warranted. As an alternative, the Applicant would be willing to accept a condition similar to that recommended by Staff for the Beacon Solar Energy Project, as follows:

The Project owner shall use 2013 model year or newer vehicles, meeting California model year on-road vehicle emission standards, for onsite parabolic mirror washing activities and all other facility maintenance activities. Other vehicle/fuel types may be allowed assuming that the emission profile for those vehicles, including fugitive dust generation emissions, is comparable to the vehicles types identified above.

DR-AIR-20

Information Required:

Please provide quarterly wind rose data for the Mojave, Ridgecrest, and Trona monitoring sites.

Response:

The quarterly wind rose data are provided at the end of this section as Attachment DR-AIR-20, Quarterly Wind Roses.

DR-AIR-21

Information Required:

Please provide the coordinates of the Mojave, Ridgecrest, and Trona monitoring sites in Latitude and Longitude or Universal Transverse Mercator (UTM) coordinates.

Response:

The Latitude and Longitude coordinates for the three sites are as follows:

Mojave:	Latitude: 35.051	Longitude: -118.146
Trona:	Latitude: 35.764	Longitude: -117.396
Ridgecrest (China Lake):	Latitude: 35.688	Longitude: -117.693

DR-AIR-22

Information Required:

Please provide a data completeness comparison for the Mojave, Ridgecrest, and Trona monitoring sites for meteorological data from 2000 to 2008.

Response:

The Mojave measurement site, operated by the California Air Resources Board (ARB) was chosen as the surface station for the RSPP mainly due to data capture statistics at the upper air station (Mercury-Desert Rock, Nevada) and alternate surface stations recommended by Glen Stephens at KCAPCD, specifically China Lake Naval Air Facility in Ridgecrest and the Trona measurement site. In an email dated July 14, 2009, Mr. Stephens indicated that if the data capture at Trona and China Lake were not sufficient for use in dispersion modeling, the use of the data from the Mojave site would be acceptable. The text of the email is included at the end of this response.

The data capture statistics for the upper air soundings from Mercury-Desert Rock, presented in Table DR-AIR-22-1, show that the upper air data after 2004 do not meet the 90 percent (minimum) completeness criteria recommended by EPA ambient air quality monitoring and modeling guidelines. Therefore, no meteorological data after 2004 were considered for the analysis.

Table DR-AIR-22-1 Upper Air Data Capture Statistics for Mercury-Desert Rock, NV

Year	Missing Soundings	% Complete
2000	1	99.7%
2001	2	99.5%
2002	4	98.9%
2003	2	99.5%
2004	0	100.0%
2005	54	85.2%
2006	52	85.8%
2007	107	70.7%
2008	101	72.4%

According to the National Climatic Data Center - Integrated Surface Hourly meteorological data, the data capture statistics for 2000 through 2004 at China Lake Naval Air Facility, shown in Table DR-AIR-22-2 are well below the 90 percent data capture threshold for wind speed, wind direction and ambient temperature. Therefore, China Lake Naval Air Facility was not chosen as the surface station for the dispersion modeling analysis.

Table DR-AIR-22-2 Data Capture Statistics at China Lake Naval Air Facility

Year	% Complete		
	Wind Direction	Wind Speed	Temperature
2000	36.6%	45.2%	47.9%
2001	32.3%	44.4%	46.4%
2002	32.9%	48.0%	47.8%
2003	34.5%	48.9%	48.7%
2004	34.7%	47.9%	47.7%

Surface data for the Trona air monitoring station obtained from Mojave Desert Air Quality Management District (MDAQMD) were analyzed for data capture statistics for 2000 through 2004. The data capture at Trona also is incomplete (i.e., less than 90 percent) for wind speed in 2003 and for wind direction in 2001 (see Table DR-AIR-22-3). Therefore, the Trona Air Monitoring station was not chosen as the surface station for the dispersion modeling analysis.

Table DR-AIR-22-3 Data Capture Statistics at Trona Air Monitoring Station

Year	% Complete		
	Wind Direction	Wind Speed	Temperature
2000	96.1%	99.7%	99.7%
2001	79.6%	96.8%	96.8%
2002	95.3%	99.3%	99.3%
2003	91.4%	88.1%	91.7%
2004	99.8%	95.0%	98.9%

Surface data from the Mojave air monitoring site for 2002 through 2004, chosen to coincide with the three most recent years in which the upper air data from Mercury-Desert Rock has a data capture greater than 90 percent, were analyzed to assess the completeness of the data. As shown in Table DR-AIR-22-4, the data capture for wind direction, wind speed and temperature meet the 90 percent data capture completeness criteria. Therefore, based on data capture statistics, the Mojave air monitoring station was chosen as the surface station for the dispersion modeling analysis.

Table DR-AIR-22-4 Data Capture Statistics at Mojave ARB Air Monitoring Station

Year	% Complete		
	Wind Direction	Wind Speed	Temperature
2002	99.7%	99.7%	99.7%
2003	99.9%	99.9%	99.9%
2004	93.6%	93.5%	93.6%

Email from Glen Stephens of Kern Country APCD to Matthew Stresing of AECOM, 7/17/09:

From: Glen Stephens [mailto:GlenS@co.kern.ca.us]
Sent: Tuesday, July 14, 2009 10:25 AM
To: Stresing, Matthew
Subject: Re: MET Data Selection for Ridgecrest Solar Power Project

Matthew, Please proceed.

-Glen

Glen Stephens, P.E.
Kern County Air Pollution Control District
Phone: (661) 862-8687
FAX: (661) 862-5251

>>> "Stresing, Matthew" <Matthew.Stresing@aecom.com> 07/14/2009 6:51 AM >>>

Glen,

Per our phone conversation regarding MET data selection to be used in dispersion modeling for the proposed solar power project near Ridgecrest, I investigated surface data for China Lake Naval Air Facility and at the Trona air monitoring site.

According to the NCDC ISH Data Inventory, the data capture at China Lake (shown in table below) is only >90% for two years (2007-2008) with years before 2007 being well below 90%. Therefore, China Lake cannot be used.

Monthly Data Capture at China Lake Naval Air Facility														
USAF	WBAN	YEAR	Observations per Month											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
746120	93104	2002	334	325	368	385	370	358	341	375	336	387	334	323
746120	93104	2003	341	338	367	404	361	373	388	363	390	382	318	319
746120	93104	2004	312	346	399	392	356	365	350	387	358	350	338	300
746120	93104	2005	313	345	388	370	366	373	336	379	392	343	313	315
746120	93104	2006	354	321	385	337	334	350	346	401	353	334	355	304
746120	93104	2007	296	885	1162	924	902	736	750	748	825	879	704	749
746120	93104	2008	658	658	732	403	617	732	742	745	713	747	791	635

I requested and received surface data for the Trona air monitoring station from MDAQMD and analyzed the data capture for 2002-2004. 2002-2004 was chosen to coincide with upper air data at Mercury Desert Rock, NV that meets 90% data capture. Unfortunately the data capture at Trona also has a data capture issues where the wind speed in 2003 is <90% (see the table below). Therefore I propose using meteorological data previously process for the Beacon Solar Power Project using Mojave ARB surface data (2002-2004) with concurrent upper air data from Mercury Desert Rock, NV.

2002 Data Capture Statistics for Trona Air Monitoring Site		
Parameter	**# of Hours Missing**	**% Complete**
Pressure	59	99.3%
Temperature	64	99.3%
Wind Speed	65	99.3%

2003 Data Capture Statistics for Trona Air Monitoring Site		
Parameter	**# of Hours Missing**	**% Complete**
Pressure	631	92.8%
Temperature	725	91.7%
Wind Speed	1042	88.1%

2004 Data Capture Statistics for Trona Air Monitoring Site		
Parameter	**# of Hours Missing**	**% Complete**
Pressure	8	99.9%
Temperature	97	98.9%
Wind Speed	437	95.0%

Please feel free to call me with any questions or comments.

Matt

DR-AIR-23

Information Required:

Please confirm the emergency generator engines size and describe what facilities the emergency generator will support in an emergency.

Response:

The emergency generator will be a 2-megwatt (output) diesel-fired unit. The engine driving the generator is 2,922 horsepower. The Applicant will purchase and install an engine meeting the applicable emissions standards for this engine as of the date of manufacture, as defined by the applicable regulation.

At this time, the Applicant plans to order the equipment upon approval of the CEC license, anticipated in 2010. The appropriate design standard for 2010 model year engines greater than 750 horsepower is the Tier 2 standard. The Applicant proposed a Tier 2 engine for the emergency generator based on the emission standards identified in 40 Code of Federal Regulations (CFR), Part 60, Subpart IIII, Standards of Performance for Stationary Compression Ignition Internal Combustion Engines. Pursuant to Section 60.4202(a)(2) of that subpart, engines with a maximum rating of more than 50 horsepower must meet the emission standards listed in 40 CFR 89.112 for all pollutants beginning in 2007. The emission standards

listed in 40 CFR 89.112 for engines with rated power greater than 560 kilowatt (kW) (750 Hp) are Tier 2 standards which are: 6.4 grams per kilowatt hour (g/kWh) for NOx and non-methane hydrocarbons (NMHC) combined, 3.5 g/kWh for CO and 0.20 g/kWh for PM.

If the equipment is not ordered until 2011, the appropriate design standard would be the Interim Tier 4 standards, in accordance with the California Airborne Toxic Control Measure (ATCM) for Stationary Compression Ignition Engines. According to the ATCM, new stationary emergency engines must meet the standards for off-road engines of the same model year and maximum rated power as specified in the Off-Road Compression Ignition Engines Standards (Title 13, California Code of Regulations (CCR), Section 2423). Title 13 CCR Section 2423 sets emission standards for the generator engine with model years 2011 and later. The Interim Tier 4 standard applies to the Project generator engine as the engine would be larger than 900 kW (750 horsepower) and would be manufactured between 2011 and 2014. The standards are 0.67 g/kWh for NOx, 0.40 g/kWh for NMHC, 3.5 g/kWh for CO and 0.10 g/kWh for PM.

Tier 2 emissions were used in the emission calculations, ambient air quality impacts analysis (i.e., modeling) and health risk assessment. If the equipment is not ordered until 2011, the appropriate design standard would be the Interim Tier 4 standard and NOx, NMHC and PM10 emissions would be lower than the emissions from the Tier 2 engine. In that case, the air quality impacts would be lower than the impacts predicted for the Tier 2 engine. Thus, use of the Tier 2 emissions yields the worst-case predicted impacts for modeling, for predicting emission offset requirements, and for predicting health risk impacts.

The emergency generator is required to provide motive power to three principle areas of the facility: 1) Freeze Protection Pump, 2) Balance of Plant (BOP) Motor Control Center (MCC), and 3) HTF MCC. The specific loads for the BOP MCC and HTF MCC are shown in Table DR-AIR-23-1, and there may be other small loads connected to the power supply to allow the facility to shut down safely.

Table DR-AIR-23-1 Emergency Loads

BOP MCC	HTF MCCs	
Heat Trace XFMR	Power supply cabinet channel A - H	Anticondensation heater LV-motors
Main Fire Alarm Panel	Nitrogen system Heater switchboard	HTF control valve behind reheater 1 to 4
CEMS HVAC	Nitrogen system Junction Box-Power	Centralization box signals
480V Power Panel	PLC Main nitrogen supply	Anticondensation heater LV-motor
STG Turning Gear	Field Supervisory Control 1 and 2	Fire alarm control panel supply 1 and 2
ST Turbine Lube Oil Pump	Fiber optic termination cabinet	Centralization box signals
Fire Water Jockey Pump	HTF control system supply 1 and 2	Distribution box heaters
Battery Charger A	Nitrogen control valves in front of expansion vessels	Filler valve of HTF system
UPS Bypass	Tracing of main service water pipe	Tracing of overflow vessel 1 to 8
CEMS Skid	Control valve in ullage pipe	Control valve in ullage pipe
Gen Breaker	Transformer temperature monitoring cabinet	Anticondensation heater LV-motors
GSU Fans Feeder	Shutoff devices	Overflow return pumps
	Control valve in front of reclamation flash vessel	HTF drain pumps

DR-AIR-24

Information Required:

Please confirm that 500 hours/year of heater operation is sufficient for HTF freeze protection.

Response:

Based on the system performance modeling and historical ambient temperature data, 500 hours of operation for the HTF heater is expected to be sufficient for HTF freeze protection.

DR-AIR-25

Information Required:

Please confirm that the sole purpose of the auxiliary heater is for HTF freeze protection and that it will not be used directly for power generation or for rapid start support.

Response:

The sole purpose of the HTF heater is to ensure the HTF fluid temperature is maintained at a minimum of 54 degrees Fahrenheit for HTF freeze protection. This unit will not be used for direct power generation or for rapid start support.

DR-AIR-26

Information Required:

Please confirm that the use of the auxiliary boiler is strictly for rapid start support through overnight low load (25 percent) operation and early morning full load operation and that it will not be used directly for power generation or for HTF freeze protection.

Response:

The auxiliary boiler will be used to support rapid startup each morning, specifically to establish the steam seals in the steam turbine and maintain the air-cooled condenser (ACC) in an evacuated condition so that the facility can generate power as soon as the solar-generated steam is sufficient to drive the steam turbine. The auxiliary boiler will not be used directly for power generation or for HTF freeze protection. The maximum daily operation of the boiler is expected to be 15 hours per day at 25 percent load and two hours per day at full load.

DR-AIR-27

Information Required:

Please identify the equivalent MWh generated or enabled by the rapid start support use of this boiler.

Response:

The equivalent megawatt per hour (MWh) generated or enabled by the rapid start support use of these boilers is determined by estimating the time required to evacuate the ACC if the seal steam was lost, as steam is required to establish the seal. According to the ACC equipment manufacturer, approximately one hour is required to evacuate the ACC. Based on this duration, use of the auxiliary boiler enables an additional net output at 27 gigawatt hours per year for the Project.

Note that the auxiliary boiler capacity does not directly influence the MWh enabled by the use of the boiler. The boiler is used to maintain the steam seal on the steam turbine and ACC and maintain the ACC in an evacuated condition (under vacuum) during non-generating periods (i.e., at night). The size of the boiler is dictated by the steam requirements for those two functions only. The MWh "saved" is estimated by predicting the time required to generate enough steam to establish the steam seal on the turbine and ACC and then evacuate the ACC using only solar heat (i.e., assuming that the gas-fired boiler did not exist). According to engineering estimates, the time required to generate sufficient steam to establish the steam seal on the turbine and ACC and then evacuate the ACC is approximately one hour following sunrise. One hour represents approximately six percent of the daily availability for power production during the summer (16 hours per day of sunlight) and approximately 10 percent of the availability during the winter (10 hours per day of sunlight). The actual calculation to determine MWh enabled was performed with a thermodynamic model of the solar plant operation, and is not a simple calculation.

In addition, use of the auxiliary boiler reduces the wear and tear on the steam turbine by avoiding the heat-up and cool-down cycle that would occur without the boiler. This provides the direct benefit of longer service intervals and less downtime.

DR-AIR-28

Information Required:

> Please provide an estimate of the SF6 onsite inventory and leakage emissions both in operation and construction phases to complete the GHG emission estimates.

Response:

Sulfur hexafluoride (SF_6) will not be used during the construction period. The on-site inventory of SF_6 during operations is found in the circuit breakers and will be not more than 100 pounds for the Project. The SF_6 leakage rate from operating equipment is guaranteed at 0.5 percent per year and can be less than 0.2 percent per year with current best technology. At the maximum guaranteed leak rate of 0.5 percent, this corresponds to 0.5 pounds per year of SF_6 emissions, or 5.98 metric tons per year of CO_2 equivalent (CO_2e) for the Project. The more probable, technically feasible leak rate is 0.2 percent, which corresponds to approximately 71.7 metric tons CO_2e emissions over the 30-year plant lifetime.

DR-AIR-29

Information Required:

Please confirm that there will be no gasoline or diesel vehicle refueling storage at the site and that either fuel/lube trucks will be used for onsite refueling or the onsite dedicated vehicles will have to drive to the nearest gasoline station, which is approximately a ten mile round trip from the site, to refuel. If gasoline or diesel storage is used at the site, provide information for any proposed onsite gasoline or diesel storage and refueling facilities including throughput information and permitting requirements.

Response:

The diesel-fueled equipment (i.e., mirror wash trucks, soil stabilizer application trucks, and emergency fire water pump and generator engines) will be refueled by a mobile fuel truck that will travel to the Project site. The gasoline powered maintenance trucks will be refueled at the nearest retail gasoline station. There are no fuel storage facilities planned for the Project.

DR-AIR-30

Information Required:

Please indicate if the additional vehicle mileage required for offsite refueling of the dedicated onsite vehicles or fuel/lube truck mileage is considered in the total vehicle miles estimates and emissions estimates, or please correct the estimates accordingly.

Response:

As noted above, the diesel-fueled equipment will be refueled by a mobile fuel truck that will travel to the Project site. The gasoline powered maintenance trucks will be refueled at the nearest retail gasoline station. The vehicle miles traveled for fueling operations are summarized in Table DR-AIR-30-1.

Emission estimates have been revised to include emissions from periodic delivery of diesel fuel to the Project site via a mobile refueling truck. The mobile refueler is assumed to travel from Lancaster, a round trip travel distance of 161 miles. The mobile refueler is assumed to make 12 fuel deliveries per year.

Maintenance vehicle emission estimates have been revised to reflect periodic refueling at a local service station, assumed to be located in Ridgecrest, a roundtrip travel distance of approximately 25 miles. Refueling is assumed to occur a total of 26 times per year and a maximum of twice per day. Detailed calculations of the refueling mileage are also provided in Table E.3-8a in the spreadsheet with filename *Ridgecrest DR Operating Emissions* on the CD-ROM (Attachment DR-AIR-3, Air Emission Calculations).

Emissions associated with this off-site vehicle travel are summarized in Table DR-AIR-30-2, and detailed calculations are provided in Table E.2-7 on the CD-ROM.

Table DR-AIR-30-1 Vehicle Refueling Mileage Estimate

Fuel Type		Diesel	Gasoline
Vehicle Use		Miscellaneous Solar Vehicle Refueling	Maintenance Truck Refueling
Vehicle Type		Water Trucks, Freightliner 5,000 gallon	Pickup Truck
Fuel Type		Diesel	Gasoline
Number of Trips	Trips per Day	1	2
	Trips per Year	12.0	26.0
Destination	---	Lancaster	Ridgecrest
Round Trip Distance	Miles per Trip	161	25
Miles Traveled	Miles per Day	161	50
	Miles per Year	1,932	650

Table DR-AIR-30-2 Off-site Vehicle Criteria Pollutant Emission for the Project

Trip Type	**NOx**	**VOC**	**CO**	**SOx**	**PM10**	**PM2.5**
	Monthly Emissions (lb/month)					
Propane Delivery	5.7E+00	4.2E-01	1.6E+00	6.3E-03	4.2E-01	3.0E-01
Miscellaneous Delivery	1.1E+01	8.4E-01	3.2E+00	1.3E-02	8.4E-01	6.0E-01
Diesel Truck Refueling	5.6E+00	4.2E-01	1.6E+00	6.3E-03	4.2E-01	3.0E-01
Maintenance Vehicles	4.6E-03	2.1E-03	6.0E-02	5.3E-04	5.0E-02	2.3E-02
Total	**22.621**	**1.672**	**6.389**	**0.026**	**1.723**	**1.226**
	Annual Emissions (tpy)					
Propane Delivery	2.9E-01	2.1E-02	8.0E-02	3.2E-04	2.1E-02	1.5E-02
Miscellaneous Delivery	1.7E-01	1.3E-02	4.8E-02	1.9E-04	1.3E-02	9.0E-03
Diesel Truck Refueling	3.4E-02	2.5E-03	9.4E-03	3.8E-05	2.5E-03	1.8E-03
Maintenance Vehicles	3.0E-05	1.4E-05	3.9E-04	3.5E-06	3.2E-04	1.5E-04
Total	**0.491**	**0.036**	**0.138**	**0.001**	**0.037**	**0.026**

DR-AIR-31

Information Required:

Please provide a list from the KCAPCD of large stationary source projects with permitted emissions, for projects with greater than 5 tons of permitted emissions of any single criteria pollutant, located within six miles of the project site that have been recently permitted, but did not start operation prior to 2009, or are in the process of being permitted.

Response:

Please refer to the response to DR-AIR-32 below.

DR-AIR-32

Information Required:

Please provide a cumulative impacts modeling analysis in consultation with Energy Commission staff, if necessary, based on the project list provided by KCAPCD.

Response:

In an email to Richard Hamel of AECOM dated August 26, 2009, Glen Stephens of the KCAPCD indicated that no applicable Kern County permitted sources existed within 6 miles of the RSPP site and that the addition of ambient background concentrations would be sufficient for the cumulative modeling analysis. As a result, no non-Project sources were included in the RSPP modeling analysis. The text of that email is included below:

Richard, you are correct in your assessment.

-Glen

Glen Stephens, P.E.
Kern County Air Pollution Control District
Phone: (661) 862-8687
FAX: (661) 862-5251

>>> "Hamel, Richard" <richard.hamel@aecom.com> 08/26/2009 2:26 PM >>>
Glen,

Thank you for your assistance earlier today regarding the Ridgecrest Solar Power Project.

This email is a follow up to confirm that I requested information about any other emissions sources in the area that would need to be included in a cumulative modeling analysis, if one is required, for PM10. You indicated that no other KCAPCD permitted emissions sources are located in the RSPP area and hence adding the appropriate ambient background for PM10 would be sufficient to demonstrate compliance with the NAAQS. If I misunderstood anything, please let me know.

Thanks again,
Richard Hamel

DR-AIR-33

Information Required:

Please provide copies of any official submittals and correspondence to or from KCAPCD within 5 days of their submittal to or their receipt from the District.

Response:

The correspondence with the KCAPCD regarding this Project since the submittal of the AFC in September 2009 is limited to the submittal of the air permit application; a copy of which have been provided to CEC. As requested, future correspondence will be provided in a timely manner.

Attachment DR-AIR-3

Air Emission Calculations

(On CD-ROM)

Attachment DR-AIR-6

Revised Air Quality Impacts Assessment

AECOM
Environment

Attachment DR-AIR-6

Revised Air Quality Impact Assessment for Ridgecrest Solar Power Project

09-AFC-9

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1.0 Introduction

This document outlines the supplemental modeling performed in response to RIDGECREST SOLAR POWER PLANT (09-AFC-9), DATA REQUESTS SET 1 issued by the California Energy Commission (CEC) on December 22, 2009. This attachment provides the results of revised air dispersion modeling performed in response to the following CEC Air Quality data requests:

- DR-AIR-6: Please update the construction and operations particulate modeling analysis, as necessary, based on the revised fugitive dust emission calculations.
- DR-AIR-10: Please provide a defensible rationale as to why the locations for the area source emission inputs did not change from short-term to annual modeling, or please provide annual construction modeling that matches the extent of annual construction activities.
- DR-AIR-11: Please provide a revised construction emissions NO_2 modeling analysis that uses the NOx_OLM option with an OLM source group, and if necessary or desired, that uses actual hourly background NO_2 data.
- DR-AIR-17: Please review the maintenance vehicle annual mileage estimates and revise the emission estimates and air dispersion modeling as necessary if corrections are found that increase the emission estimates.

Additionally, as outlined in the Alternatives section there are concerns about the orientation of the site as proposed in the AFC in regard to the passage of the El Paso Wash through the Project area. A revised site layout has therefore been prepared. Because of the reconfiguration of the site and in response to the four data requests listed above, the newest version of the AERMOD model (version 09292) was applied with a three-year sequential hourly meteorological data set, which is more than the one year of meteorological data required by Appendix B of the CEC's Guidelines (Rules of Practice and Procedure, Power Plant Site Certification, 2008) for both the operations and the construction modeling.

The meteorological data and ambient background concentrations used remain the same as in the original application and are fully documented in Section 5.2 of the Application for Certification (AFC) and not repeated here. Questions concerning the selection of the meteorological data are addressed in the responses to DR-AIR-20, -21, and -22. The configuration of the model sources and the receptor grids have been updated for the reconfigured site and are documented in the sections below.

The Air Dispersion Modeling Archive is included electronically on a CD at the end of this attachment.

2.0 Summary of Modeling Revisions

2.1 Criteria Pollutant Emissions Changes

For both operations and construction, a number of changes were made to the sources and their emissions used in the modeling analysis. These changes include:

- Due to siting considerations, the planned configuration of the facility has changed, resulting in the relocation of the power block. As a result, the locations of the ancillary equipment sources have changed and are updated in the revised modeling.
- Particulate matter less than 10 microns (PM10) and particulate matter less than 2.5 microns (PM2.5) emissions were updated to reflect the adjusted silt content for the particulate modeling (per DR-AIR-4).
- Emissions for all criteria pollutant emissions during operations were revised based on updated operations-related vehicular travel estimates (per DR-AIR-14, -15, -16, and -17).
- Emissions for all criteria pollutant emissions during operations were revised based on model year 2013 emission factors (per DR-AIR-18)
- The emergency diesel generator located at the power block has been resized since the original AFC submittal. As a result, the source parameters and criteria pollutant emissions have been updated for the operations modeling (per DR-AIR-23).

The revised detailed emission calculations for construction and operations were provided in spreadsheets provided in Attachment DR-AIR-3 of this submittal.

2.2 Modifications to the Annual Construction Sources

Per request DR-AIR-10, the annual construction modeling was modified by adjusting the area sources to cover construction across the entire Project site. As was discussed in the response to DR-AIR-10, keeping the construction emission sources in the worst-case location for the entire year for the annual period model runs is a very conservative (worst-case) approach compared to distributing the annual emissions over the entire site. To respond to the CEC data request, the revised source locations and layout used in the revised modeling are given in Figure DR-AIR-6-1.

As described in the AFC, the solar field construction activities were divided into three phases: 1) surveying, brush removal and site preparation; 2) scraping and grading; and 3) solar panel installation. In addition to the three area sources representing those phases, additional area sources were defined for modeling purposes which included power block construction and a vehicle corridor from the laydown area to the construction zone.

In the prior modeling, each construction activity was allocated to an individual area source. In the revised annual modeling, the surveying, brush removal, site preparation, scraping and grading, and solar panel installation emission sources were combined into eighteen large solar array construction sources which covered all of the solar fields at the facility. Emissions from each construction activity were equally allocated to each of the eighteen new construction area sources, which combined had a total area of 4,479,185 square meters (m^2). In addition, the power block construction area source was represented by a polygon area source with an area of 113,515 m^2. The revised sources used in the annual construction modeling are shown in Figure DR-AIR-6-1.

Vehicular travel to and from the lay down area was represented by a polygon area source with a total area of 592,420 m^2. This source represents emissions from haul trucks and construction equipment with vertical exhaust pipes travelling from the laydown/manufacturing area at the southern end of Solar Field 2 to the various power block and solar array construction areas. The base elevation chosen for this source was the elevation at the centroid of the source (819.9 meters [m]).

For fugitive particulate emissions, all of the construction emission sources had a second overlaid area source representing paved and unpaved roadway travel and other construction activities that produce fugitive emissions (e.g. scraping, grading and vehicular travel in unpaved areas).

2.3 Modifications to the Short Term (24-hours and less) Construction Sources

Because of the reconfiguration of the site layout, new short term construction sources were chosen to represent worst case construction impacts. These revised construction sources are shown in Figure DR-AIR-6-2 and represent the following:

- Power block construction;
- Surveying and grubbing activities (i.e., brush removal and coarse grading);
- Scraping, grading, and foundation emplacement;
- Solar panel installation; and
- Travel to and from the laydown area to the various construction sites.

Because of the “just in time” construction approach, only a limited area of the Project site would be undergoing construction activities on a given day. A worst-case modeling scenario was developed involving construction in Solar Field 2 and the power block, as shown in Figure DR-AIR-6-2. The modeling scenario selected is conservative for several reasons:

1. The grubbing, scraping and grading, and mirror installation modeling sources are aligned west to east along the eastern property fence line downwind of and parallel to the prevailing wind direction. These sources are also located close to the power block construction source providing the maximum overlap of impacts between the construction sources.
2. The compactness of the modeling sources will maximize the local emission flux from the individual sources.
3. The maximum construction emissions associated with the power block are assumed to occur concurrently with the construction of the solar array field in the area most likely to cause the worst case impacts.

The power block construction emission source was represented by a polygon area source area of 113,515 m^2. This area source represents the entire power block area. The construction emission flux for this source was calculated based on the equipment and operations on a typical day during the month with peak construction emissions. The area source represents emissions from construction equipment with vertical exhaust pipes. For fugitive dust emissions, the power block emission source had a second overlaid area source representing low-level emissions from paved and unpaved roadway travel and other construction activities that produces fugitive emissions (e.g., scraping, grading and vehicular travel in unpaved areas).

The grubbing, scraping and grading, and solar panel installation emission sources were each represented by adjoining square area sources 200 m by 200 m (40,000 m^2). The three area sources represent the typical area that would be under construction during any given 24-hour period. The construction emission flux was calculated based on the equipment and operations in an area of this size on a typical day during

the month with peak construction emissions. As with the power block construction source, each area source represents emissions from construction equipment with vertical exhaust pipes. For fugitive dust sources, each area source had a second overlaid area source representing fugitive dust generated from vehicle travel on the paved and unpaved roads and other construction activities that would produce fugitive dust emissions (e.g. scraping, grading and wind-blown fugitives from storage piles). As shown in Figure DR-AIR-6-2, the three area sources representing the solar field construction were placed in an east-west orientation along the eastern fence line downwind of and parallel to the predominant wind direction, which maximizes the cumulative impacts of the three sources.

Vehicular travel to and from the laydown area was represented by a polygon area source with a total area of approximately 224,455 m^2. This area source represents emissions from haul trucks and construction equipment with vertical exhaust pipes travelling to and from the laydown/manufacturing area at the southern end of Solar Field 2 to and from the various construction areas. For fugitive emissions, the roadways emission source had a second overlaid area source representing fugitive dust generated from vehicle travel on the paved and unpaved roadways. The base elevation chosen for this source was the elevation at the mid-point of the entire source (829.0 m).

Buoyancy and mechanical turbulence from the hot exhaust and mobility of the construction equipment and haul trucks was simulated by use of a constant initial vertical dimension in the area source algorithm. Fugitive dust emissions from onsite motor vehicles were modeled as low-level area sources since these emissions would almost all occur near ground level.

The large construction equipment was assumed to have a release height of 3.7 m. The initial vertical depth of the diesel exhaust plume for construction activities was estimated as being four times the release (exhaust) height. This height (14.8 m) takes into account the plume rise of the hot diesel exhaust, mechanical mixing on the site introduced by the movement of heavy equipment, and structure wake turbulence introduced by buildings and structures on the Project site. The initial area source vertical standard deviation for the construction equipment is calculated by taking this vertical depth and dividing by 2.15 for an initial sigma-z of 6.88 m, consistent with EPA modeling guidance for AERMOD.

A release height of 2.0 m was assumed for the fugitive emissions from onsite vehicle sources, with an initial plume height of 15 feet (4.57 m). Following EPA AERMOD guidance, the initial area source vertical standard deviation for construction combustion emissions is estimated as the plume depth divided by 2.15, or 2.13 m.

2.4 Modifications to the Operations Modeling Sources

As was described in Section 2.1, the planned configuration of the facility has changed significantly due to siting concerns. As a result, the power block is now located on the southwest side of Solar Field 2 in the new configuration, and thus the ancillary equipment has also moved. Additionally, the characteristics of the emergency generator to be installed at the power block has been updated since the AFC submittal based on additional information becoming available. The revised source characteristics and locations for the ancillary equipment are given in Table DR-AIR-6-1.

Table DR-AIR-6-1 Stack Parameters for RSPP Ancillary Equipment

Parameter	Auxiliary Boiler	Emergency Generator	Fire-Water Pump	HTF Heater	Cooling Tower [2]
Stack Coordinates (m)[1]	432,325; 3,935,541	432,290; 3,935,480	432,222; 3,935,477	432,332; 3,935,486	432,241; 3,935,554
Stack Base Elevation (ft)	2,685	2,685	2,685	2,685	2,685
Stack Height (ft)	50	23	10	80	22.4
Stack Diameter (ft)	3	0.75	0.5	3	12
Exit Temperature (^{o}F)	300	770	770	300	90.4
Exit Velocity (ft/sec)	23.6	465	107	23.6	27.0

1. Coordinates for UTM Zone 11 referenced to Datum NAD83.
2. The auxiliary cooling tower has two cells and each was modeled as a single stack. Coordinate provided is the westernmost of the two cells.

Because of the change in location and orientation of the ancillary equipment, a revised Good Engineering Practice (GEP) stack height analysis was conducted to evaluate the potential for building downwash from the power block sources. Point sources with heights below GEP are considered to be subject to building downwash and require building dimensions to be input to AERMOD. The GEP stack height analysis was conducted using the EPA Building Profile Input Program (BPIP) (version 04274) that performs the GEP calculation for a multi-building complex on a stack-by-stack basis. The revised stack locations and buildings included in the GEP analysis for the power block are shown in Figure DR-AIR-6-3. A summary of the GEP analysis is provided in Table DR-AIR-6-2. The stack heights of the Project ancillary equipment will be less than their respective GEP formula heights and thus subject to building downwash. Therefore, building dimensions developed by BPIP for all stacks were input to the dispersion model. The BPIP input and output files are provided on the modeling archive CD.

In addition to the emission sources associated with the power block, the Project will require periodic vehicle travel over the unpaved portions of the solar field to perform routine maintenance including mirror washing, maintenance inspections and repairs of the piping network, herbicide application, soil stabilizer application and water application for dust suppression. Criteria pollutant emissions from the combustion of fuels in the vehicles and fugitive PM10 and PM2.5 emissions are expected from vehicle travel in the solar field. The emissions are included in the modeling in the form of ten area sources laid over the solar arrays, one for each of the six rectangular tiers of solar panels in the northern solar array (Solar Field 2), and one for each of the four rectangular tiers in the southern array (Solar Field 1). One area source was placed over each of these ten large array areas for the purpose of modeling vehicular emissions within the arrays. The total area of the ten area sources was approximately 4,739,500 m^2. The emissions for maintenance vehicle travel were distributed evenly over the entire solar array area.

Table DR-AIR-6-2 Summary of GEP Analysis

Emission Source	Model Source Name	Stack Height (m)	Controlling Buildings or Structures	Building Height (m)	Projected Width (m)	GEP Formula Height (m)
Auxiliary Boiler	AUXBOIL_1	15.24	Air Cooled Condenser	36.6	146.0	91.4
Emergency Generator	EMERGEN_1	7.01	Air Cooled Condenser	36.6	146.0	91.4
Fire-Water Pump	FIRPUMP_1	3.05	Air Cooled Condenser	36.6	153.0	91.4
HTF Heater	HTFHEAT_1	24.38	Air Cooled Condenser	36.6	146.0	91.4
Cooling Tower	COOL1_1-COOL2_1	6.84	Air Cooled Condenser	36.6	146.0	91.4

2.5 NO_2 Modeling with the Ozone Limiting Method

Per request DR-AIR-11, the ozone limiting method (OLM) modeling for Nitrogen Dioxide (NO_2) for both construction and operations was updated to include an OLMGROUP source group to which all modeled sources were added. For the Air Quality Impacts Analysis (AQIA), OLM was applied as implemented in AERMOD with the use of hourly ozone concentrations from the most representative monitor. In using the OLM in AERMOD, conversion of nitrogen oxide emissions to NO_2 concentrations are limited based on the availability of ozone as determined by the ambient background levels. The updated NO_2 modeling for construction and operations for both the 1-hour and annual periods used this updated OLMGROUP configuration.

Monitoring data for ozone were available at the Mojave monitoring station. All missing hourly ozone data were filled using the average hourly concentration over the three years of data.

2.6 2.6 Revised Receptor Grid

Because of the reconfiguration of the site and resulting changes in the location of fence line, a revised comprehensive Cartesian receptor grid extending to approximately 10 kilometers (km) from the center of the Project site was used in the AERMOD modeling to assess maximum ground-level pollutant concentrations. Based on preliminary modeling, the 10-km receptor grid was found to be sufficient to resolve the maximum impacts and any significant impact area(s).

The Cartesian receptor grid consisted of the following receptor spacing from the Project fence line:

- 100 to 3,000 m at 100-m increments;
- Beyond 3,000 m to 5,000 m at 200-m increments; and
- Beyond 5 km to 10 km at 500-m increments.

Discrete receptors were placed approximately every 50 m along the facility fence line for increased resolution of impacts along this boundary. Note that this fence line is within the BLM Right of Way (ROW).

The AERMAP receptor locations (operation emissions) and the AERMAP domain are shown in Figure DR-AIR-6-4 (near-field portion of the receptor grid) and Figure DR-AIR-6-5 (far-field receptors). Terrain elevations from the National Elevation Dataset (NED) acquired from the United States Geological Service (USGS) National Map Seamless Server were processed with AERMAP to develop the receptor terrain elevations and corresponding hill height scale required by AERMOD. The NED file used was from Universal Transverse Mercator (UTM) Zone 11 and referenced to North American Datum (NAD) 83. All receptors were also referenced to NAD83. The NED file, along with the AERMAP input and output files, are included on the modeling archive CD.

3.0 Revised Air Quality Impact Assessment

3.1 Impacts from RSPP Construction

The results of the construction modeling are provided in Table DR-AIR-6-3. Note that these results are based on modeling which uses the site-wide area sources for annual modeling as requested by the CEC (see DR-AIR-10). As shown in the table, all impacts, when added to the appropriate ambient backgrounds, are below their respective National Ambient Air Quality Standards (NAAQS)/ California Ambient Air Quality Standard (CAAQS) with the exception of 24-hour PM10 (CAAQS), annual PM10 (CAAQS), and 24-hour PM2.5 (NAAQS). In the case of annual PM10 and 24-hour PM2.5, Project impacts alone are below their respective CAAQS with maximum concentrations of 5.6 micrograms per cubic meter ($\mu g/m^3$) for annual PM10, and 17.4 $\mu g/m^3$ for 24-hour PM2.5.

For annual PM10, the Project impacts by themselves represent only 28 percent of the CAAQS for annual PM10 and only 19 percent of the total impact to the annual PM10 concentrations when the worst-case background is considered. For 24-hour PM2.5, Project impacts represent 50 percent of the CAAQS and 40 percent of the total impacts when background is considered.

In the case of 24-hour PM10 impacts, the maximum modeled 24-hour impact for PM10 of 61.2 $\mu g/m^3$ exceeds the CAAQS. Exceedances were limited to six winter days over the three years modeled. One day produced seven of the modeled receptor-exceedances, one day produced two receptor-exceedances, and the remaining four days produced a single receptor-exceedance. The primary source contributing to the modeled exceedances was vehicle travel within the laydown area and from the laydown area through the solar field to the power block. The location and timing of travel on a given construction day within the laydown area and through the solar field is highly speculative and subject to many alternative configurations. The modeling scenario chosen was selected as a worst-case scenario to maximize the potential offsite impacts to ensure a conservative analysis. However, the modeling scenario used for this analysis is only one of many possible configurations of source location and vehicle/equipment emission rates on a worst-case day during construction. As all the modeled receptor-exceedances occur at the property line or within 30 m of the property line, the worst-case placement of emission sources adjacent to the property line contributes to the conservativeness of the modeling analysis. However, in actual operation, it is unlikely that individual vehicles will operate directly on the property line but rather would be constrained to travel lanes somewhat interior to the property line.

Figure DR-AIR-6-6 presents the modeled sources, the property line, the receptors with modeled exceedances, and the 3-year wind rose for Mojave. This figure demonstrates the worst-case nature of the modeling scenario assumed for construction and the adjacency of sources at the property boundary that produce the modeled exceedances.

All of the exceedances occur on winter days characterized by early morning periods of low wind speed and low mechanical turbulence (i.e., formerly called stable dispersion conditions) that occur in winter near sunrise and contribute significantly to the modeled exceedances. Construction activities will be limited during the wintertime early morning hours to minimize emissions during poor dispersion conditions. However, it is difficult in AERMOD to prepare a modeling scenario in which operations occur only during daylight hours. Therefore, because the modeling scenarios occur wintertime days in which there are emissions during hours prior to sunrise, it is likely that the modeled impacts are conservatively higher than would be experienced during actual construction.

Table DR-AIR-6-3 NAAQS/CAAQS Modeling Results for RSPP Construction

Pollutant	Averaging Period	Concentrations ($\mu g/m^3$)				
		AERMOD Result[2]	Ambient Background[3]	Total [4,5,6]	CAAQS	NAAQS
NO_2 [1]	1-hr	193.8	103.5	297	339	--
	Annual	6.3	9.4	16	57	100
CO	1-hr	738.0	3,680	4,420	23,000	40,000
	8-hr	152.5	1,840	1,990	10,000	10,000
PM10	24-hr	61.2	72.0	133	50	150
	Annual	5.6	23.0	29	20	--
PM2.5	24-hr	17.4	26.1	44	--	35
	Annual	0.7	7.0	8	12	15
SO_2	1-hr	2.9	86.5	89	665	--
	3-hr	1.0	44.5	46	--	1,300
	24-hr	0.2	13.1	13	105	365
	Annual	0.01	2.6	3	--	80

1. Modeled NO_2 concentrations as determined with the OLM.
2. Annual concentrations are highest annual mean. Short term impacts are high 1st-high except PM2.5 24-hour which is high-2nd-high.
3. From Table 5.2-32 of the RSPP AFC. These values correspond to the highest monitored values from 2005 – 2007, except for PM2.5, which is the 98th percentile value over three years for the Indio, California monitoring site.
4. Modeled concentration plus ambient background.
5. Result reflects 10-hour days from March through September and 8-hour days from October through February.
6. Totals are rounded to three or fewer significant figures.

Overall, the construction modeling is very conservative and significantly overestimates the expected impacts over the duration of the construction period. Only a single, worst-case source location was modeled for the entire construction period. The source locations were chosen on the basis of two worst-case assumptions: 1) worst-case alignment of the prevailing wind, the construction sources, and the vehicle corridor from the laydown area to the power block; and 2) placement of the construction sources along the downwind property boundary (see Figure DR-AIR-6-6). The assumed area sources for the construction activities most likely would not be reflective of actual site activity for more than one month out of the entire construction period as the construction locations will continually move across the entire project site.

The emissions estimates used in the modeling are also highly conservative. For each month of construction, the daily peak emission rates from vehicle and equipment activity were estimated. The daily emission rate for the month with the peak total daily emissions was then converted to an hourly rate and was assumed to reflect the emission rate for every hour of every day during the entire construction period. Such an assumption will significantly overestimate the total mass of emissions that will occur during the construction of the facility, and the temporal release profile of those emissions during the day. For example, the peak emission rate modeled may reasonably reflect peak hourly emissions on a given peak day but is unlikely to represent accurately the emission profile first thing in the morning when construction activities commence. However, it is these first hour in the morning periods in which the model predicts occurrence of the modeled PM10 exceedances.

In summary, the construction modeling analysis incorporates a number of worst-case assumptions that result in an extremely conservative modeling analysis that is likely to overestimate peak PM10 impacts during construction. These assumptions include use of a modeling analysis that includes the simulation of emissions during hours prior to sunrise in the winter and the highly improbable coincidence of the following factors:

1. The alignment of emission sources with the worst-case prevailing wind direction,
2. The placement of the sources in the worst-case position adjoining the property boundary, and
3. The use of construction period peak worst-case emissions for every hour modeled.

3.2 Impacts from RSPP Operations

The worst-case operations emissions of the Project stationary sources were modeled along with vehicular emissions from the solar field maintenance vehicles. The maximum modeled concentrations for all Project emissions are summed with ambient background concentrations for comparison to the CAAQS/NAAQS in Table DR-AIR-6-4.

As shown in Table DR-AIR-6-4, the total concentrations comprised of maximum modeled concentration plus maximum ambient background are below the NAAQS/CAAQS for all pollutants with the exception of the 24-hour PM10 CAAQS, annual PM10 CAAQS, and 1-hour NO_2 CAAQS.

In the case of PM10, the ambient background utilized already exceeds the standards, and RSPP contributions by themselves are below the standards (78 percent and 15 percent of the 24-hour and annual PM10 CAAQS, respectively).

In the case of 1-hour NO_2, periods during each year showed modeled impacts which, when added to the maximum ambient background, exceeded the 1-hour NO_2 CAAQS of 339 µg/m^3. To refine the modeling analysis, AERMOD was rerun using the “Maxifile” option to determine how many hours produced impacts of at least 235 µg/m^3, which, when added to the maximum ambient background concentration of 104 µg/m^3, would exceed the CAAQS. The results showed that only nine hours out of the three years modeled (i.e., an average of only three hours per year) had the potential to exceed the 1-hour NO_2 CAAQS.

As a further refinement, hourly NO_2 background data for the Mojave, California monitoring site were acquired from the U.S. Environmental Protection Agency AIRS database data repository (http://www.epa.gov/ttn/airs/airsaqs/detaildata/downloadaqsdata.htm). The actual ambient background NO_2 concentration for each hour was then added to the modeled concentration and compared to the CAAQS. The results are shown in Table DR-AIR-6-5. As seen in the table, when added to the time-matched ambient background NO_2 concentration, all nine hours with the potential to exceed the CAAQS fall below the standard of 339 µg/m^3. Thus compliance is demonstrated and no additional analysis is required.

Table DR-AIR-6-4 NAAQS/CAAQS Modeling Results for RSPP Operations

Pollutant	Averaging Period	Concentrations ($\mu g/m^3$)			
		AERMOD Result[2]	Ambient Background[3]	Total [4,5]	CAAQS / NAAQS [6]
NO_2 [1]	1-hr	302.0	103.5	406	339
	Annual	0.1	9.4	9.5	57
CO	1-hr	1,604.6	3,680	5,290	23,000
	8-hr	359.1	1,840	2,200	10,000
PM10	24-hr	39.2	72.0	111	50
	Annual	3.0	23.0	26.0	20
PM2.5	24-hr	4.9	26.1	31.0	35
	Annual	0.3	7.0	7.3	12
SO_2	1-hr	11.3	86.5	97.8	655
	3-hr	7.8	44.5	52.3	1,300
	24-hr	0.6	13.1	13.7	105
	Annual	0.04	2.6	2.7	80

1. Modeled NO_2 concentrations as determined with the OLM.
2. Annual concentrations are high annual mean. Short term impacts are high 1st-high except PM2.5 24-hour which is high-2nd-high.
3. Highest value from Table 5.2-32 of RSPP AFC.
4. Modeled concentration plus ambient background.
5. Totals are rounded to three or fewer significant figures.
6. The most restrictive of the CAAQS or NAAQS is presented.

Table DR-AIR-6-5 Time matched NO_2 impacts for Hours with Potential CAAQS Exceedance

Hour	Modeled Impact ($\mu g/m^3$)	Ambient Background (ppb)	Ambient Background ($\mu g/m^3$)	Total Concentration[1] ($\mu g/m^3$)	Fraction of CAAQS (%)
5/24/02 Hour 14	279.27	5	9.41	289	85.2%
8/10/02 Hour 11	244.10	5	9.41	254	74.8%
8/17/02 Hour 10	269.60	7	13.17	283	83.4%
9/02/02 Hour 09	236.41	6	11.29	248	73.1%
5/21/03 Hour 11	271.45	10	18.81	290	85.6%
6/01/03 Hour 14	301.95	6	11.29	313	92.4%
6/04/03 Hour 08	235.97	11	20.69	257	75.7%
7/27/03 Hour 14	267.18	3	5.643	273	80.5%
6/29/04 Hour 09	237.90	13	24.45	262	77.4%

1. Totals are rounded to three significant figures.
ppb = parts per billion
$\mu g/m^3$ = micrograms per cubic meter

3.3 Cumulative Impacts from RSPP Operations

As discussed in the response to DR-AIR-31, no other existing or permitted-but-not-yet-operating sources were identified through contact with the Kern County Air Pollution Control District or through scans of aerial photographs. Therefore, because there are no nearby non-Project sources that will contribute to a cumulative impact, a cumulative modeling analysis is not necessary and was not performed.

Figure DR-AIR-6-1 Revised Area Sources Used in Annual Construction Modeling

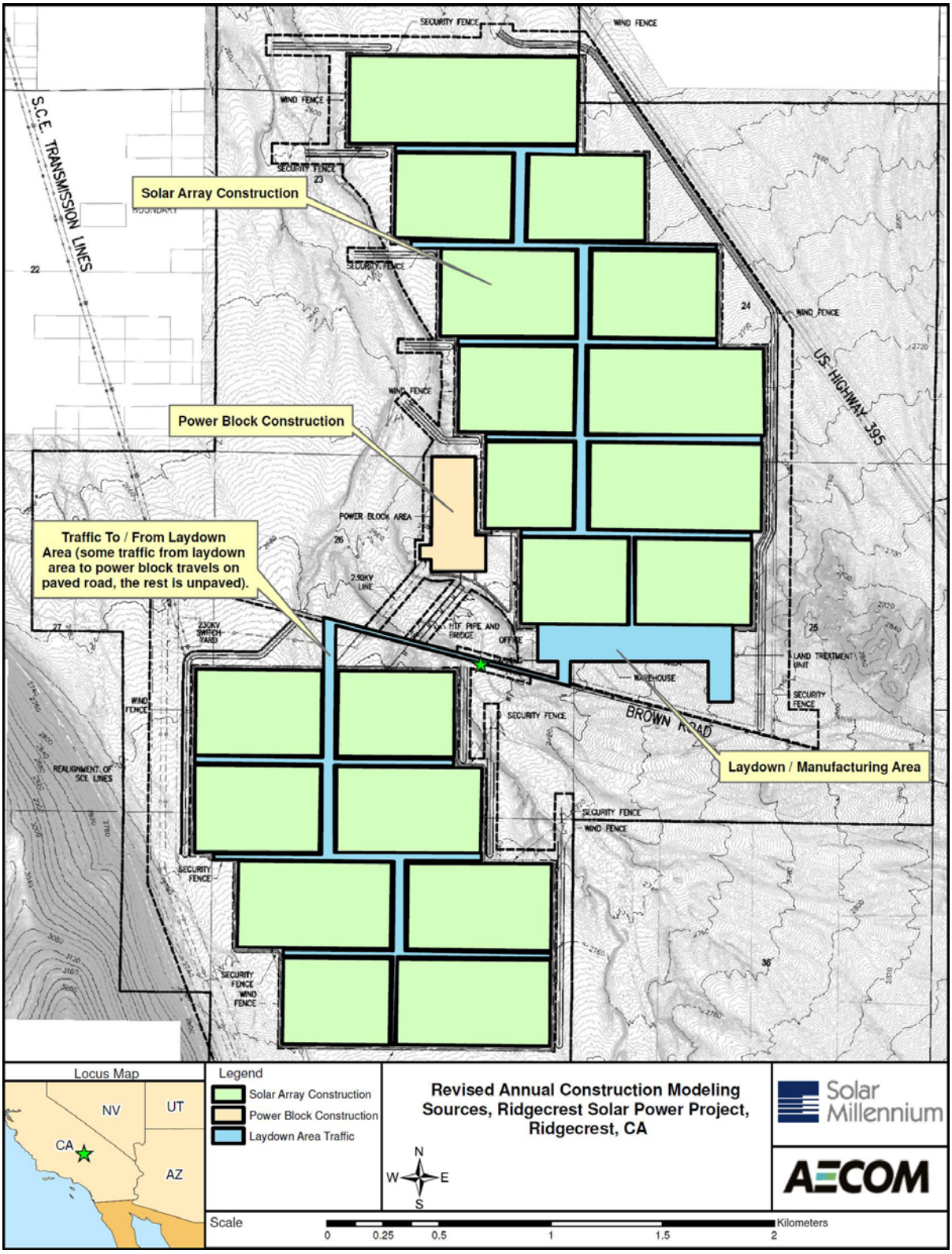


Figure DR-AIR-6-2 Revised Area Sources Used in Short Term Construction Modeling

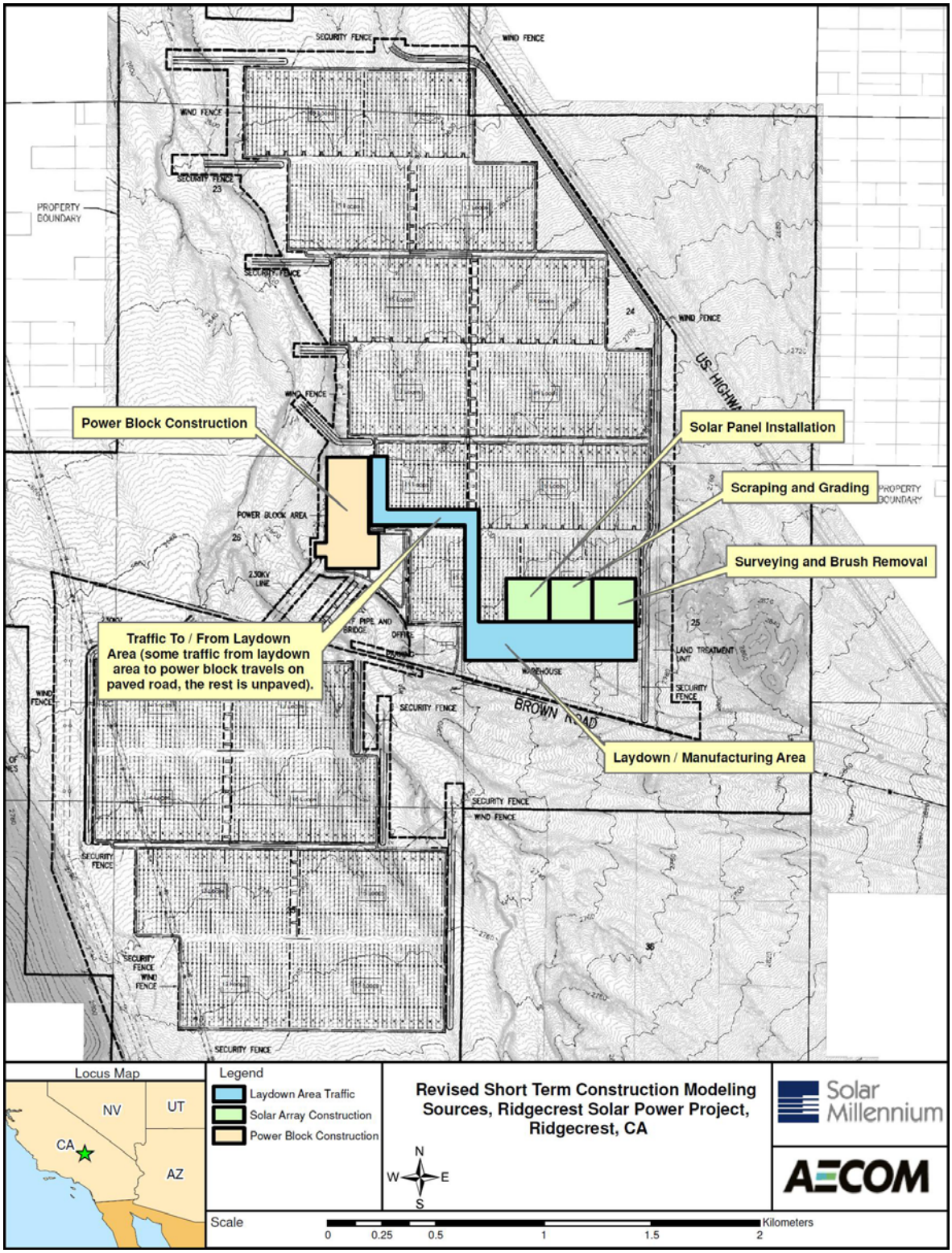
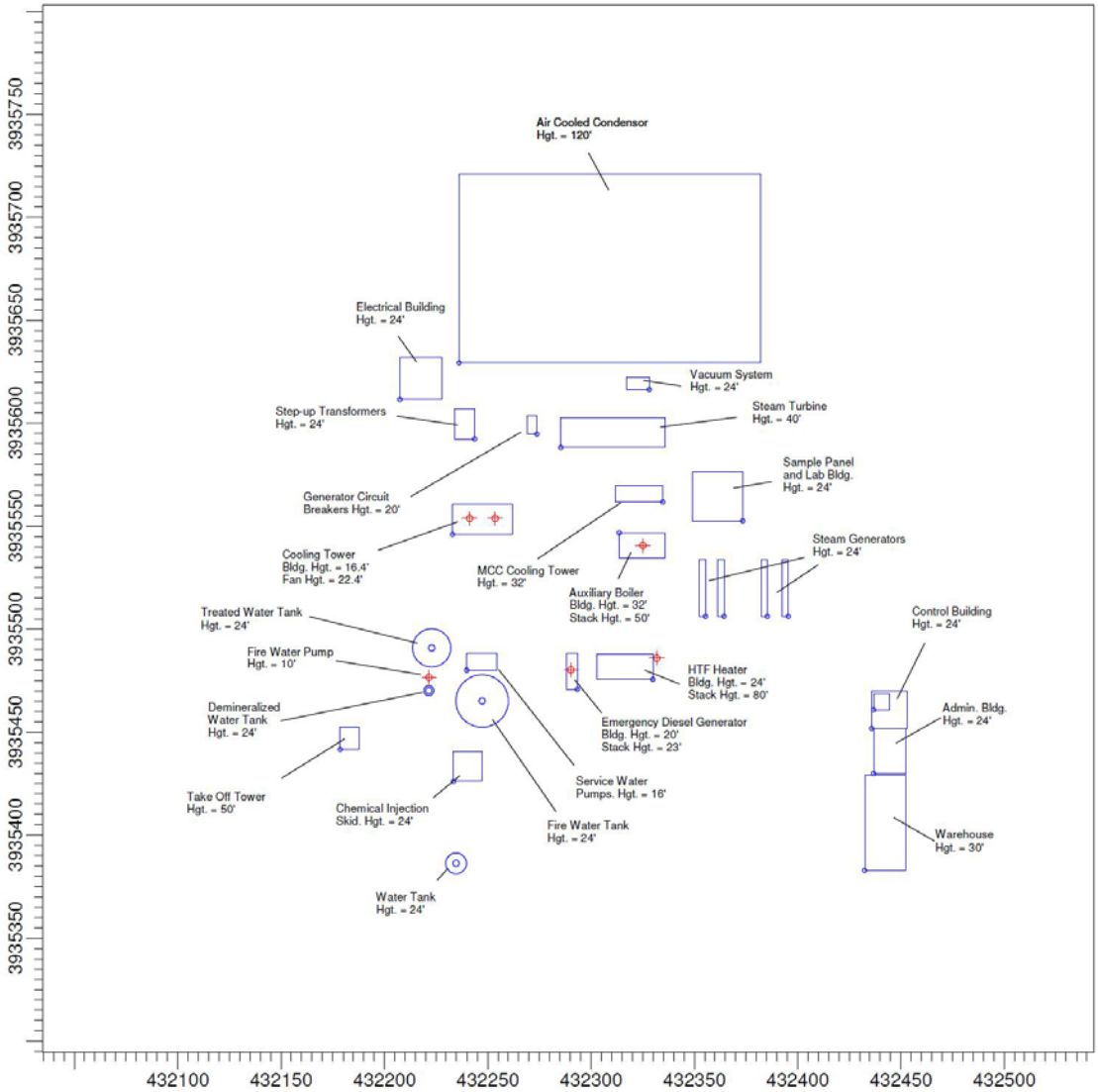


Figure DR-AIR-6-3 Revised Buildings Structures Included in GEP Analysis

PROJECT TITLE:

Structures Evaluated in GEP Analysis
Ridgecrest Solar Power Project



COMMENTS:	SOURCES: 16	COMPANY NAME:	
	RECEPTORS: 6382	MODELER:	
		SCALE: 1:3,104 (0 – 0.1 km)	
		DATE: 1/19/2010	PROJECT NO.:

AERMOD View - Lakes Environmental Software

J:\AQES\Projects\Solar Millennium\Ridgecrest\Response to comments\Lakes\New_Ops.isc

Figure DR-AIR-6-4 Revised Near Field Receptors used in RSPP Modeling Analysis

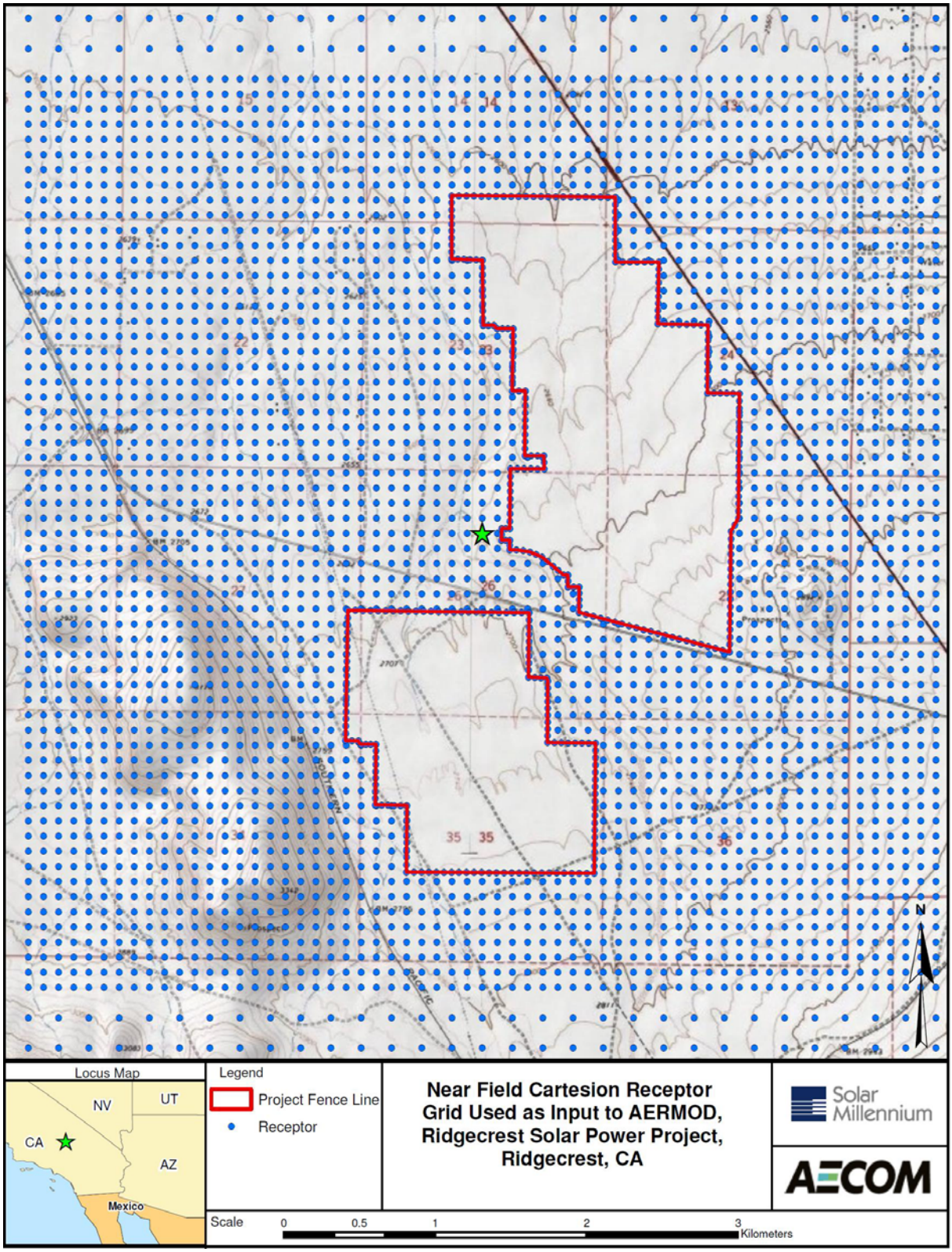


Figure DR-AIR-6-5 Revised Far Field Receptors used in RSPP Modeling Analysis

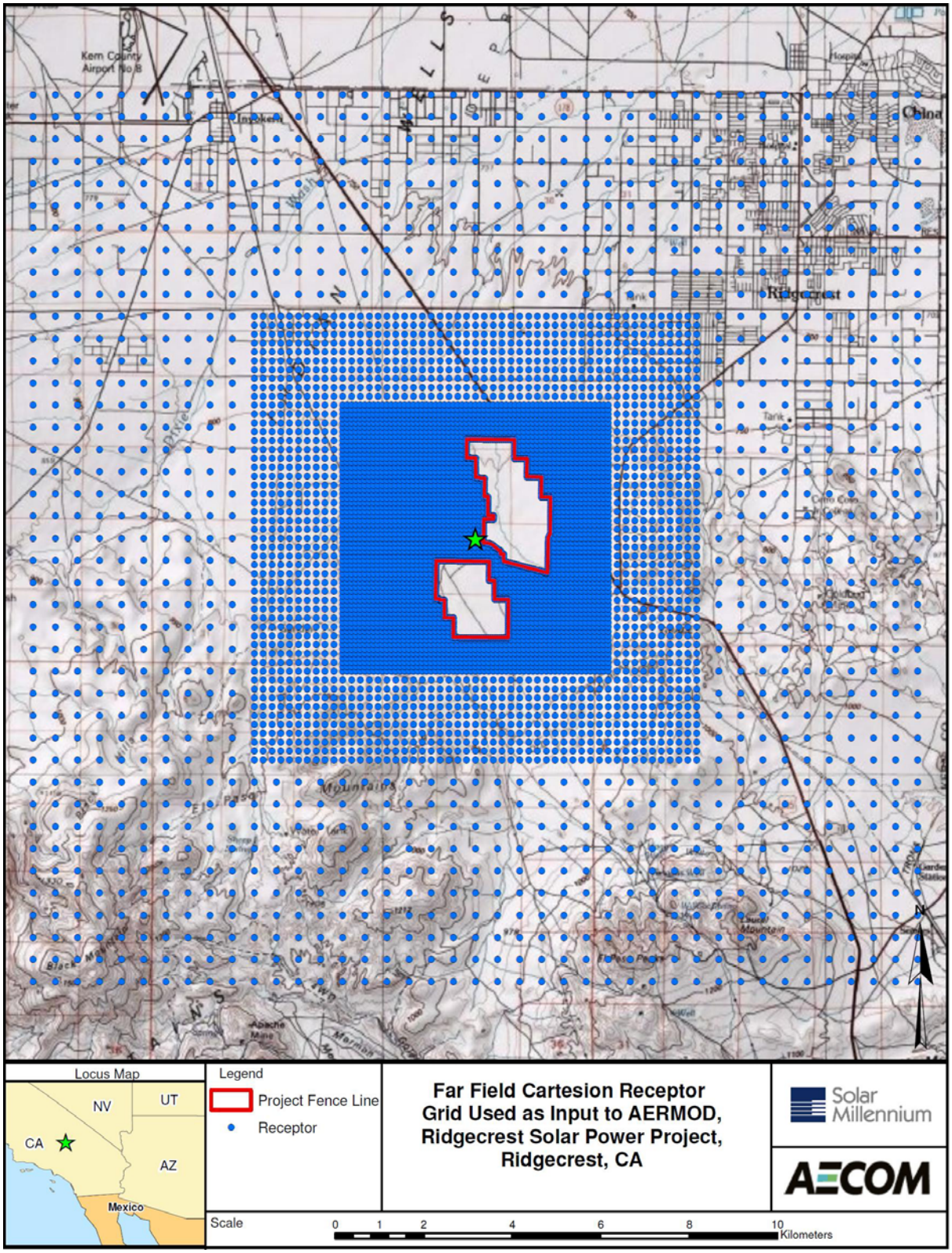
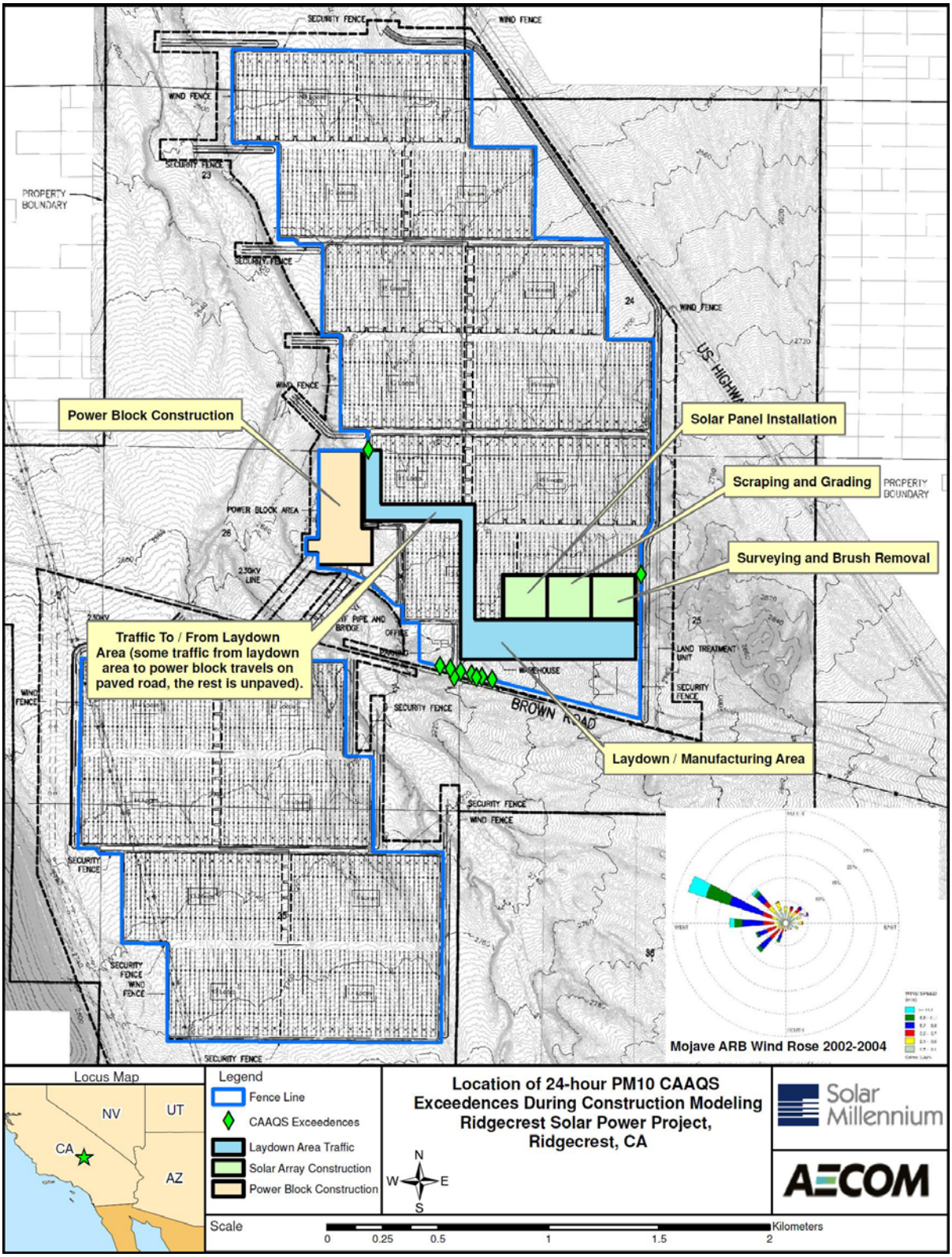


Figure DR-AIR-6-6 Location of Construction Modeling PM10 24-Hour CAAQS Exceedences



Air Dispersion Modeling CD Archive (On CD-ROM)

Attachment DR-AIR-12

Construction Greenhouse Gas Emission Calculations

Prepared for:
Solar Millennium
Ridgecrest Solar Power Project

Attachment DR-AIR-12 Construction Greenhouse Gas Emissions Calculations

AECOM, Inc.
December 2009
Document No.: DR-AIR-12

Prepared for:
Solar Millennium
Ridgecrest Solar Power Project

Attachment DR-Air-12 Construction Greenhouse Gas Emissions Calculations

Prepared By Howard Balentine

Reviewed By Russ Kingsley

AECOM, Inc.
December 2009
Document No.: DR-AIR-12

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1.0 Introduction

This document contains a description of greenhouse gas (GHG) emissions calculated for construction of the Ridgecrest Solar Power Project (RSPP, or Project). Section 2 describes the methodology used to calculate emissions, results are presented in Section 3, and references are provided in Section 4. Table 1 at the end of this document provides the computed GHG emissions factors for construction equipment obtained from the OFFROAD2007 model output. Table 2 provides of the RSPP follow in tables at the end of the computed GHG emission factors for motor vehicles obtained from the EMFAC2007 BURDEN model output.

2.0 Construction Greenhouse Gas Emissions

GHG emissions will arise from the operation of construction equipment and motor vehicles. This report describes the calculation methodology for the GHG emissions associated with Project construction. GHG emissions during each month of construction were calculated separately and the monthly emissions were summed over the construction duration for each Project component to calculate total GHG emissions.

2.1 Overview of Calculation Methodology

Emissions were computed for three GHGs: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). When the respective emissions for a given GHG is multiplied by the corresponding global warming potential (GWP), the emissions of each gas is expressed as its equivalent amount of CO_2 emissions, assuming a 100-year quantification period. The sum of the individual CO_2 equivalent (CO_2e) emissions for each of the three gases results in the project total CO_2 equivalent emissions.

There are multiple emission factors available in the literature and published protocols for computation of GHG emissions from fuel combustion. These factors tend to differ by the units of the emission factors and the assumptions of a given heat (or carbon) content of the fuel. However, almost all of these emission factors are ultimately based on a standard set of emission factors published by the Intergovernmental Panel on Climate Change (IPCC, 2006). For example, the Air Resources Board (ARB) reporting guidance for mandatory GHG reporting (ARB, 2008) references the ARB AB-32 Mandatory Reporting Guidance document (ARB, 2008) which, in turn, references an EPA GHG inventory guidance document (EPA, 2003), which, in turn, states that EPA GHG calculation methodology for mobile sources is consistent with IPCC 2006 guidance.

The GHG emissions for construction are based on output from the OFFROAD2007 (ARB, 2007a) and EMFAC2007 (ARB, 2007b) BURDEN models. These models were used to compute the criteria pollutant emissions during construction and quantified in the Application for Certification (AFC) for the RSPP. The same model runs are used as a basis for estimating GHG emissions during construction because both models produce estimates of CO_2 emissions. In addition, the OFFROAD2007 model directly provides estimates of N_2O and CH_4 emissions from diesel equipment[1].

---

1. While OFFROAD2007 output provides N_2O emissions as an output, the N_2O values output by OFFROAD2007 for all equipment sizes and equipment types are zero. However, N_2O emissions are a small fraction of CO_2e emissions from equipment during construction activities, even when the much larger GWP of N_2O compared to CO_2 is taken into account. Therefore, the zero values for N_2O emissions are used without modification or adjustment. The assumption of zero for N_2O emissions from construction equipment is well within the very large uncertainty associated with the quantification process for estimating construction emissions and has an insignificant impact on the overall GHG emission estimates during construction over the lifetime of the facility.

For past projects, the CEC has requested that the GHG emission computations for mobile sources follow the methodology contained in the ARB mandatory reporting guidance document. These emission factors are in terms of kilograms of CO_2 per gallon for motor fuels and gram per mile for N_2O and CH_4. For the RSPP, the GHG emission estimates from construction activities are based on the ARB OFFROAD2007 and EMFAC2007 BURDEN models, which as discussed above, are ultimately based on IPCC 2006 emission factors.

The composite GHG emission factors used for a given run of OFFROAD2007 and EMFAC2007 are not explicitly listed in the model output but can be readily computed from model output. The emission factors can be computed on either 1) an hours of operation (or mileage) basis or 2) a fuel consumption basis, because total GHG emissions by GHG are listed, along with hours of operation or mileage accumulation for a given equipment/vehicle type, and the fuel consumption. Both sets of emission factors are ultimately the same with only unit conversions applied, along with assumptions of energy content per unit volume and fuel consumption/fuel economy assumptions. In other words, the OFFROAD2007 and EMFAC2007 output data can be used to compute GHG emission factors on different bases, depending on the intended use. As needed, the emission factors can be readily converted from one basis to the other using output data from the model. For example, if the on-road emission factors are computed on a per-volume of fuel used basis, they are easily converted to a mileage basis by dividing by the fuel economies used by EMFAC2007. Likewise, if the emission factors are on a per-hour-of-operation basis, they can readily be converted to units of emissions per volume of fuel consumed by dividing by the default specific fuel consumption provided in the OFFROAD2007 output.

The activity data developed to estimate emissions from equipment and vehicles for the RSPP are naturally compiled in terms of hours of operation (equipment) and miles traveled (vehicles). Therefore, the most direct method for using OFFROAD2007 and EMFAC2007 output to compute GHG emissions is to use the model output to compute composite GHG emission factors that are on a per-hour-of-operation basis for equipment and on a per-mile basis for vehicles.

Therefore, for this analysis, the construction equipment GHG emission factors are derived from OFFROAD2007 output by dividing the total emissions for each GHG and equipment class by the hours of operation for that GHG and equipment class. Likewise, GHG emission factors for motor vehicles are derived from EMFAC2007 output by dividing the total emissions for each vehicle type by the output activity (miles) for that vehicle type. Once computed, unit conversions are applied to adjust the emission factors to the desired metric units (kg/mile). This straight forward approach avoids the necessity of assuming a specific fuel consumption or fuel economy that may differ from that used in OFFROAD2007 or EMFAC2007, thereby potentially biasing the estimate of the total GHG emissions.

EMFAC2007 only provides estimates of CO_2 emissions. To estimate N_2O and CH_4 emissions, the mobile source emission factors in the California Climate Action Registry (CCAR) General Reporting Protocol Version 3.1 (CCAR, 2009) was used. These emission factors are on a gram-per-mile basis, are ultimately based on the IPCC 2006 emission factors, and are identical to those contained in the ARB mandatory reporting regulation.

2.2 Construction Equipment Exhaust GHG Emissions

The combustion of fuel to provide power for the operation of various construction activities and equipment results in the generation of GHG, including CO_2, CH_4, and N_2O. The following predictive emission equation was used to calculate exhaust emissions from construction equipment:

$$\text{Exhaust Emissions}_{ij}\,(\text{MT}) = EF_{ij} \times T_j / 1000 \qquad \text{(Eq. 2-1)}$$

Where:

$EF_{,i,j}$ = Emission factor for specific GHG *i* from construction equipment type *j* (kg/hour)

T_j = Operating time for equipment of type *j* (hr)

1000 = kilograms per metric tonne (kg/MT)

The exhaust emission factor E_{ij} is computed from the OFFROAD2007 output by dividing the total emissions for a given GHG *i* and equipment type *j* by the operating hours of that equipment type in the OFFROAD2007 run. The OFFROAD2007 model calculates total daily emissions of CO_2, N_2O, and CH_4 by equipment category (crane, dozer, grader, etc.) and type of fuel (diesel, gasoline, etc.) within engine horsepower ranges in a geographic area, such as statewide or within a given jurisdiction (e.g., Kern County Air Pollution Control District). The model also calculates total daily operating hours within the geographic area by equipment category, fuel and horsepower range. For the RSPP, OFFROAD2007 was run to generate statewide average emissions and activity data for 2010 for equipment with engines meeting Tier 3 emission standards, consistent with the revised construction criteria pollutant analysis for the RSPP prepared in Data Response DR-AIR-8 and -9 as part of responding to CEC data requests.

The total GHG emissions are the summation over all of the operating equipment with application of the appropriate GWP for each GHG. The GWP used for this analysis are those required by the ARB mandatory reporting rule and are equal to 1 for CO_2, 21 for CH_4, and 310 for N_2O.

The OFFROAD2007 GHG emission estimates, the hours of operation, the computed emission factors, and the projected hours of operation for the diesel off-road equipment anticipated to be used during construction of the RSPP are provided in Table 1 at the end of this document.

2.3 Motor Vehicle Exhaust Emissions

The combustion of fuel in motor vehicle engines results in the generation of GHGs, including CO_2, CH_4 and N_2O. The following predictive equation was used to calculate exhaust emissions from motor vehicles:

$$\text{Exhaust Emissions}_{ij}\,(\text{MT}) = EF_{ij} \times VMT_j \times CF_i / 1000 \qquad \text{(Eq. 2-1)}$$

Where:

$EF_{i,j}$ = Emission factor for specific GHG *i* from motor vehicles type *j* (kg/mile or g/mile)

VMT_j = Mileage for vehicle type *j* (miles)

CF_i = EF units conversion factor (1.0 for CO2, 0.001 for CH4 and N2O to convert from g/mi to kg/mi)

1000 = kilograms per metric tonne (kg/MT)

The exhaust emission factor E_{ij} for CO_2 is computed from the EMFAC2007 BURDEN output by dividing the total emissions for a given GHG *i* and vehicle type *j* by the mileage accumulation for that vehicle type in the EMFAC2007 run. For the RSPP, EMFAC2007 was run to generate statewide emissions and activity data for 2010. The EMFAC2007 Model calculates total daily emissions of CO_2, N_2O, and CH_4 by vehicle type (light-duty truck, heavy-heavy duty diesel vehicle, etc.) and type of fuel (diesel, gasoline, etc.) in a geographic area, such as the Kern County Air Pollution Control District jurisdiction. For N_2O and CH_4, the exhaust emission factors come from the CCAR General Reporting Protocol Table C.6 (CCAR, 2009). As stated above, these N_2O and CH_4 emission factors are identical to those required by ARB under the AB-32 mandatory GHG reporting.

The total GHG emissions are the summation over all of the operating vehicle types with application of the appropriate GWP for each GHG. The GWP used for this analysis are those required by the ARB mandatory reporting rule and are equal to 1 for CO_2, 21 for CH_4, and 310 for N_2O.

The 2009 OFFROAD2007 BURDEN GHG emission estimates, accumulated mileage, the computed emission factors, and the projected operating miles for vehicles anticipated to be used during construction of the RSPP are in Table 2 at the end of this document.

Emissions were calculated from estimates of 1) the types, number, horsepower rating and daily operating hours for construction equipment; and 2) the types, number and daily miles traveled by onsite and offsite motor vehicles. These estimates were made by construction month for construction of the solar facility. The monthly emissions are based on 22 working days per month, consistent with the emission calculations for the criteria pollutants emitted during construction activities. The monthly emissions for equipment and vehicles for each GHG were summed to produce monthly and project total CO_2e emissions estimates.

Detailed GHG construction emission calculations are provided in the spreadsheet with filename Air Attachment Emission Calculations on the CD-ROM.

3.0 GHG Emission Calculation Results and Context

Global warming is a global issue, not a local issue, and there is no significance criterion yet established by the CEC for CO_2e emissions. Lacking a significance criterion for construction emissions, a more robust evaluation of the potential impact of construction CO_2e emissions for a solar power plant is to compute the emissions for construction and operation over the lifetime of the facility and compare those total emissions to the emissions that would be emitted from an alternative source of electrical power generation. An appropriate alternative to consider for comparison would be a modern combustion turbine combined cycle (CTCC) natural gas fired power plant.

To this end, the emissions from construction and operation of a CTCC facility based on a 30-year lifetime were estimated from information provided in the Application for Certification (AFC) for a current CTCC power plant seeking licensing approval before the CEC. The facility chosen is the Oakley Generating Station (Docket 09-AFC-04, previously named the Contra Costa Generating Station) (CEC, 2009), a nominal 624 MW greenfield facility. For this 2x1 facility (two combustion turbines with one steam turbine), the reported CO_2e emissions from the 33 month construction period is 10,524 metric tons (MT).

The appropriate operational CO_2 emissions factor to apply to a modern CTCC facility is the California Public Utility Commission limit on new power plant, i.e., CO_2 emissions of 1,100 pounds-per-megawatt-hour of electrical generation. The AFC for the Oakley Generating Station provides an equivalent availability factor for the facility of 92 percent to 98 percent, with an average of 95 percent. The equivalent availability factor takes into account both the hours of operation and the operating load for the facility.

Table 3 presents the estimated the GHG emissions (CO_2e) for construction and operation over a 30-year lifetime for the RSPP and an equivalent CTCC plant providing the same nominal generating capacity (250 MW). From Table 3, the construction emissions for the RSPP are 67,700 MT, compared to the construction emissions for the Oakley Generating Station of 10,500 MT. Both quantities are rounded to the nearest 100 MT. Please note that no adjustment was made to the construction emission estimate for Oakley to adjust for the size of the facility compared to that for the RSPP. There are larger GHG emissions associated with the solar plant construction due to a much larger area requiring scraping and grading, cut and fill, and assembly and installation, etc., during construction of the solar arrays. However, the operational GHG emissions from a CTCC plant dwarf the operational GHG emissions from a solar plant. Overall, the lifetime emission burden for the solar facility is 0.7 percent of the lifetime emission burden of the equivalent CTCC power plant.

4.0 References

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CCAR, 2009. California Climate Action Registry General Reporting Protocol, Version 3.1, January, Available online at: http://www.climateregistry.org/tools/protocols/general-reporting-protocol.html as of 12/15/2009.

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IPCC, 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006), Volume 2 (Energy) , Available online at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html as of 12/15/2009.

EPA, 2003 Introduction to Estimating Greenhouse Gas Emissions. June 2003, and subsequent updates.

TABLES
(Tables 1 and 2 Provided on CD Rom)

Table 3. RSPP and Equivalent CTCC Power Plant Construction and Operation GHG Emissions Over a Projected 30-Year Operational Lifetime

Project	Nominal Size (MW)	Construction Period (months)	Construction GHG Emissions (MT CO2e)	Annual Operational GHG Emissions (MT CO2e/year)	30-Year Facility Lifetime GHG Emission Burden (MT CO2e)	*RSPP* Emissions as Percent of CTCC Plant (%)
RSPP	*250*	*28*	*67,700*	*4,800*	*211,700*	0.*7%*
Generic CTCC	*250*	33	10,500	*1,038,100*	*31,153*,500	

All GHG emissions rounded to the nearest 100 MT. Generic CTCC operational emissions based on CPUC limit of 1,100 lbs CO_2/MWh, yearly operation of 8760 hours, and an equivalent availability factor of 95%. The construction emission estimates are representative of those for the Oakley Generating Station (09-AFC-04), a nominal 624 MW CTCC facility. The Generic CTCC facility emission estimate is underestimated because it does not include CH_4 or N_2O emissions from facility operation.

Attachment DR-AIR-20

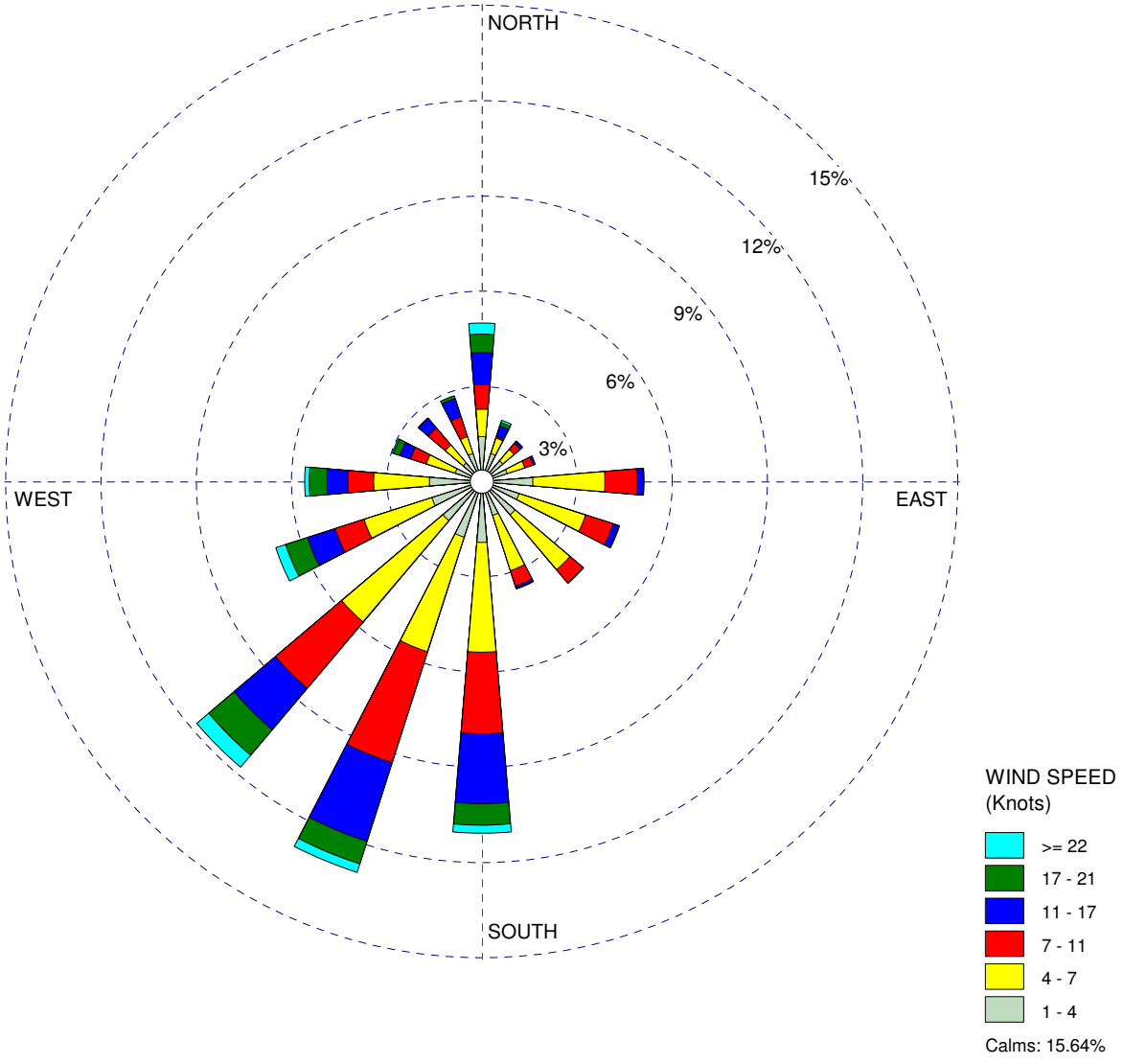
Quarterly Wind Roses

WIND ROSE PLOT:

China Lake NAF, Kern County, CA
Wind Rose for 2000-2004 - 1st Quarter (Jan. 1- Mar. 31)

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2002 2003 2004 2000 2001 **Jan 1 - Mar 31** **00:00 - 23:00**	**AECOM**	
		MODELER: **M. Stresing**	AECOM
	CALM WINDS: **15.64%**	TOTAL COUNT: **4290 hrs.**	
	AVG. WIND SPEED: **6.97 Knots**	DATE: **12/4/2009**	PROJECT NO.: **60139696**

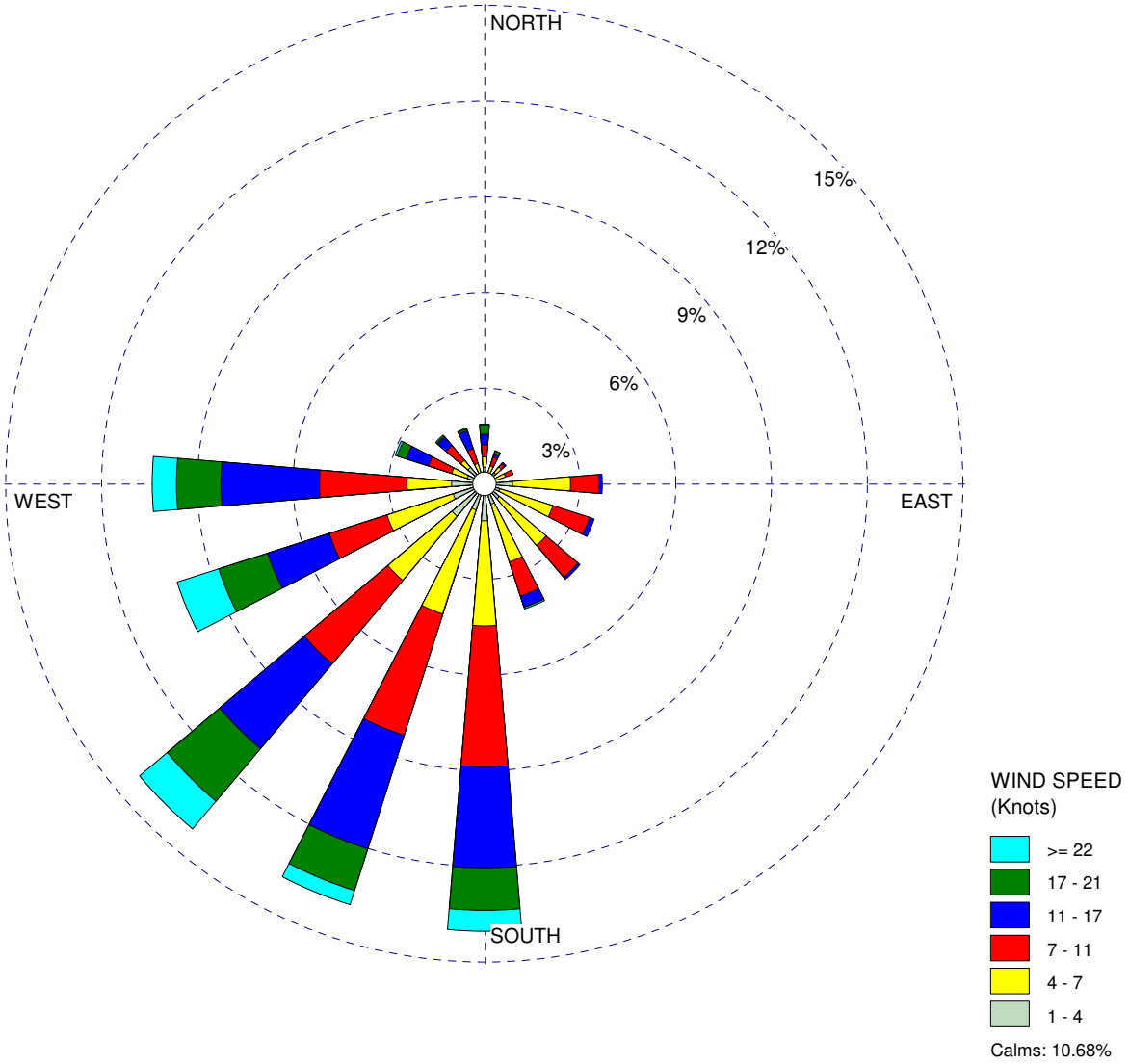
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

China Lake NAF, Kern County, CA
Wind Rose for 2000-2004 - 2nd Quarter (Apr. 1- Jun. 30)

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2002 2003 2004 2000 2001 **Apr 1 - Jun 30** **00:00 - 23:00**	**AECOM**	
		MODELER: **M. Stresing**	AECOM
	CALM WINDS: **10.68%**	TOTAL COUNT: **4746 hrs.**	
	AVG. WIND SPEED: **9.33 Knots**	DATE: **12/4/2009**	PROJECT NO.: **60139696**

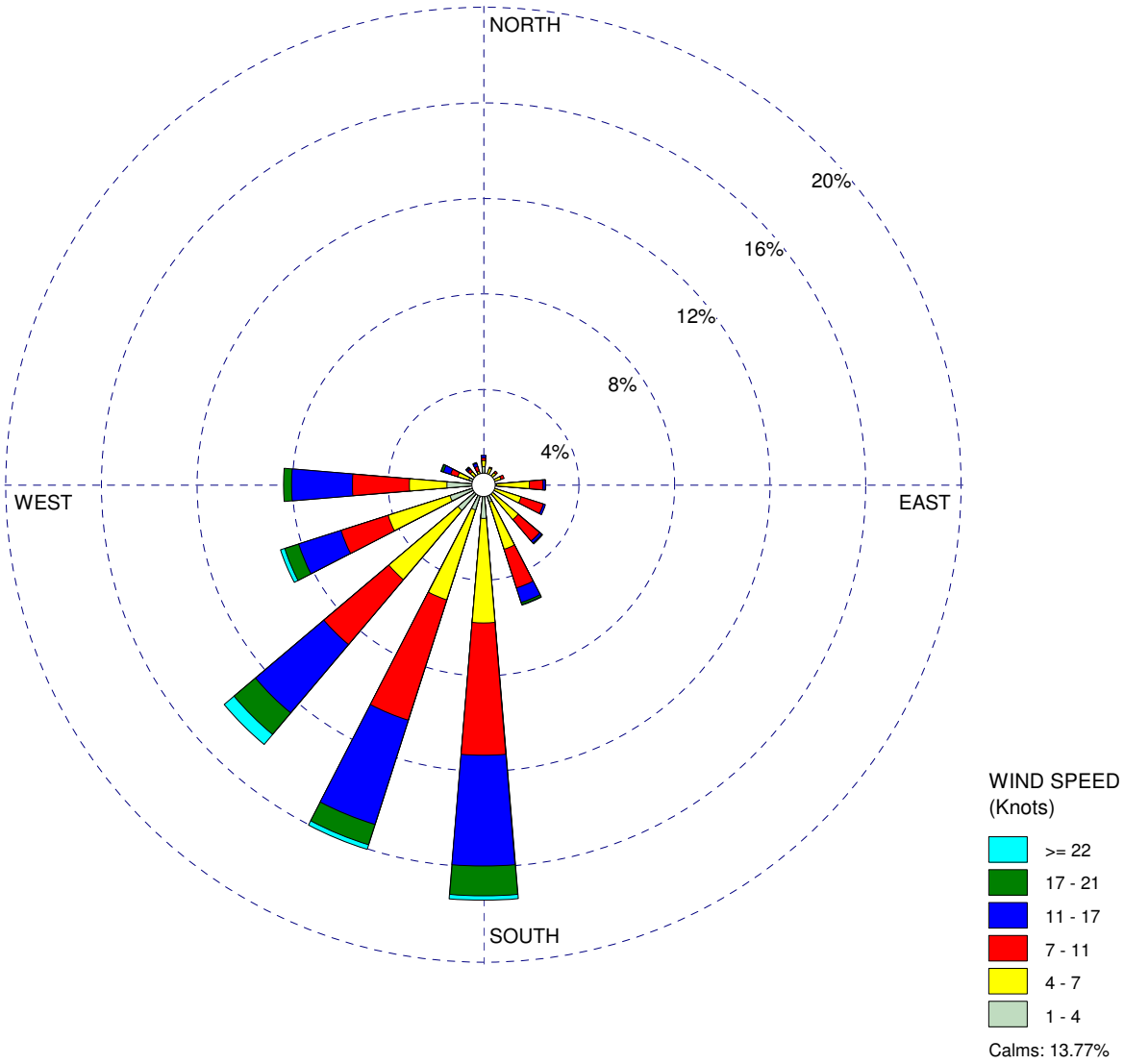
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

China Lake NAF, Kern County, CA
Wind Rose for 2000-2004 - 3rd Quarter (Jul. 1- Sep. 30)

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2002 2003 2004 2000 2001 **Jul 1 - Sep 30** **00:00 - 23:00**	**AECOM**	
		MODELER: **M. Stresing**	AECOM
	CALM WINDS: **13.77%**	TOTAL COUNT: **4414 hrs.**	
	AVG. WIND SPEED: **8.00 Knots**	DATE: **12/4/2009**	PROJECT NO.: **60139696**

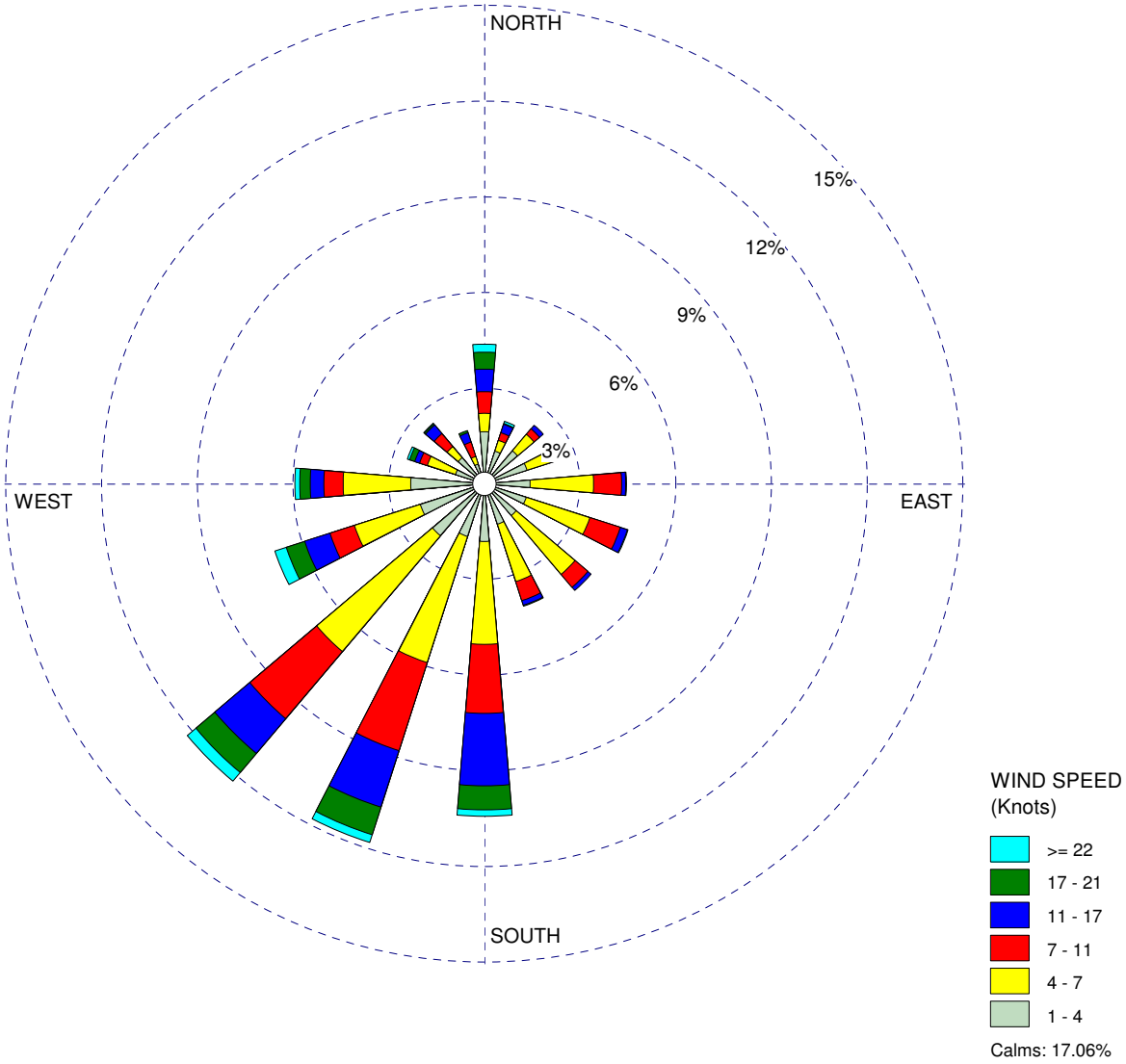
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

China Lake NAF, Kern County, CA
Wind Rose for 2000-2004 - 4th Quarter (Oct. 1- Dec. 31)

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2002 2003 2004 2000 2001 **Oct 1 - Dec 31** **00:00 - 23:00**	**AECOM**	
		MODELER: **M. Stresing**	AECOM
	CALM WINDS: **17.06%**	TOTAL COUNT: **3981 hrs.**	
	AVG. WIND SPEED: **6.46 Knots**	DATE: **12/4/2009**	PROJECT NO.: **60139696**

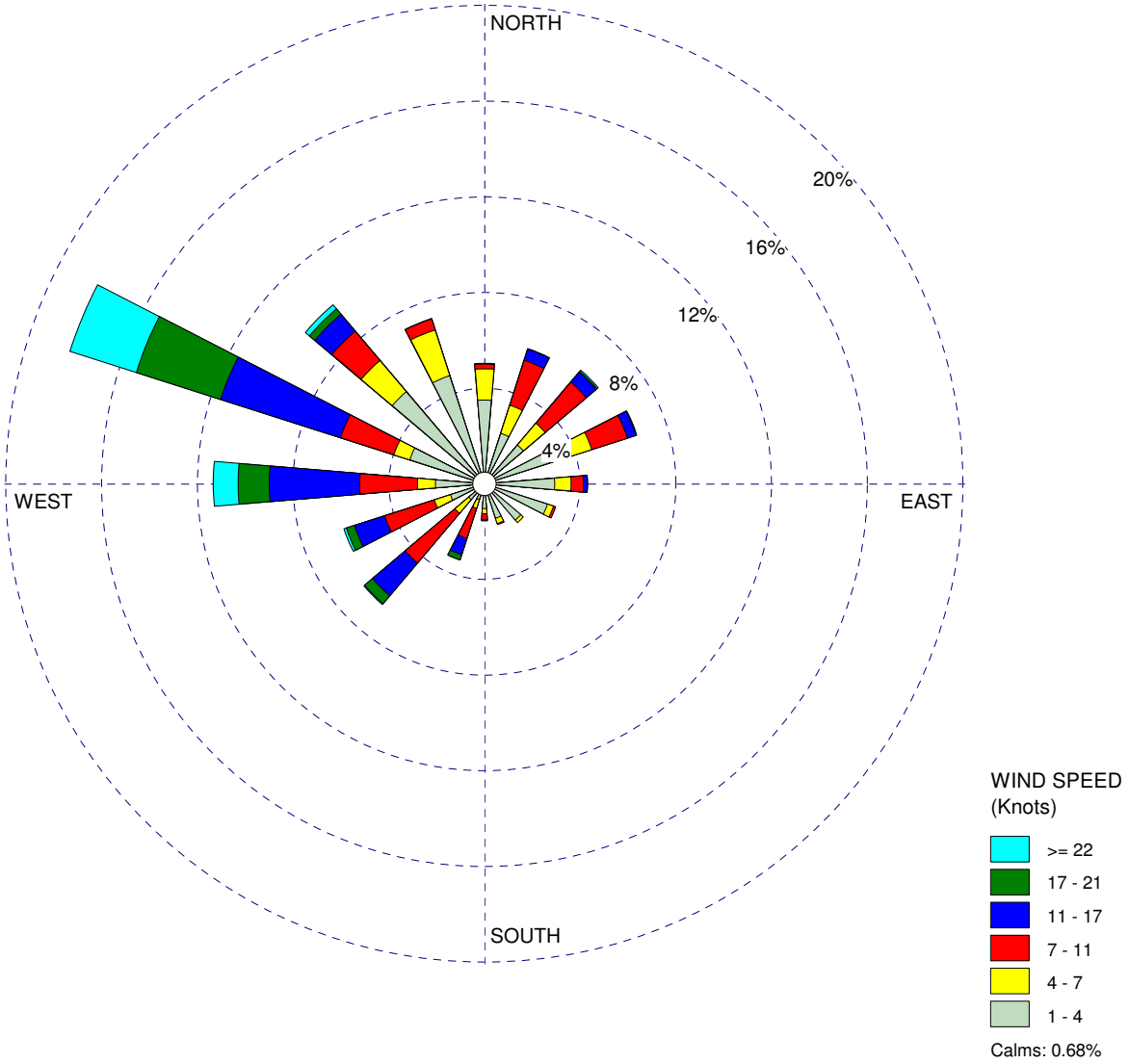
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Mojave ARB Measurement Site
Wind Rose for 2000-2004 - 1st Quarter (Jan. 1- Mar. 31)

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2000-2004 **Jan 1 - Mar 31** **00:00 - 23:00**	**AECOM**	
		MODELER: **M. Stresing**	AECOM
	CALM WINDS: **0.68%**	TOTAL COUNT: **8642 hrs.**	
	AVG. WIND SPEED: **8.17 Knots**	DATE: **12/15/2009**	PROJECT NO.: **60139696**

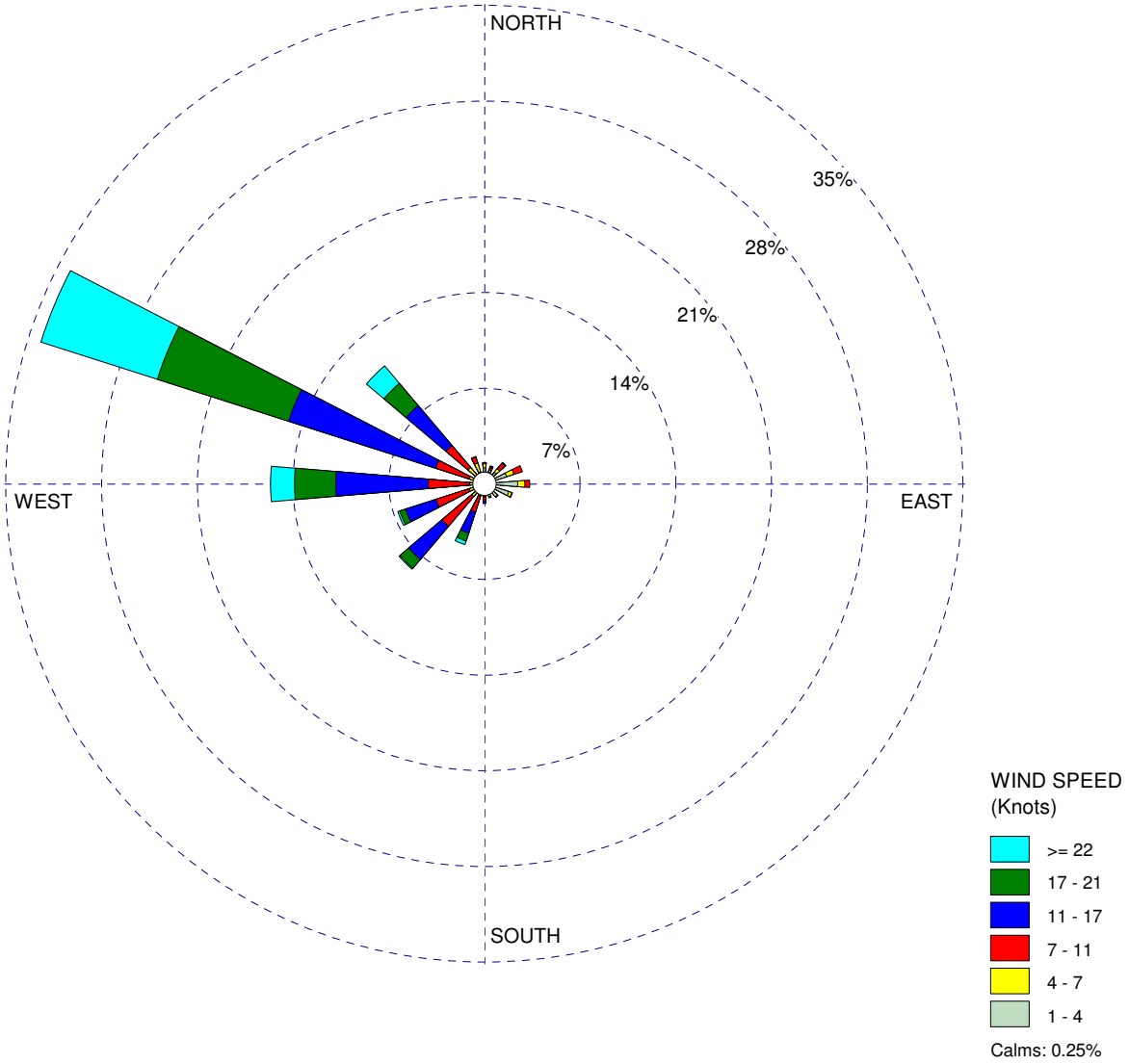
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Mojave ARB Measurement Site
Wind Rose for 2000-2004 - 2nd Quarter (Apr. 1- Jun. 30)

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2000-2004 **Apr 1 - Jun 30** **00:00 - 23:00**	**AECOM**	
		MODELER: **M. Stresing**	AECOM
	CALM WINDS: **0.25%**	TOTAL COUNT: **8385 hrs.**	
	AVG. WIND SPEED: **13.26 Knots**	DATE: **12/15/2009**	PROJECT NO.: **60139696**

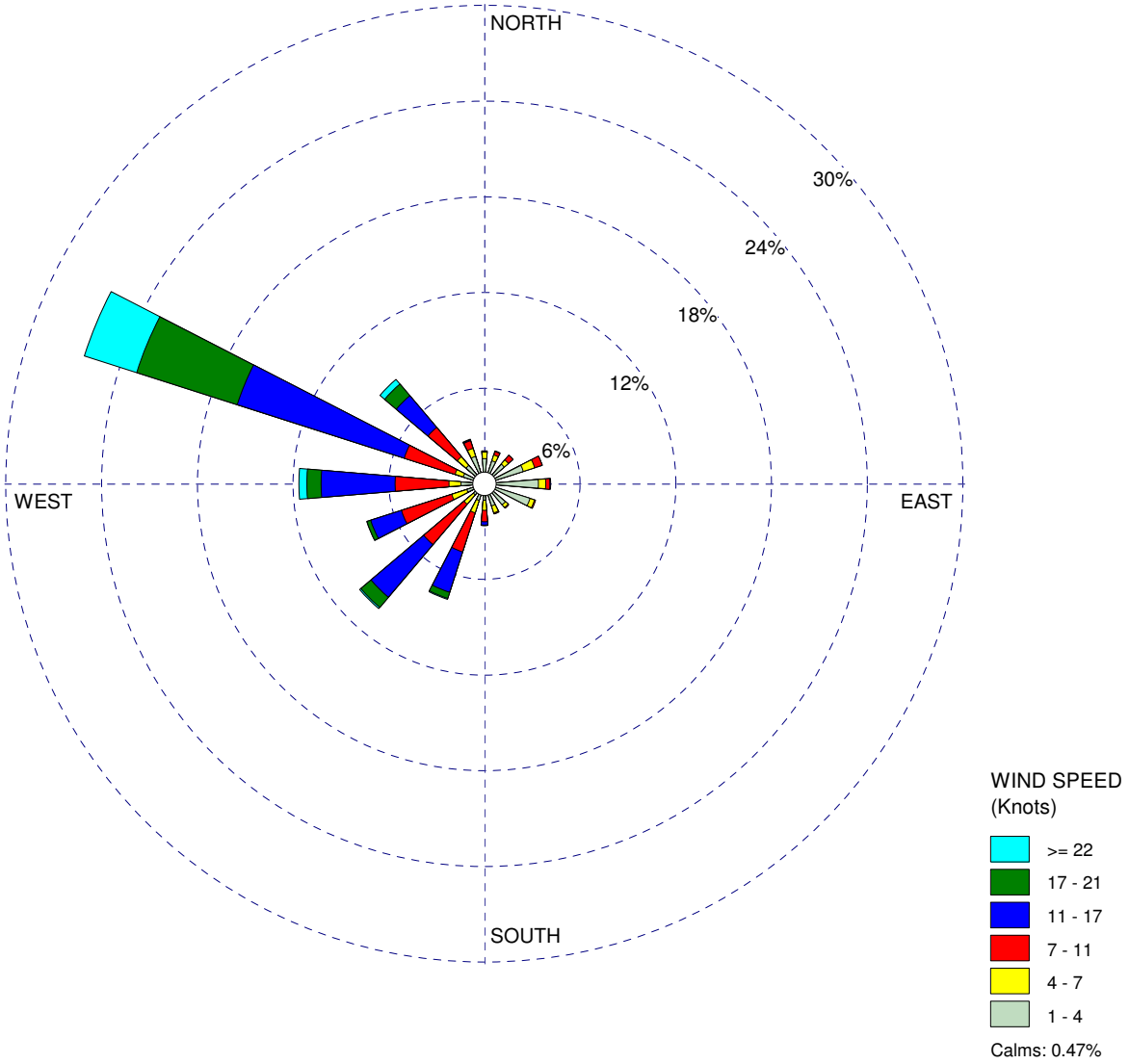
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Mojave ARB Measurement Site
Wind Rose for 2000-2004 - 3rd Quarter (Jul. 1- Sep. 30)

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2000-2004 **Jul 1 - Sep 30** **00:00 - 23:00**	**AECOM**	
		MODELER: **M. Stresing**	AECOM
	CALM WINDS: **0.47%**	TOTAL COUNT: **8275 hrs.**	
	AVG. WIND SPEED: **10.10 Knots**	DATE: **12/15/2009**	PROJECT NO.: **60139696**

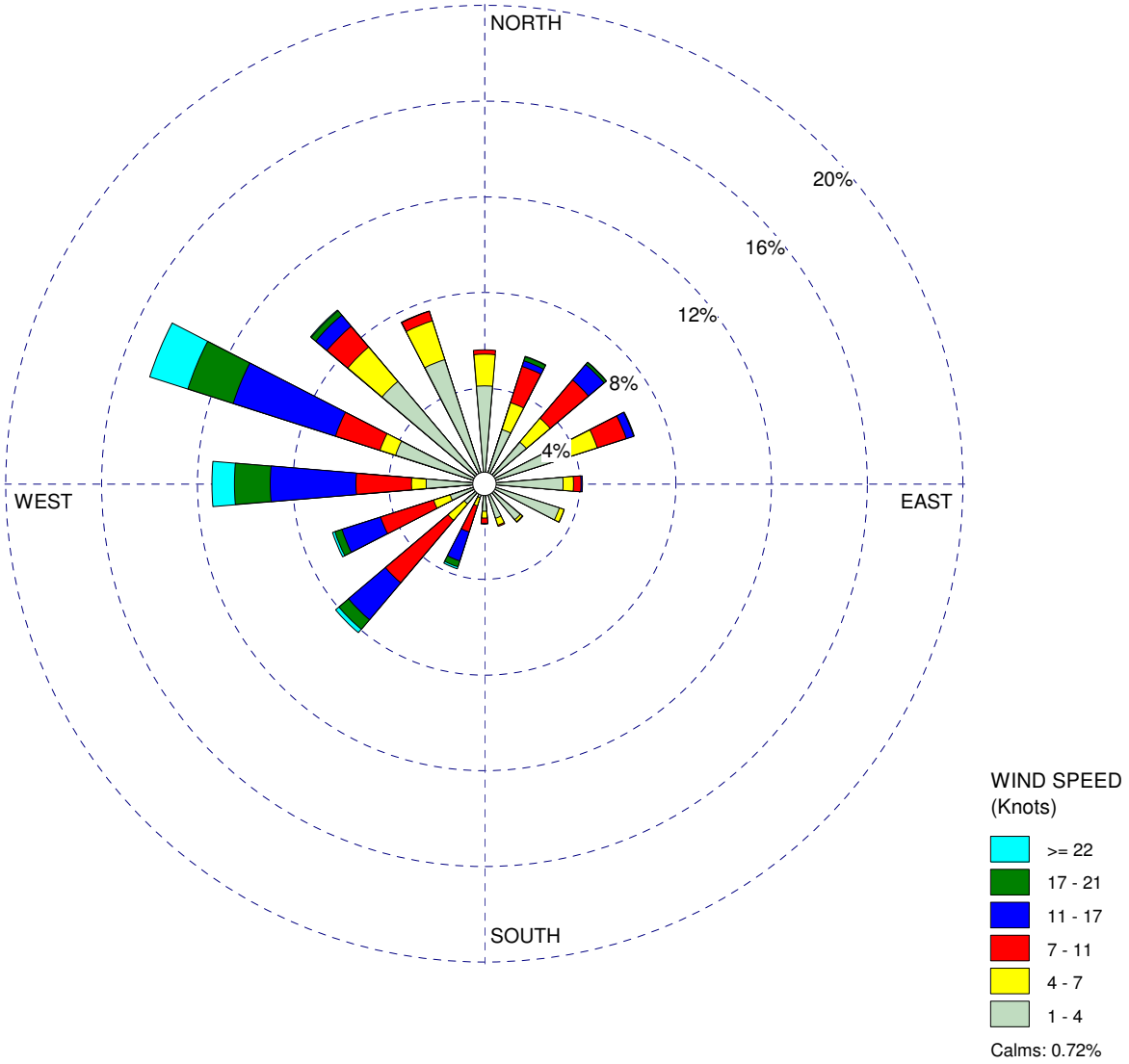
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Mojave ARB Measurement Site
Wind Rose for 2000-2004 - 4th Quarter (Oct. 1- Dec. 31)

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2000-2004 **Oct 1 - Dec 31** **00:00 - 23:00**	**AECOM**	
		MODELER: **M. Stresing**	AECOM
	CALM WINDS: **0.72%**	TOTAL COUNT: **9556 hrs.**	
	AVG. WIND SPEED: **7.46 Knots**	DATE: **12/15/2009**	PROJECT NO.: **60139696**

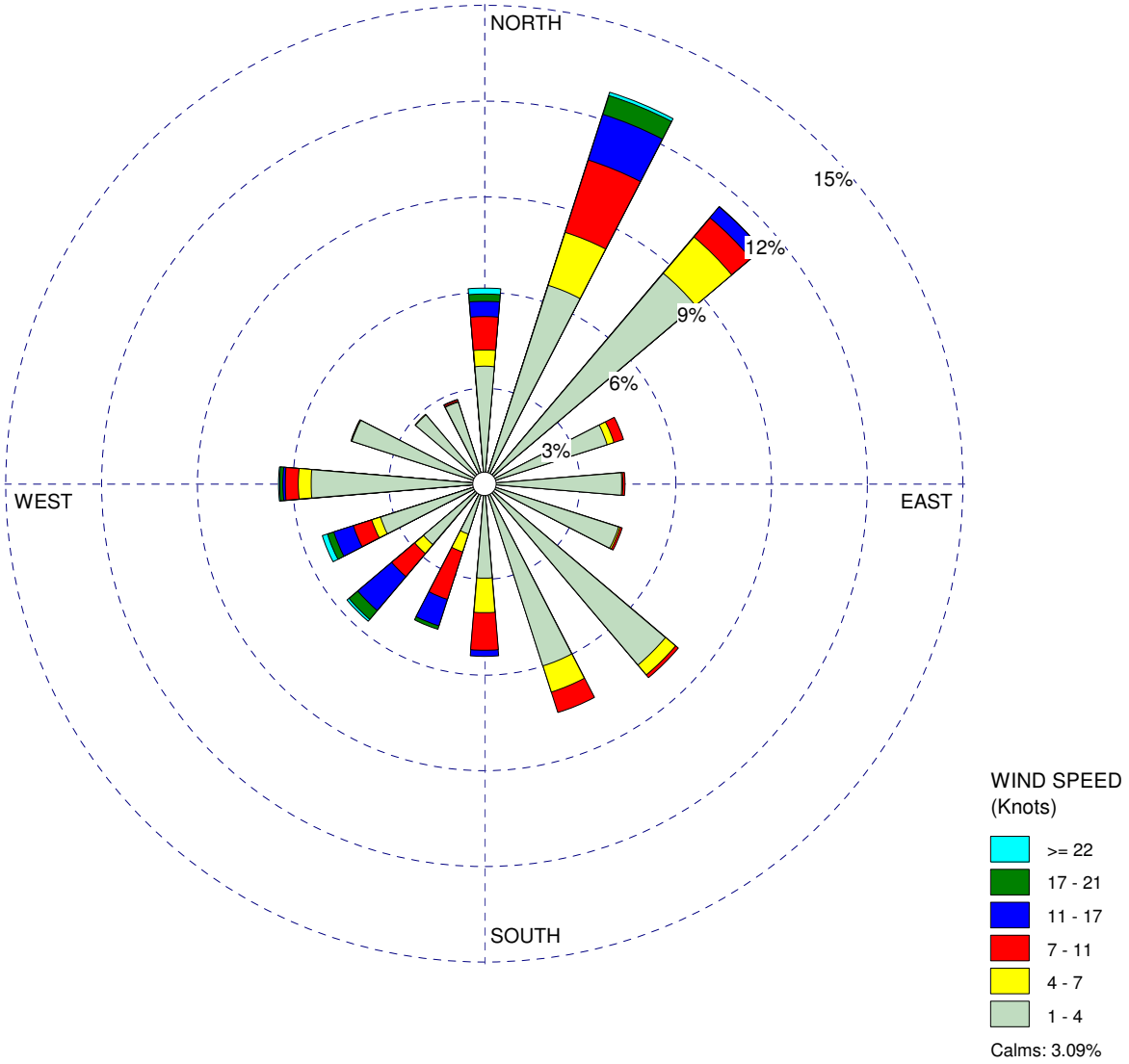
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Trona Measurement Site
Wind Rose for 2000-2004 - 1st Quarter (Jan. 1- Mar. 31)

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2000-2004 **Jan 1 - Mar 31** **00:00 - 23:00**	**AECOM**	
		MODELER: **M. Stresing**	AECOM
	CALM WINDS: **3.09%**	TOTAL COUNT: **9072 hrs.**	
	AVG. WIND SPEED: **4.23 Knots**	DATE: **12/15/2009**	PROJECT NO.: **60139696**

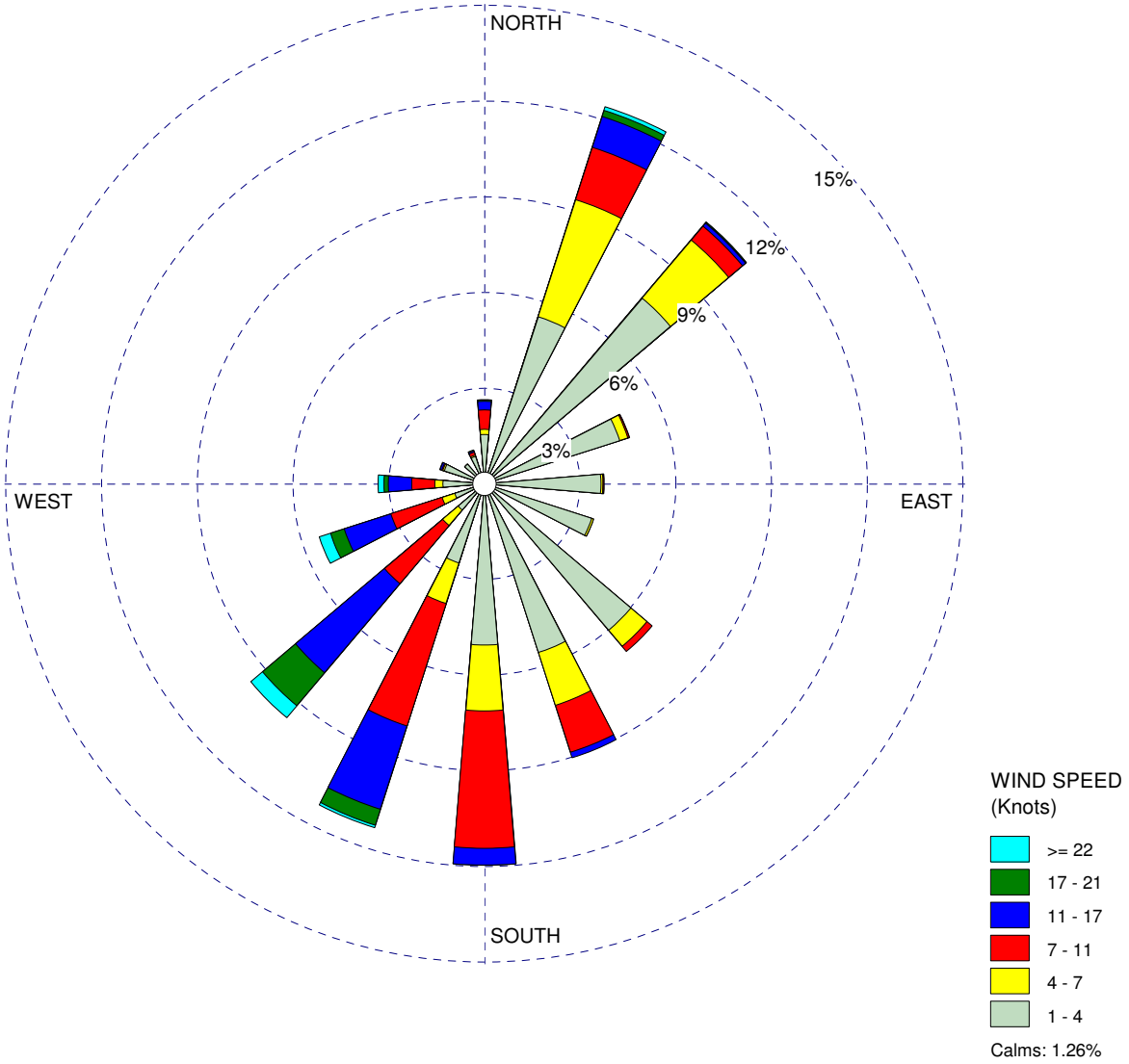
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Trona Measurement Site
Wind Rose for 2000-2004 - 2nd Quarter (Apr. 1- Jun. 30)

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2000-2004 **Apr 1 - Jun 30** **00:00 - 23:00**	**AECOM**	
		MODELER: **M. Stresing**	AECOM
	CALM WINDS: **1.26%**	TOTAL COUNT: **9905 hrs.**	
	AVG. WIND SPEED: **6.20 Knots**	DATE: **12/15/2009**	PROJECT NO.: **60139696**

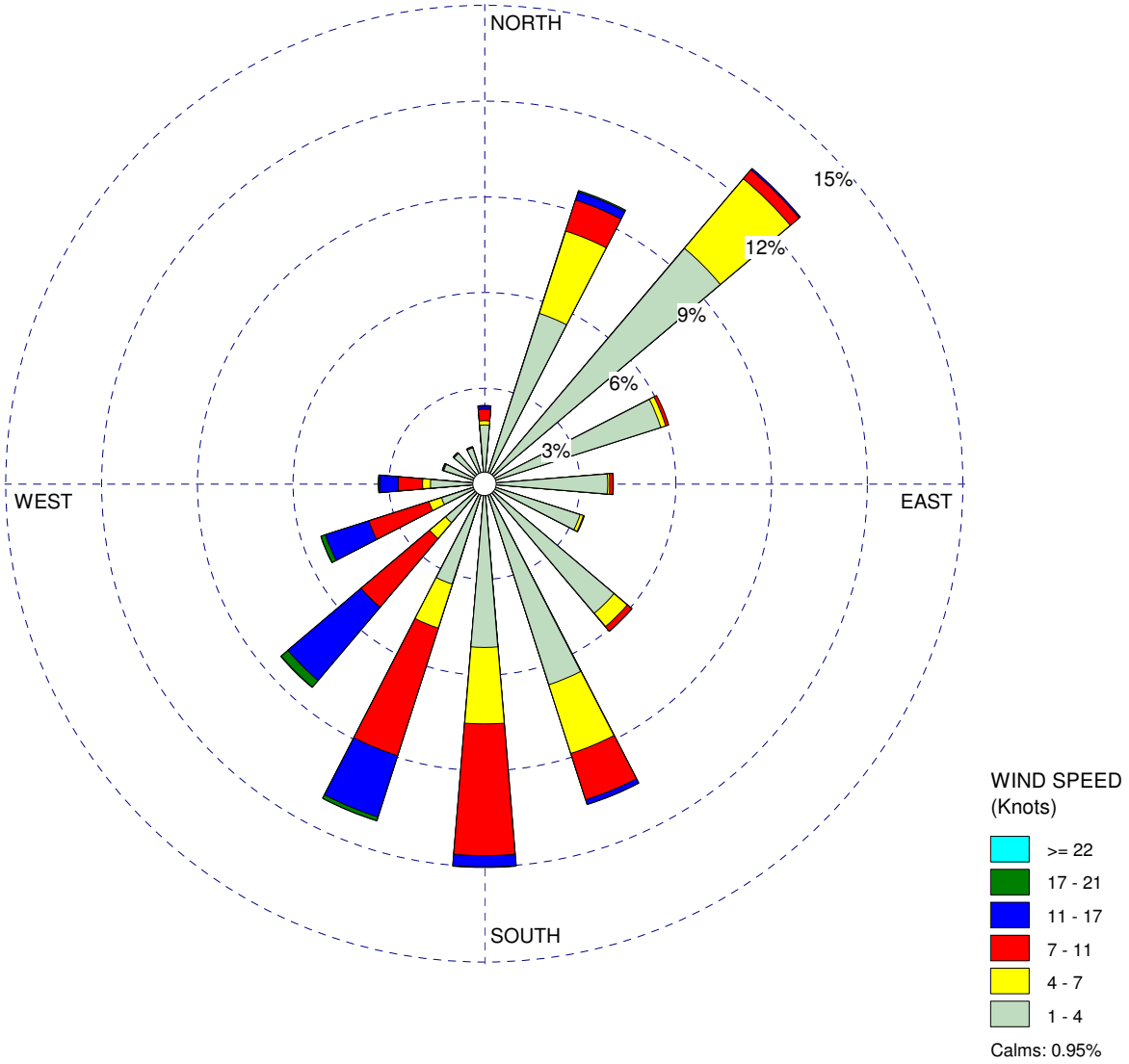
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Trona Measurement Site
Wind Rose for 2000-2004 - 3rd Quarter (Jul. 1- Sep. 30)

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2000-2004 **Jul 1 - Sep 30** **00:00 - 23:00**	**AECOM**	
		MODELER: **M. Stresing**	AECOM
	CALM WINDS: **0.95%**	TOTAL COUNT: **11029 hrs.**	
	AVG. WIND SPEED: **5.17 Knots**	DATE: **12/15/2009**	PROJECT NO.: **60139696**

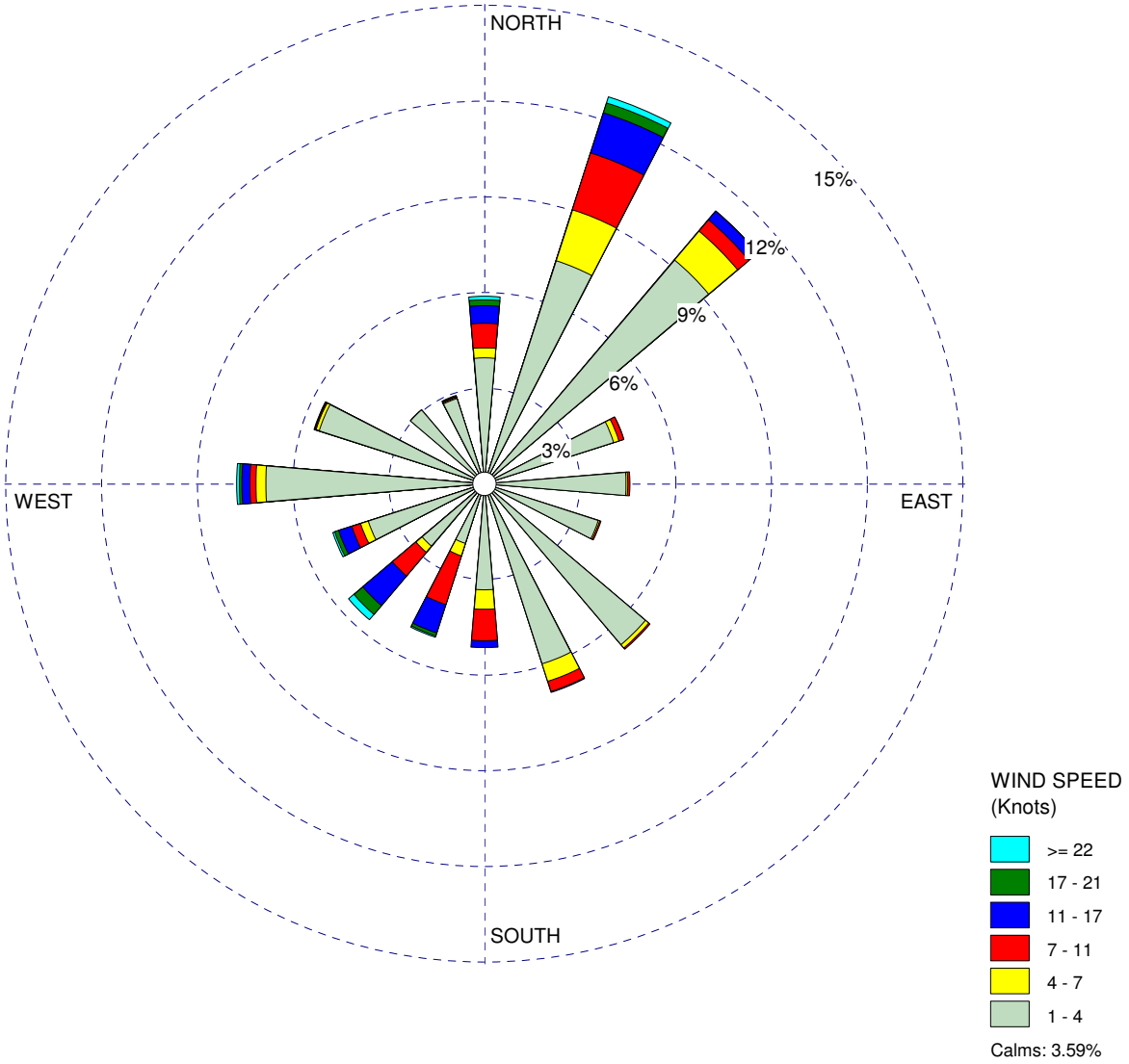
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Trona Measurement Site
Wind Rose for 2000-2004 - 4th Quarter (Oct. 1- Dec. 31)

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2000-2004 **Oct 1 - Dec 31** **00:00 - 23:00**	**AECOM**	
		MODELER: **M. Stresing**	AECOM
	CALM WINDS: **3.59%**	TOTAL COUNT: **9795 hrs.**	
	AVG. WIND SPEED: **3.84 Knots**	DATE: **12/15/2009**	PROJECT NO.: **60139696**

WRPLOT View - Lakes Environmental Software