URS

# Memorandum

Date: October 11, 2010

To: Scott Bohning, U.S. Environmental Protection Agency Region IX

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From: Julie Mitchell, URS



Subject: **Model Parameter Selection for HECA Project 1-Hour $NO_2$ NAAQS Regional Modeling**

As a part of the Prevention of Significant Deterioration (PSD) application, the Hydrogen Energy California (HECA) project will need to show compliance with the nitrogen dioxide ($NO_2$) 1-hour National Ambient Air Quality Standard (NAAQS). In preparation to conduct the requested regional $NO_2$ modeling analysis, HECA is requesting acknowledgement from U.S. Environmental Protection Agency (EPA) Region IX staff that the input parameters for the regional $NO_2$ modeling analysis described in this document are acceptable. This document describes key model parameters that will be used in conducting the Tier 3 "detailed screening methods" modeling for the $NO_2$ 1-hour federal standard (EPA, 2010c).

**Plume Volume Molar Ratio Method**

The ozone ($O_3$) limiting method (OLM) that HECA intends to use is the plume volume molar ratio method (PVMRM) algorithm in the American Meteorological Society/EPA Regulatory Model (AERMOD) to estimate the 1-hour ground level concentrations of $NO_2$. Because PVMRM is a non-regulatory option in AERMOD, justification for its use is required. On September 16, 2010, San Joaquin Valley Air Pollution Control District (SJVAPCD) posted a draft guidance document on their website, *Assessment of Non-Regulatory Options in AERMOD Specifically OLM and PVMRM*, to aid in this justification. This guidance document is attached to this memo as Attachment A. Based on the SJVAPCD guidance and discussions with EPA Region IX staff, HECA provides the following five-point justification for use of the PVMRM model:

1. **The model has received a scientific peer review**

   As noted in the memorandum from EPA dated June 29, 2010, because AERMOD is the preferred model for dispersion for a wide range of applications, the alternative model demonstration for use of the OLM/PVMRM options within AERMOD focuses on the treatment of nitrogen oxides ($NO_X$) chemistry within the model, and does not need to address basic dispersion algorithms within AERMOD. The chemistry for PVMRM has been peer-reviewed, as noted by the documents posted on EPA's Support Center for Regulatory Air Modeling web site entitled *Sensitivity Analysis of PVMRM and OLM in AERMOD* (MACTEC, 2004) and *Evaluation of Bias in AERMOD-PVMRM* (MACTEC, 2005). Both documents indicate that the models appear to perform as expected.

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2. **The model can be demonstrated to be applicable to the problem on a theoretical basis**

   As noted in the document entitled *Sensitivity Analysis of PVMRM and OLM in AERMOD* prepared by Roger W. Brode of MACTEC (now with EPA OAQPS):

   > *"Overall the PVMRM option appears to provide a more realistic treatment of the conversion of $NO_X$ to $NO_2$ as a function of distance downwind from the source than OLM or the other $NO_2$ screening options (Hanrahan, 1999a; Hanrahan, 1999b). No anomalous behavior of the PVMRM or OLM options was identified as a result of these sensitivity tests."*

   Based on this report, the model appears to be applicable to the problem of $NO_2$ formation and provides a better estimation of the $NO_2$ impacts compared to other screening options.

3. **The databases which are necessary to perform the analysis are available and adequate**

   The data needed to conduct a PVMRM run are (1) hourly meteorological data, (2) hourly $O_3$ data, and (3) in-stack $NO_2/NO_X$ ratio. A further refinement of the modeling will entail use of hourly ambient $NO_2$ data. HECA processed the meteorological, $O_3$, and $NO_2$ data following applicable EPA guidance as discussed in later sections of this document. The analysis will use the $NO_2/NO_X$ in-stack ratio, which are obtained from published references and engineering estimates.

4. **Appropriate performance evaluations of the model have shown that the model is not biased toward underestimates**

   As noted in the document entitled *Evaluation of Bias in AERMOD-PVMRM* prepared by Roger W. Brode, PVMRM has been judged to provide unbiased estimates based on criteria that are comparable to, or more rigorous than, evaluations performed for other dispersion models.

5. **A protocol on methods and procedures to be followed has been established**

   At the beginning of the PSD application process in 2008, HECA submitted a modeling protocol (URS, 2008) outlining the techniques to be used in the PSD analyses. HECA has incorporated EPA protocol comments into its air quality modeling techniques. HECA requests that EPA consider modeling techniques outlined in the 2008 modeling protocol (URS, 2008), subsequent 2009 revision to modeling protocol (URS, 2009), and this document when approving the modeling techniques that will be used to analyze the 1-hour $NO_2$ NAAQS. Further discussions with EPA have taken place to determine appropriate modeling techniques for conducting the 1-hour $NO_2$ NAAQS modeling. This document presents some of the modeling parameters that HECA proposes to use in conducting the 1-hour $NO_2$ NAAQS regional analysis.

**$NO_2/NO_X$ In-Stack Ratio**

For the emergency generators, firewater pump, and auxiliary boiler, the analysis will use the $NO_2/NO_X$ in-stack ratio obtained from SJVAPCD's 2010 draft guidance document, *Assessment of Non-Regulatory Options in AERMOD Specifically OLM and PVMRM* (Attachment A) and the updated Recommended In-Stack $NO_2/NO_X$ Ratios (Attachment B). For the emergency generators and fire water pump, the analysis will use an in-stack ratio of 0.2 from the "IC Engines (Diesel)" category. For the auxiliary boiler, the analysis will use 0.1 for the in-stack ratio from the category "Boilers (NG)."

Currently, limited information is available on in-stack $NO_2/NO_X$ ratios for gasifier refractory heaters, thermal oxidizers, and flares. The gasifier refractory heaters are fueled with natural gas and are expected to have an exhaust profile similar to a natural gas boiler; therefore, the in-stack ratio of 0.1 will be used. The exhaust from the thermal oxidizer or flares will have very little to no residence time in the stack, so almost no conversion of nitrogen oxide (NO) to $NO_2$ is expected. For these sources, it was conservatively assumed that 10 percent of the $NO_X$ will be $NO_2$.

No data exist for the $NO_2/NO_X$ in-stack ratio for turbines burning hydrogen-rich fuel. The turbine vendor expects the $NO_2/NO_X$ in-stack ratio will be similar to turbines that burn natural gas. Based on the in-stack $NO_2/NO_X$ ratio of 0.091 for a natural gas turbine as determined by SJVAPCD guidance, and accounting for the conversion of NO to $NO_2$ across the oxidation catalyst that could be as high as 20 percent ($NO_2/NO_X$ ratio 0.2), HECA proposes to use the conservative $NO_2/NO_X$ in-stack ratio of 0.3 for all turbine operating conditions (engineering estimate).

**Ambient $NO_2/NO_X$ Ratio**

The PVMRM algorithm uses the ambient $NO_2/NO_X$ ratio in calculating the predicted $NO_2$ concentrations. On an hourly basis, the ambient $NO_2/NO_X$ ratio will vary depending on nearby sources, meteorological conditions, and ambient $O_3$ concentrations. The PVMRM algorithm in AERMOD is not designed to accept hourly ambient $NO_2/NO_X$ ratios; therefore, the regional annual average ratio will be used in the model.

The analysis will use the equilibrium ratio from actual annual average monitoring data from all $NO_2$ monitoring stations in Kern County for the same years used for the meteorological data in the modeling (2004 through 2008). The monitors within Kern County that measure $NO_2$ are Arvin-Bear Mountain Boulevard, Bakersfield California Avenue, Bakersfield Golden State Highway, Edison, and Shafter. The data were obtained from the California Air Resource Board (CARB) AQMIS website (CARB, 2010). The annual average $NO_2/NO_X$ ratio for these 5 years of monitoring data is 0.63.

**Ozone and Nitrogen Dioxide Data**

*Shafter Monitoring Station*

To show project compliance with the new $NO_2$ 1-hour NAAQS, $NO_2$ and $O_3$ monitoring data are needed for modeling. Hourly $O_3$ data will be used in conjunction with the PVMRM algorithm in AERMOD. $NO_2$ hourly data will be used to represent ambient background $NO_2$ concentrations from sources not included in the regional modeling analysis, such as mobile sources. The hourly $NO_2$ data will be combined with the hourly $NO_2$ impacts predicted from the modeling to show the maximum potential regional $NO_2$ impacts described in the following section. Because the modeled impacts will account for the extremely unlikely event that all nearby sources operate at their maximum-hourly emission rates in any given hour, the addition of background data adds another layer of conservatism to the already over-predicted 1-hour modeled impacts.

The $NO_2$ and $O_3$ monitored data should cover the same years as the meteorological data used in modeling, and be from the same monitoring station, to represent the balance between ambient nitrogen dioxide and ozone concentrations. The meteorological data used for modeling are from the Bakersfield Meadows Field Airport, for years 2004 through 2008, and are discussed in detail in the next section. Several monitoring stations within Kern County in the San Joaquin Valley Air Basin were considered for the $NO_2$ and $O_3$ data. The nearest monitoring station to the proposed project site that measured both these pollutants during these years is located in Shafter, California. Raw data for the Shafter monitoring station from CARB also demonstrated data completeness requirements during all quarters (more than 75 percent data capture) for all 5 years, per 40 Code of Federal Regulations Parts 50 and 58, February 9, 2010, Appendix S, 3.2(b). Additionally, the Shafter station is representative of the rural location at the HECA project site. Shafter is located on the roof of the local Department of Motor Vehicles, which is surrounded by parking lots, and is near several roadways and a railroad. California State Route 43 is 540 feet to the west of the Shafter monitoring station, and has an average daily traffic volume of 14,000 trips (Caltrans, 2010). The Shafter monitoring station is 350 feet to the west of the Burlington Northern Santa Fe railroad. Due to the close proximity to State Route 43 and the railroad, the data from this station account for potential impacts from sources related to transportation. The monitor is not near large industrial sources, but such sources will be accounted for in the regional modeling. The Shafter monitoring station is expected to measure significantly more pollution from mobile sources than if a monitor were located next to the completed HECA project.

EPA has expressed concern that $NO_2$ impacts from mobile sources may be underestimated; $NO_2$ and $O_3$ data from a monitoring station that is near mobile sources should adequately account for such sources in the regional analysis. Because the $NO_2$ 1-hour analysis that is being conducted is a regional analysis, it would be inappropriate to use $O_3$ data from a station heavily influenced by local sources. Because the Shafter monitoring station is near mobile sources but no large industrial sources, and is not downwind from an urban area, the

data appropriately represent ambient $O_3$ concentrations expected to be found throughout rural San Joaquin Valley.

Therefore, the Shafter monitoring station was chosen to represent the background $NO_2$ and $O_3$ data in the modeling.

Other stations that were considered for $NO_2$ and $O_3$ data are shown in Table 1. These other stations did not meet the following criteria:

1. Meet data completeness requirements;
2. Match the rural land use surface parameters of the proposed project site;
3. Show close proximity to the project site compared to other monitoring stations;
4. Monitor $NO_2$ or $O_3$ data; or
5. Meet a combination of the above-mentioned points.

**Table 1**
**Monitoring Stations Considered for Ozone and Nitrogen Dioxide Data,**
**Kern County, San Joaquin Valley Air Basin**

| Monitoring Station | $NO_2$ data availability years | $O_3$ data availability years | Distance from project site (miles) | All quarters between 2004-2008 have 75% raw data capture for $NO_2$ and $O_3$?[1] |
|---|---|---|---|---|
| Maricopa-Stanislaus Street | Not Applicable | 87-08 | 19 | Not Applicable |
| Shafter-Walker Street | 89-08 | 89-08 | 13 | Yes |
| Taft College | Not Applicable | Not Applicable | 13 | Not Applicable |
| Bakersfield-Golden State Highway | 94-08 | 94-08 | 21 | No; 1st and 2nd quarter of 2004 under 75% data capture |
| Bakersfield-5558 California Avenue | 94-08 | 94-08 | 18 | No; 3rd quarter of 2004 under 75% data capture |
| Bakersfield-410 E Planz Road | Not Applicable | Not Applicable | 21 | Not Applicable |

Notes:

[1] Raw data per quarter must meet 75% data capture, per 40 Code of Federal Regulations Parts 50 and 58, February 9, 2010, Appendix S, 3.2(b)

Data from CARB: http://www.arb.ca.gov/aqmis2/aqdselect.php?tab=specialrpt

Bakersfield $NO_2$ and $O_3$ data were not used because neither station in Bakersfield met data completeness requirements, nor are the Bakersfield stations' urban locations representative of the rural HECA site. Figure 1 displays an overview image of the proposed project and locations of several nearby monitoring stations. Close-up aerial images of the HECA project

site next to the surface meteorological station used in the AERMET files (described below in the Meteorological Data section) are shown in Figure 2. Finally, zoomed-in locations of the monitoring stations at Shafter, Bakersfield-California Avenue, and Bakersfield-Golden State Highway are presented in Figures 3 through 5, respectively.

The Shafter $O_3$ and $NO_2$ data for 5 years was run through a URS FORTRAN program to fill in one or two missing consecutive hour time spans, using interpolation from measured concentrations surrounding the missing hour(s). Hours that were missing for more than 2 hours in a row were substituted with the maximum value of the monitored concentrations from the same hour from the previous or subsequent day. The data from the previous and subsequent day were reviewed by an air quality scientist to ensure anomalous data did not skew the data files. No anomalous data were encountered. The filling method described above will not underestimate the missing background $O_3$ or $NO_2$ concentrations, because the maximum concentration for the given hour was substituted. These data only constitute the contribution from mobile sources; the modeling very conservatively predicts the contributions from nearby sources simultaneously operating at maximum hourly emissions.

*Use of Hourly Nitrogen Dioxide Data in Modeling*

The hourly $NO_2$ data will be combined with the hourly $NO_2$ impacts predicted from the modeling to show the maximum potential regional $NO_2$ impacts. The modeling analysis will be conducted per the procedures outlined by EPA in *Notice Regarding Modeling for New Hourly $NO_2$ NAAQS* (EPA, 2010b). In this approach, AERMOD with PVMRM is run to produce an output file with $NO_2$ concentrations at every receptor for every hour in the meteorological data set using the hourly POSTFILE option. Concurrent hourly $NO_2$ background data are then added to the modeled $NO_2$ concentrations to obtain the total $NO_2$ concentration for each hour. From these hourly data, the maximum 1-hour concentration for each day of the data period at each receptor is determined using a FORTRAN post-processing program designed for this purpose. The post–processor then determines the eighth-highest daily maximum 1-hour concentration from the daily 1-hour maximum concentrations at each receptor for each year modeled. The eighth-highest concentration is representative of the 98th percentile concentration from the distribution of daily 1-hour maximum values. The eighth-highest daily 1-hour maximum concentrations at each receptor are then averaged across the five modeled years and the maximum of these averaged values from all receptors is used to represent the peak predicted offsite $NO_2$ concentration for comparison with the NAAQS.

A post-processor program was developed by URS to process the AERMOD POSTFILE output files with the concurrent $NO_2$ background data. The post-processor calculates the 98th percentile of the daily maximum 1-hour concentrations for each year of meteorological data at each receptor. The maximum averaged 98th percentile $NO_2$ concentration predicted for offsite receptors using this analysis approach will be compared with the federal $NO_2$ 1-hour standard of 100 parts per billion (ppb), which is equivalent to 188.68 micrograms per cubic meter ($\mu g/m^3$), to determine whether compliance will be achieved.

**Meteorological Data**

*Bakersfield Meadows Field Airport*

Hourly surface data were obtained from the SJVAPCD for the Bakersfield Meadows Field Airport meteorological station for the years 2004 through 2008. The SJVAPCD hourly surface observation data included meteorological parameters of temperature, dew point, pressure, wind speed, wind direction, cloud cover, and ceiling height. SJVAPCD has prepared a document describing their meteorological processing methodology, "Procedures for Downloading and Processing NCDC Meteorological Data," provided in Attachment C.

The Bakersfield Meadows Field Airport data are collected approximately 20 miles northeast of the HECA project site. The data meet the EPA criteria for representativeness, and are suitable based on proximity and terrain similarities between the Project Site and the Bakersfield Meadows Airport Station. The terrain immediately surrounding the meteorological station and the HECA site is rural as shown on Figure 2. Circles with a 1-kilometer (km) radius around the HECA project site and the meteorological station show terrain similarities, specifically open fields and semi-developed land use categories. Projected HECA structures will create a more developed site at the project location, producing some developed land use, similar to the airport. There are no major geographical features that could influence the meteorological conditions between or near the locations. The 2004-2008 data set represents data collection over 5 years. Although only 1 year of onsite data is required for use in regulatory modeling under EPA guidelines, a 5-year data set was used to better represent the project site conditions, as well as to capture worst-case meteorological conditions.

The Bakersfield meteorological station and project site lay within the southern portion of the San Joaquin Valley, between the foothills of the Sierra Nevada Mountains to the east, the Diablo Mountain Range to the west, and the Tehachapi mountains to the south. The project site sits at 288 feet above sea level while the meteorological station sits at 489 feet. The climate in the valley is warm and semi-arid, with the wet season occurring between October and April. The 30-year normal sky coverage in the Bakersfield has 189 days of clear skies, 80 days of party cloudy skies, and 92 days of cloudy skies. Summers are clear and dry. The relative humidity is low in the summer and high in the winter, with an average annual relative humidity of 54 percent. Winds in the San Joaquin Valley often flow with the axis of the valley, and thus blow frequently from the northwest. During the summer the northwest sea breezes frequent the Bakersfield area; especially during hot summer periods, which may carry dust and bring thermal instability. As air descends downward over the mountain ranges, it warms and dries out, allowing temperatures in the city and adjacent areas of the southeastern San Joaquin Valley to run warmer than areas further north. A very strong eastern Chinook wind will often blow through the Tehachapi Pass during the winter months. Frontal passages are also common in winter months throughout the valley. (NCDC, 2010; NOAA, 2008).

Only two long-term upper air stations exist for the entire State of California. The California stations are in Oakland and San Diego. There is an upper air station at Vandenberg Air

Force Base in California, but this station has insufficient hourly data for modeling. SJVAPCD chose the Oakland International Airport upper air station for all meteorological data processing. Data were obtained from the National Oceanic and Atmospheric Administration Radiosonde Database for the same years as the surface station data. The Oakland Airport upper air station is located approximately 235 miles northwest of the project site. Using the Oakland upper air data and the Bakersfield surface data, AERMET creates an hourly wind profile increasing with height to estimate wind parameters at different plume heights.

The EPA AERMOD Implementation Guide in January 2008 discussed a fairly new developed tool called AERSURFACE, which may be used to establish realistic and reproducible surface characteristic values around the meteorological surface station. SJVAPCD used the AERSURFACE program to determine surface characteristics for input into the AERMET processor program for the Bakersfield meteorological data set. AERSURFACE uses United States Geological Survey National Land Cover Data 1992 archives to determine the Albedo, Bowen ratio, and surface roughness length representative of the surface meteorological station.

For the AERSURFACE input, the EPA-recommended surface parameter distance of 1 km was used to develop surface roughness values and a 10-km radius was used for Albedo and Bowen ratios. Figure 2 displays an aerial view of the HECA project site and Bakersfield Meadows Airport meteorological station site, with a circle 1 km in radius surrounding both locations. The meteorological station is at an airport, does not receive continuous snow cover in the winter, and is not in an arid region. The Bowen ratio calculation is based on the upper, middle, or lower 30th percentile surface moisture conditions representing wet, average, or dry conditions, respectively.

For reference, an annual wind rose based on the 5 years of surface Bakersfield data is provided as Figure 6, Annual Wind Rose for Bakersfield Meadows Field Airport. Winds blow predominantly from the northwest with an average annual speed of 6 miles per hour, but winds are often calm. Western Regional Climate Center (WRCC, 2010) Bakersfield Meadows Airport temperature data for the years 1937 through 2010 indicate the average annual high and low temperature for this station are 79 F and 53°F, respectively.

The HECA site is in close proximity to the Bakersfield Meadows Airport meteorological station, so the locations have a similar climate, the land use surrounding each location is comparable, and there are no major geographical features between the HECA site and weather station that could influence a difference between the meteorological conditions. Therefore, the meteorological data at the Bakersfield Meadows Airport station are representative for use in the $NO_2$ regional modeling analysis.

**References**

Caltrans (California Department of Transportation), 2010. Traffic Data Branch, Average Daily Traffic for Hwy 43 at Shafter, California. http://www.dot.ca.gov/hq/traffops/saferesr/trafdata/.

CARB (California Air Resources Board), 2010. Air Quality Data Query Tool. http://www.arb.ca.gov/aqmis2/ aqdselect.php.

EPA (United States Environmental Protection Agency), 2004. *User's Guide for the AERMOD Meteorological Preprocessor (AERMET)*. November 2004.

EPA (United States Environmental Protection Agency), 2005. *Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions; Final Rule*. 40 CFR Part 51. Appendix W, Guideline on Air Quality Models. November 9, 2005.

EPA (United States Environmental Protection Agency), 2008a. *AERMOD Implementation Guide*. January 2008.

EPA (United States Environmental Protection Agency), 2008b. *AERSURFACE User's Guide*. EPA-454/B-08-001. January 2008.

EPA (United States Environmental Protection Agency), 2010a. *National Primary and Secondary Ambient Air Quality Standards*. 40 CFR 50. Appendix S, Interpretation of the Primary National Ambient Air Quality Standards for Oxides of Nitrogen (Nitrogen Dioxide). February 9, 2010.

EPA (United States Environmental Protection Agency), 2010b. Notice Regarding Modeling for New Hourly $NO_2$ NAAQS. February 25, 2010.

EPA (United States Environmental Protection Agency), 2010c. *Guidance Concerning the Implementation of the 1-hour $NO_2$ NAAQS for the Prevention of Significant Deterioration Program*. June 29, 2010.

MACTEC, 2004. *Sensitivity Analysis of PVMRM and OLM in AERMOD*. Alaska DEC Contract No. 18-8018-04. September 2004.

MACTEC, 2005. *Evaluation of Bias in AERMOD-PVMRM*. Alaska DEC Contract No. 18-9010-12. June 2005.

NCDC (National Climatic Data Center), 2010. Bakersfield Airport Climate-Radar Data Inventories. http://www.ncdc.noaa.gov/oa/ncdc.html.

NOAA (National Oceanic and Atmospheric Administration), 2008. The Climate of Bakersfield, California. Technical Memorandum NWS WR-281. National Weather Service (NWS). Stachelski, Chris and Gary Sanger. February 2008.

NOAA (National Oceanic and Atmospheric Administration), 2010. Radiosonde Database. http://esrl.noaa.gov/raobs/.

SJVAPCD (San Joaquin Valley Air Pollution Control District), 2010a. *Procedures for Downloading and Processing NCDC Meteorological Data*. Permit Services Department. Villalvazo, Leland and Ester Davila. May, 2010.

SJVAPCD (San Joaquin Valley Air Pollution Control District), 2010b. Assessment of Non-Regulatory Options in AERMOD Specifically OLM and PVMRM, Draft. September 16, 2010.

URS, 2008. Air Quality Modeling Protocol for the HECA Power Project, Kern County, California. April 22, 2008.

URS, 2009. Air Quality Modeling Protocol for the HECA Power Project, Kern County, California. February 6, 2009.

WRCC (Western Regional Climate Center), 2010. Bakersfield Airport Climate Statistics. http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca0442.

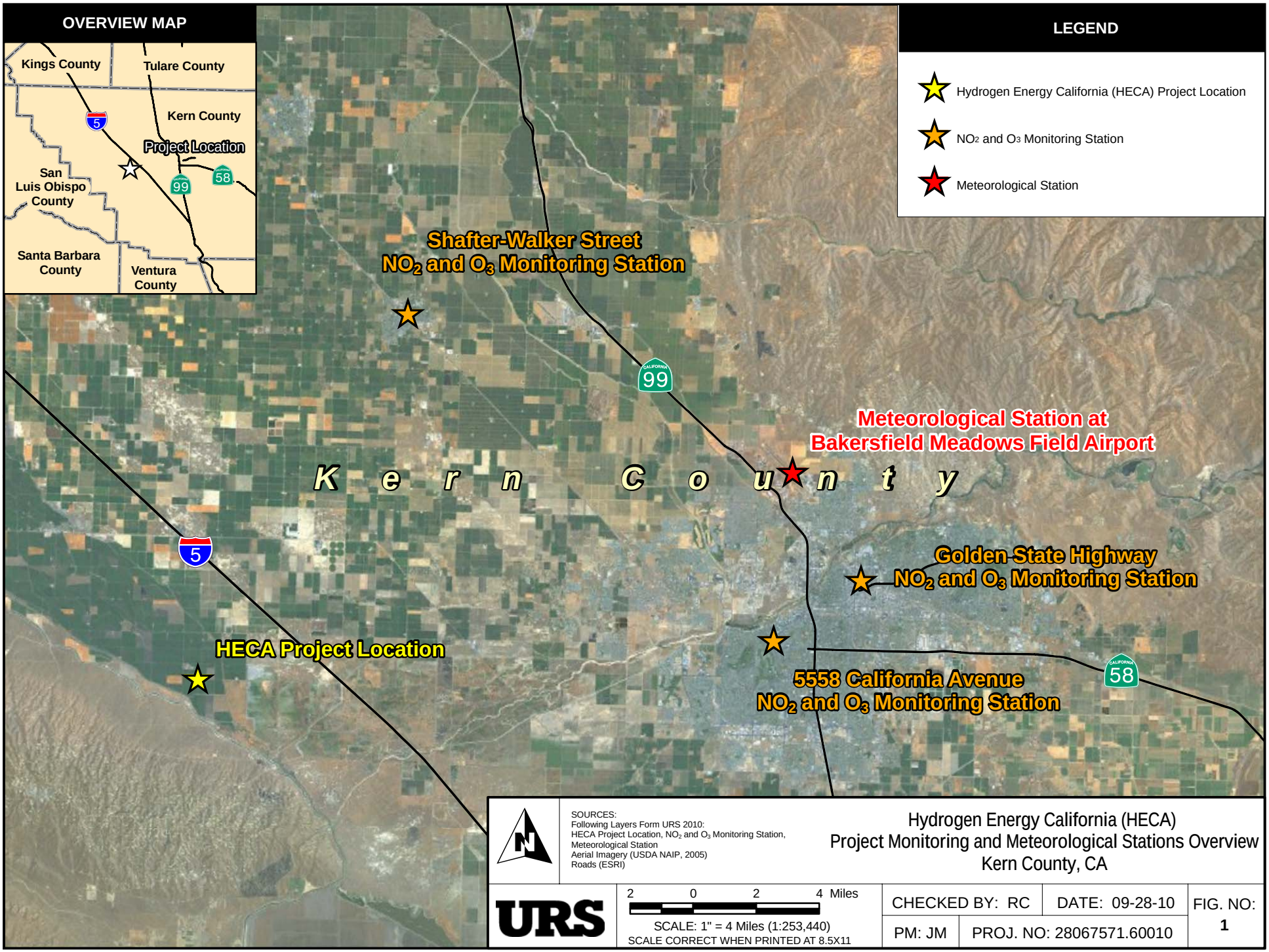
**Figures**

| | |
|---|---|
| Figure 1 | Hydrogen Energy California (HECA) Project Monitoring and Meteorological Stations Overview, Kern County, California |
| Figure 2 | Hydrogen Energy California (HECA) Project Location, and Site Plan and Meteorological Station at Bakersfield Meadows Field Airport, Kern County, California |
| Figure 3 | $NO_2$ and $O_3$ Monitoring Station, Shafter-Walker Street, Kern County, California |
| Figure 4 | $NO_2$ and $O_3$ Monitoring Station, 5558 California, Bakersfield, Kern County, California |
| Figure 5 | $NO_2$ and $O_3$ Monitoring Station, Golden State Highway, Bakersfield, Kern County, California |
| Figure 6 | Annual Wind Rose for Bakersfield Meadows Field Airport, Years 2004 – 2008. |

**Attachments**

| | |
|---|---|
| Attachment A | SJVAPCD, Assessment of Non-Regulatory Options in AERMOD Specifically OLM and PVMRM , Draft. September 16, 2010. |
| Attachment B | SJVAPCD, *Revised Table 1, Recommend In-stack $NO_2/NO_X$ Ratios*, Draft. Email from Glenn Reed to Julie Mitchell, August 24, 2010. |
| Attachment C | SJVAPCD, Permit Services Department. Villalvazo, Leland and Ester Davila. *Procedures for Downloading and Processing NCDC Meteorological Data.* May 2010. |

# FIGURES

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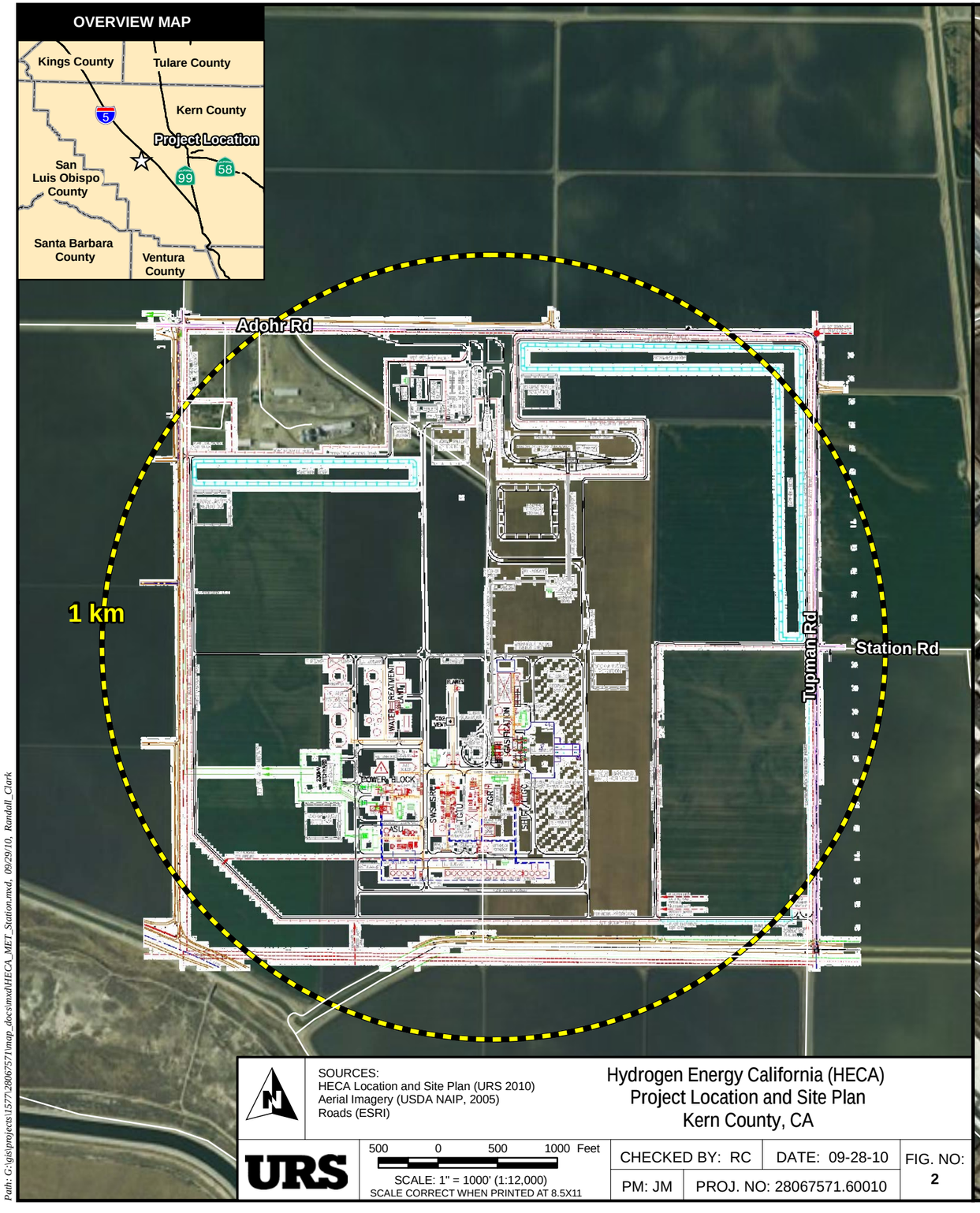


SOURCES:
HECA Location and Site Plan (URS 2010)
Aerial Imagery (USDA NAIP, 2005)
Roads (ESRI)

# Hydrogen Energy California (HECA)
# Project Location and Site Plan
# Kern County, CA

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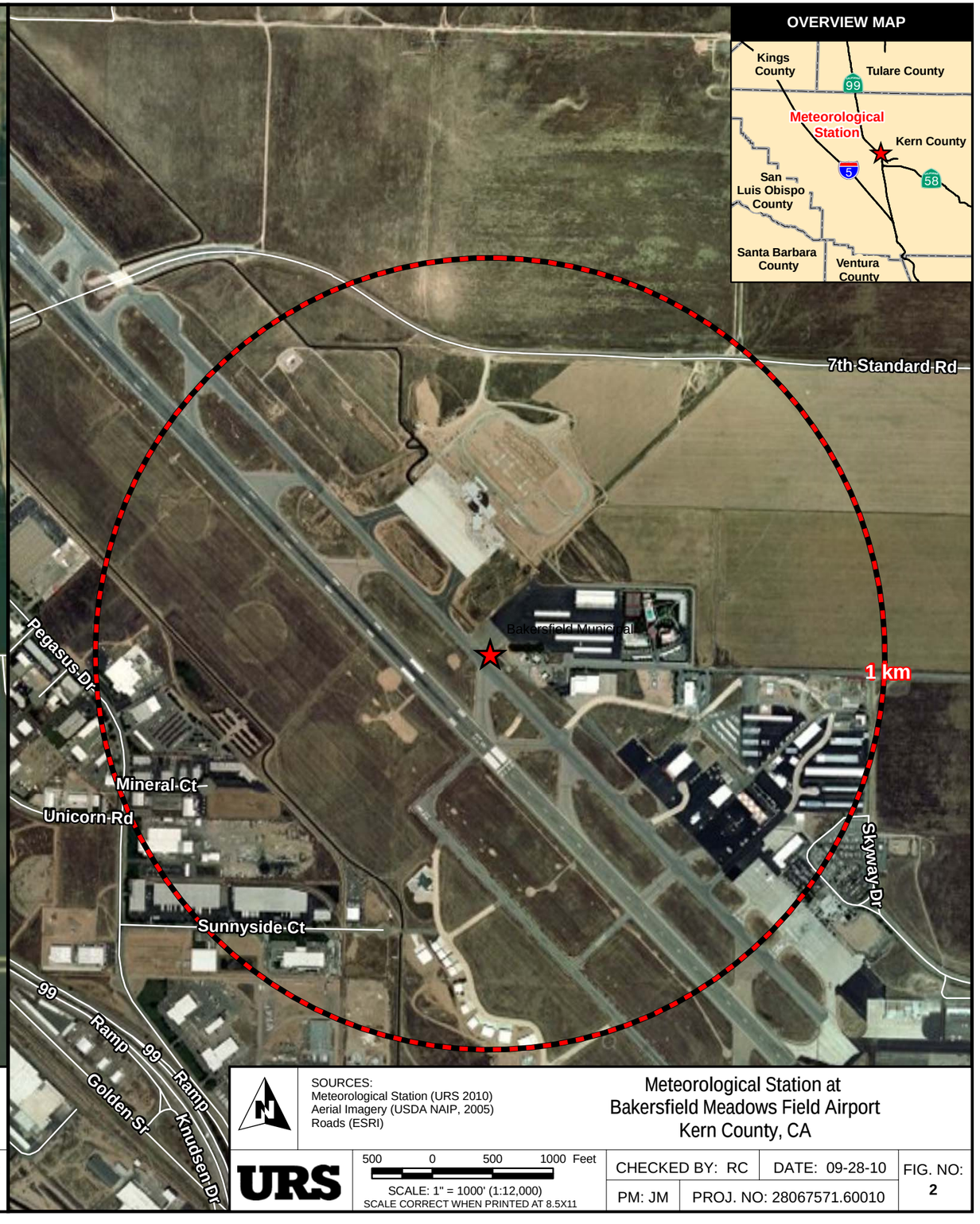


SOURCES:
Meteorological Station (URS 2010)
Aerial Imagery (USDA NAIP, 2005)
Roads (ESRI)

# Meteorological Station at
# Bakersfield Meadows Field Airport
# Kern County, CA

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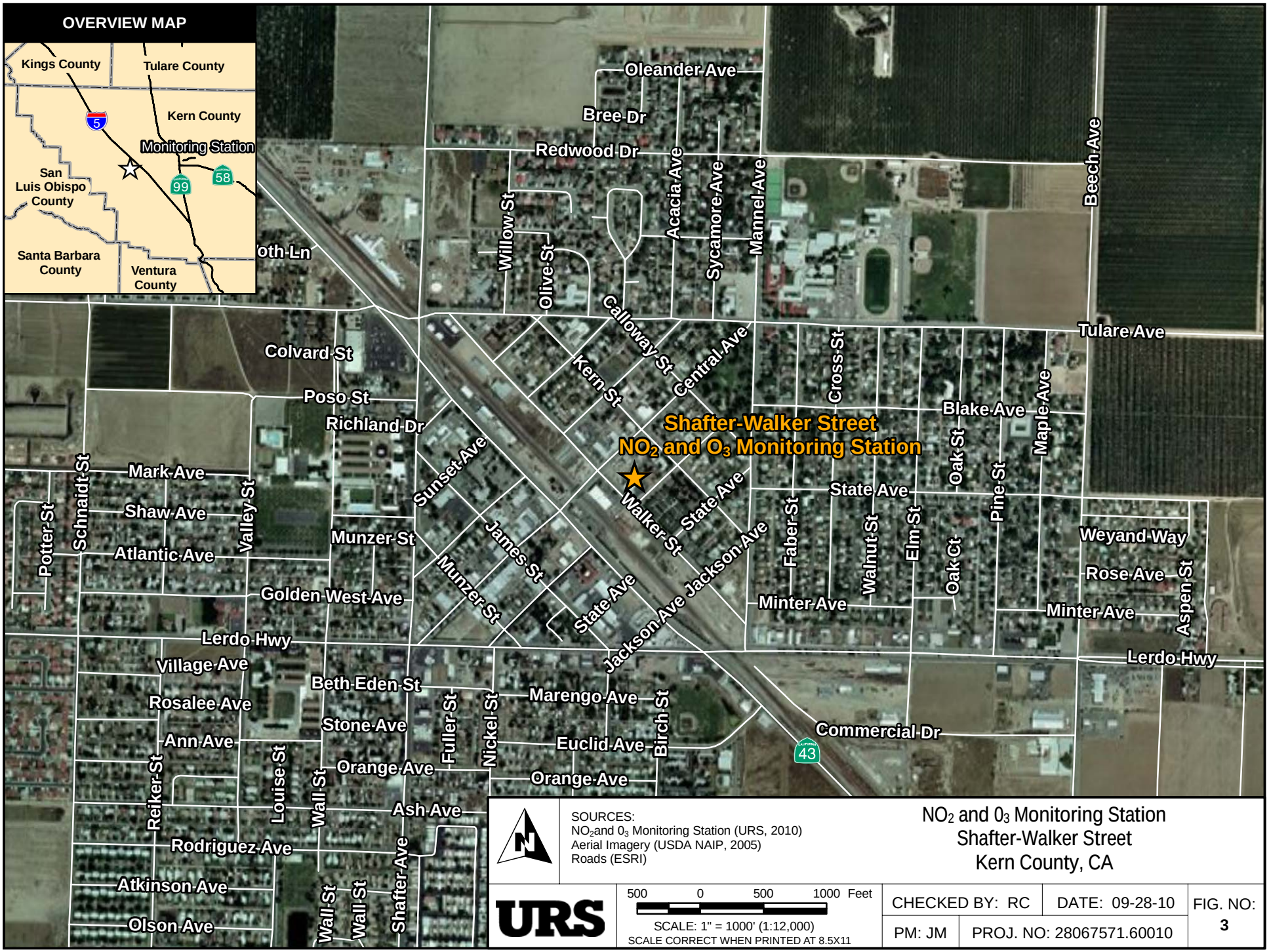


SOURCES:
$NO_2$and $0_3$ Monitoring Station (URS, 2010)
Aerial Imagery (USDA NAIP, 2005)
Roads (ESRI)

# $NO_2$ and $0_3$ Monitoring Station
# Shafter-Walker Street
# Kern County, CA

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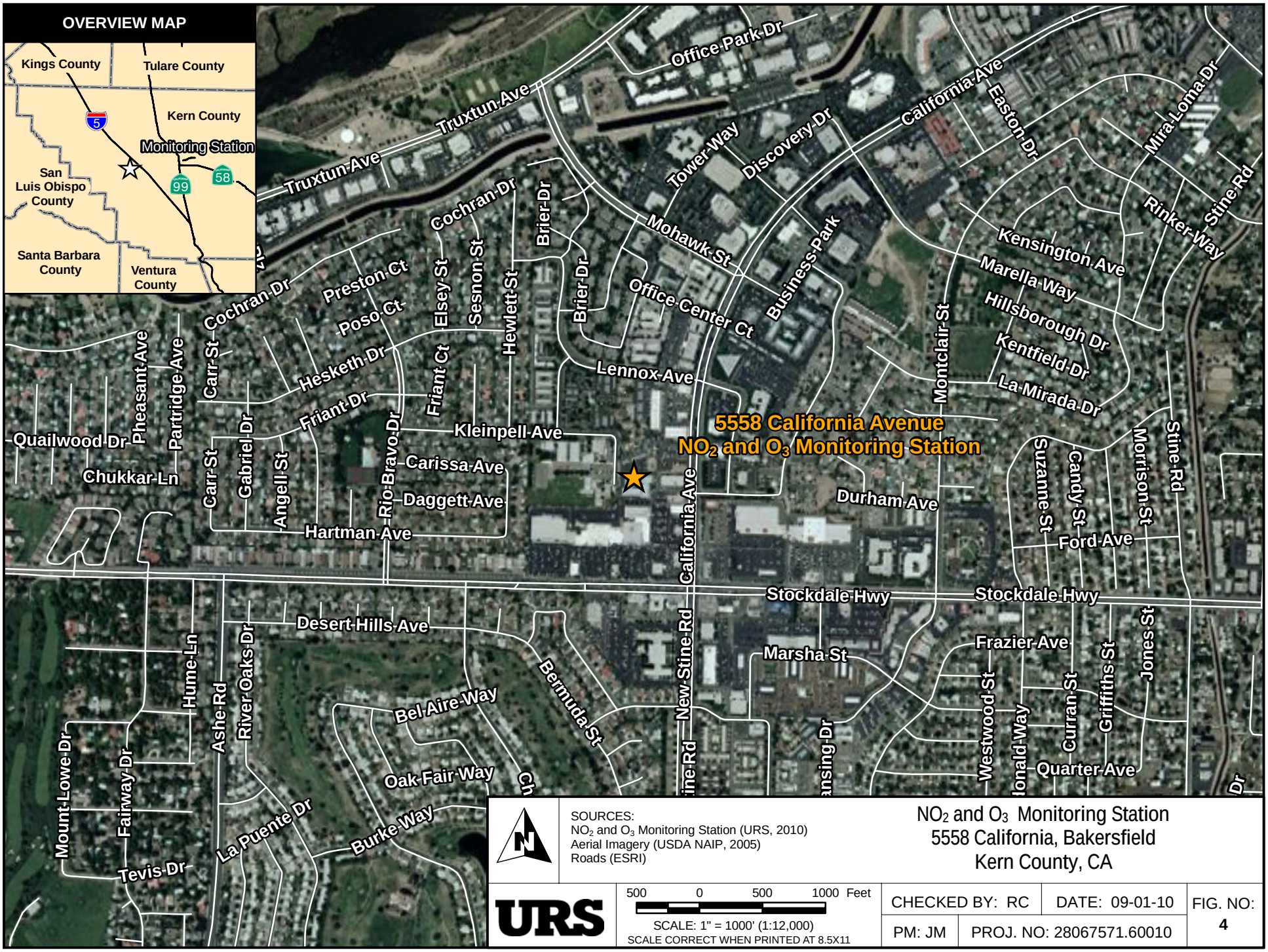


SOURCES:
$NO_2$ and $O_3$ Monitoring Station (URS, 2010)
Aerial Imagery (USDA NAIP, 2005)
Roads (ESRI)

# $NO_2$ and $O_3$ Monitoring Station
5558 California, Bakersfield
Kern County, CA

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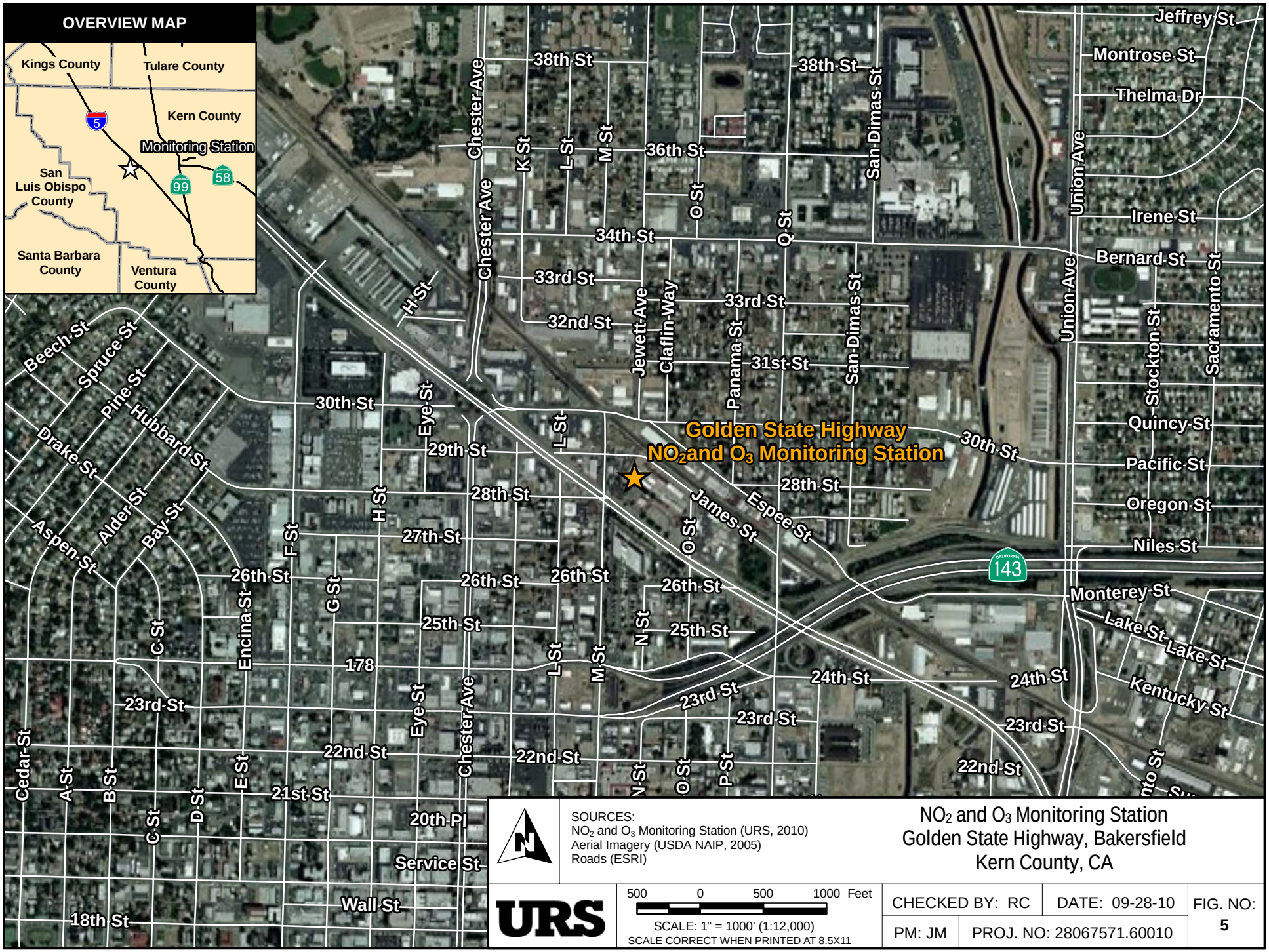



SOURCES:
$NO_2$ and $O_3$ Monitoring Station (URS, 2010)
Aerial Imagery (USDA NAIP, 2005)
Roads (ESRI)

# $NO_2$ and $O_3$ Monitoring Station
# Golden State Highway, Bakersfield
# Kern County, CA

URS

500 0 500 1000 Feet

SCALE: 1" = 1000' (1:12,000)
SCALE CORRECT WHEN PRINTED AT 8.5X11

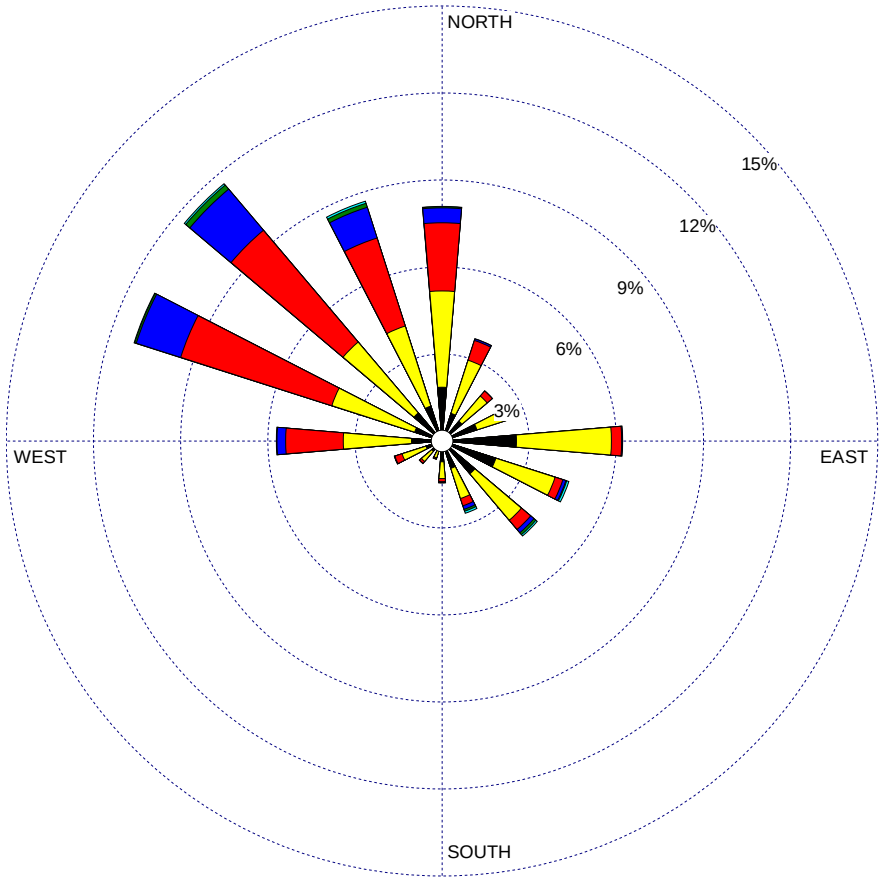
| CHECKED BY: RC | DATE: 09-28-10 | FIG. NO: 5 |
|---|---|---|
| PM: JM | PROJ. NO: 28067571.60010 | |

Path: G:\gis\projects\157728067571\map_docs\mxd\Golden_State_Hwy.mxd, 09/29/10, RandalI_Clark

**Figure 6**
**Annual Wind Rose for Bakersfield Meadows Field Airport, Years 2004-2008**

WIND ROSE PLOT:
**Station #23155**

DISPLAY:
**Wind Speed**
**Direction (blowing from)**




WIND SPEED
(m/s)

- >= 11.1
- 8.8 - 11.1
- 5.7 - 8.8
- 3.6 - 5.7
- 2.1 - 3.6
- 0.5 - 2.1

Calms: 23.82%

| COMMENTS: | DATA PERIOD: | COMPANY NAME: | |
|---|---|---|---|
| | **2004-2008**<br>**Jan 1 - Dec 31**<br>**00:00 - 23:00** | **URS Corporation** | |
| | | MODELER:<br>**LMB** | URS |
| | CALM WINDS:<br>**23.82%** | TOTAL COUNT:<br>**43367 hrs.** | |
| | AVG. WIND SPEED:<br>**2.77 m/s** | DATE:<br>**9/29/2010** | PROJECT NO.: |

WRPLOT View - Lakes Environmental Software

# ATTACHMENT A

# SJVAPCD, ASSESSMENT OF NON-REGULATORY OPTIONS IN AERMOD SPECIFICALLY OLM AND PVMRM , DRAFT

# SEPTEMBER 16, 2010

# Assessment of Non-Regulatory Options in AERMOD Specifically OLM and PVMRM

**Purpose:**
The purpose of this guidance document is to provide consistency between EPA and District modeling guidance. The District will implement this procedure to address issues indentified in the memoranda issued by EPA on June 28 and 29, 2010 concerning the implantation of the new federal 1-hour nitrogen dioxide ($NO_2$) National Ambient Air Quality Standard (NAAQS) and the use of non-regulatory options in the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD).

**Applicability:**
The following procedure applies when addressing District Permitting requirements. Projects intending to use the procedures outlined within this document as part of an application with another agency must seek approval from that agency prior to using them to determine compliance with the federal 1-hour $NO_2$ NAAQS.
.

**Background:**
In June of 2010, EPA issued two clarification memoranda concerning the implementation of the federal 1-Hour $NO_2$ standard as it relates to PSD permitting. These memoranda provided guidance on the use of AERMOD as it relates to modeling options and requirements for using alternative models/non-regulatory options.

In brief, the use of non-regulatory options in AERMOD, specifically the Ozone Limiting Method (OLM) and the Plume Volume Molar Ratio Method (PVMRM), would change the status of the model as stated in Section 3.1.2(c) of 40 CFR Part 51, Appendix W, "A preferred model should be operated with the options listed in Appendix A as ''Recommendations for Regulatory Use.'' If other options are exercised, the model is no longer ''preferred.'' Any other modification to a preferred model that would result in a change in the concentration estimates likewise alters its status as a preferred model. Use of the model must then be justified on a case-by-case basis".

In order for non-regulatory options to be used for regulatory purposes the following determination must be made as per section 3.2.2 (e) "… an alternative refined model may be used provided that:"

i. The model has received a scientific peer review;
ii. The model can be demonstrated to be applicable to the problem on a theoretical basis;
iii. The data bases which are necessary to perform the analysis are available and adequate;
iv. Appropriate performance evaluations of the model have shown that the model is not biased toward underestimates; and
v. A protocol on methods and procedures to be followed has been established."

**Non-Regulatory Option Determination:**
In order to streamline the process, the District will take the following approach when justifying the use of OLM/PVMRM for projects in the San Joaquin Valley; 1) an overall justification will be provided to address each of the five requirements listed in section 3.2.2 (e) and 2) each project will be required to complete a questionnaire intended to provide site specific information that would allow for a streamline determination of the appropriateness of the non-regulatory option(s) used (OLM/PVMRM) on a case-by-case basis, see Appendix B.

**Overall Justification:**
The following will address each of the five requirements noted in 3.2.2.(e) in order to justify the use of OLM/PVMRM for the purpose of determining compliance with the Federal 1-hour $NO_2$ standard.

**3.2.2 (e)(i)**:
The requirement of section 3.2.2 (e)(i) is: has the model received a scientific peer review? As noted in the memorandum from Taylor Fox on June 28, 2010; "Since AERMOD is the preferred model for dispersion for a wide range of application, the focus of the alternative model demonstration for use of the OLM/PVMRM options within AERMOD is on the treatment of NOx chemistry within the model, and does not need to address basic dispersion algorithms within AERMOD." Therefore the following will address the basic chemistry of each of the non-regulatory options.

**Basic OLM Chemistry**:
To provide some background, the following is a simplified explanation of the basic chemistry relevant to the OLM. First, the relatively high temperatures typical of most combustion sources promote the formation of $NO_2$ by the following thermal reaction:

$$2\ NO + O_2 \ ==>\ 2\ NO_2$$ In-stack formation of $NO_2$

OLM assumes a default 10% of the $NO_x$ in the exhaust is converted to $NO_2$ by this reaction, and no further conversion by this reaction occurs once the exhaust leaves the stack. **Please Note:** The District has compiled a list of $NO_2/NO_x$ ratios that can be used as default in-stack $NO_2/NO_x$ ratios until source test data become available, see Table 1. The remaining percentage of the $NO_x$ emissions is assumed to be nitric oxide (NO).

As the exhaust leaves the stack and mixes with the ambient air, the NO reacts with ambient ozone ($O_3$) to form $NO_2$ and molecular oxygen ($O_2$):

$$NO + O_3 \ ==>\ NO_2 + O_2$$ Oxidation of NO by ambient $O_3$

The OLM assumes that at any given receptor location, the amount of NO that is converted to $NO_2$ by this reaction is proportional to the ambient $O_3$ concentration. If the $O_3$ concentration is less than the NO concentration, the amount of $NO_2$ formed by this reaction is limited. If the $O_3$ concentration is greater than or equal to the NO concentration, all of the NO is assumed to be converted to $NO_2$.

In the presence of radiation from the sun, ambient $NO_2$ can be destroyed:

$NO_2$ + sunlight ==> NO + O  Photo-dissociation of $NO_2$

As a conservative assumption, the OLM ignores this reaction.

Another reaction that can form $NO_2$ in the atmosphere is the reaction of NO with reactive hydrocarbons (HC):

NO + HC ==> $NO_2$ + HC'  Oxidation of NO by reactive HC

The OLM also ignores this reaction. This may be a non-conservative assumption with respect to $NO_2$ formation in urban/industrial areas with relatively large amounts of reactive HC emissions.

**Basic PVMRM Chemistry:**
Building on the basic OLM chemistry, the PVMRM determines the conversion rate for $NO_x$ to $NO_2$ based on a calculation of the $NO_x$ moles emitted into the plume, and the amount of $O_3$ moles contained within the volume of the plume between the source and receptor. The dispersion algorithms in AERMOD and other steady-state plume models are based on the use of total dispersion coefficients, which are formulated to represent the time-averaged spread of the plume. A more appropriate definition of the volume of the plume for purposes of determining the ozone moles available for conversion of NOx is based on the instantaneous volume of the plume, which is represented by the use of relative dispersion coefficients, (Cole and Summerhays, 1979; Bange, 1991). The implementation of PVMRM in AERMOD is based on the use of relative dispersion coefficients to calculate the plume volume. Weil (1996 and 1998) has defined formulas for relative dispersion that are consistent with the AERMOD treatment of dispersion, and which can be calculated using meteorological parameters available within AERMOD.

The chemistry for both models has been peer-reviewed as noted by the documents posted on EPA's Support Center for Regulatory Air Modeling (SCRAM) web site entitled "Sensitivity Analysis Of PVMRM And OLM In AERMOD" and "Evaluation Of Bias In AERMOD-PVMRM". Both documents indicate that the models appear to perform as expected.

**3.2.2 (e)(ii):**
The requirement of 3.2.2 (e)(ii) is: can the model (OLM or PVMRM) be demonstrated to be applicable to the problem on a theoretical basis. As noted in the document entitled "Sensitivity Analysis of PVMRM and OLM In AERMOD" prepared by Roger W. Brode of MACTEC Federal Programs, Inc., (Now with EPA's Office of Air Quality Planning and Standards or OAQPS) "This report presents results of a sensitivity

analysis of the PVMRM and OLM options for $NO_x$ to $NO_2$ conversion in the AERMOD dispersion model. Several single source scenarios were examined as well as a multiple-source scenario. The average conversion ratios of $NO_2/NO_x$ for the PVMRM option tend to be lower than for the OLM option and for the Tier 2 option or the Ambient Ratio Method which has a default value of0.75 for the annual average. The sensitivity of the PVMRM and OLM options to emission rate, source parameters and modeling options appear to be reasonable and are as expected based on the formulations of the two methods. For a given $NO_x$ emission rate and ambient ozone concentration, the $NO_2/NO_x$ conversion ratio for PVMRM is primarily controlled by the volume of the plume, whereas the conversion ratio for OLM is primarily controlled by the ground-level $NO_x$ concentration.

Overall the PVMRM option appears to provide a more realistic treatment of the conversion of $NO_x$ to $NO_2$ as a function of distance downwind from the source than OLM or the other $NO_2$ screening options (Hanrahan, 1999a; Hanrahan, 1999b). No anomalous behavior of the PVMRM or OLM options was identified as a result of these sensitivity tests."

Based on this report for both OLM/PVMRM it appears to be applicable to the problem of $NO_2$ formation and as noted by the author provides a better estimation of the $NO_2$ impacts compared to other screening options.

**3.2.2 (e)(iii):**
The requirement of 3.2.2 (e)(iii) is: the data bases which are necessary to perform the analysis are available and adequate. The data needed to conduct an OLM/PVMRM run are 1) hourly meteorological data, 2) hourly ozone data, and 3) In-stack $NO_2/NO_x$ ratio.

Both meteorological and ozone data sets must be processed into AERMOD ready formats. The District will preprocess both the meteorological and ozone data following applicable EPA guidance. The District maintains metrological data (AERMOD ready) for ten National Weather Service and five MM-5 sites in the valley. Additionally the District maintains ozone data (AERMOD ready) for ~21 monitoring sites in the eight counties of the valley.

Currently, limited information is available on In-stack $NO_2/NO_x$ ratios nation-wide. A literature search of available data revealed In-stack $NO_2/NO_x$ ratios for a limited number of sources, see Appendix C. If a source is not listed, the source type that best represents the source under review will be used. In addition the District will start collecting In-stack $NO_2/NO_x$ data that is obtained during annual source testing, if available. These data will be compiled, and new In-stack $NO_2/NO_x$ ratios and source categories will be developed.

**3.2.2 (e)(iv):**
The requirement of 3.2.2 (e)(iv) is: has an appropriate performance evaluations of the model (OLM/PVMRM) shown that the model is not

biased toward underestimates? As noted in the document entitled "Evaluation Of Bias In AERMOD-PVMRM" prepared by Roger W. Brode of MACTEC Federal Programs, Inc.,(Now with EPA OAQPS) "This report presents results of an analysis of evaluation results to determine whether the AERMOD-PVMRM algorithm produces biased or unbiased estimates of the $NO_2/NO_x$ ratio. Evaluation results from two aircraft studies and two long-term field studies were examined, as well as comparisons between AERMOD-PVMRM and other refined chemically reactive plume models. Comparisons between predicted and observed $NO_2/NO_x$ ratios were based on results paired in time and space, providing a more rigorous assessment than is commonly used in evaluating the performance of air dispersion models. While there does not appear to be a clear and objective criterion established by EPA for determining whether a model is biased or unbiased, a general "rule of thumb" that is commonly used as a benchmark in judging the performance of air dispersion models is agreement with observations within a factor of two.

…In all cases, the average ratio between predicted and observed $NO_2/NO_x$ ratios showed agreement within a factor of two, and in most cases within about a factor of 1.5. Based on all of the data available, the AERMOD-PVMRM algorithm is judged to provide unbiased estimates of the $NO_2/NO_x$ ratio based on criteria that are comparable to, or more rigorous than, evaluations performed for other dispersion models that are judged to be refined, implying unbiased performance."

As noted in the above report it has been determined that PVMRM has been judged to provide unbiased estimates based on criteria that are comparable to, or more rigorous than, evaluations performed for other dispersion models.

At the present time no assessment of bias has been conducted for the OLM model. It has been shown in the sensitivity analysis, see discussion on item 3.2.2 (e)(ii) above, that OLM provides similar more conservative results than PVMRM. Therefore is it assumed that OLM would also provide an unbiased estimate of concentration.

**3.2.2 (e)(v):**
The requirement of 3.2.2 (e)(iv) is: has a protocol on methods and procedures to be followed been established. The methods and procedures outlined in Appendix A which is entitled "Modeling Procedures" will be implemented to comply with this requirement.

**Conclusion:**
Based on the information provided above, the District has determined that the method for determining hourly $NO_2$ concentrations using AERMOD in conjunction with the non-regulatory OLM or PVMRM options is acceptable based on the requirements in 40 CFR Part 51, Appendix W, 3.2.2(e), see below.

3.2.2 (e)(i). The model has received a scientific peer review;

- The chemistry for both models have received scientific peer review as noted in “Sensitivity Analysis of PVMRM and OLM in AERMOD” and “Evaluation of Bias in AERMOD-PVMRM”. Both documents indicate that the models appear to perform as expected

3.2.2 (e)(ii). The model can be demonstrated to be applicable to the problem on a theoretical basis;

- Both models have been reviewed and the chemistry has been widely accepted by EPA and other government agencies as being appropriate for addressing the formation of $NO_2$ and the calculation of $NO_2$ concentration at receptors downwind. Additionally, the ““Sensitivity Analysis of PVMRM and OLM in AERMOD” report would indicate OLM/PVMRM provides a better estimation of the $NO_2$ impacts compared to other screening options.

3.2.2 (e)(iii). The data bases which are necessary to perform the analysis are available and adequate;

- The District will process both the meteorological and Ozone data using applicable guidance and procedure. Additionally, the District will continue to gather/develop $NO_2$ ratios as needed.

3.2.2 (e)(iv). Appropriate performance evaluations of the model have shown that the model is not biased toward underestimates;

- As noted the “Evaluation of Bias In AERMOD-PVMRM” report, PVMRM has been judged to provide an unbiased estimate. Based on the sensitivity study, OLM was estimated to provide similar or more conservative estimates of concentration than PVMRM and therefore would also be judged to be unbiased to underestimation.

3.2.2 (e)(v). A protocol on methods and procedures to be followed has been established.”

- The methods and procedures for conducting an assessment for determining compliance with the federal 1-hour NAAQS are contained in Append A of this document.

# Appendix A
# Modeling Protocol

**Modeling Protocol for Determination of Compliance with the One-Hour Nitrogen Dioxide National Ambient Air Quality Standards**

This modeling protocol is meant to define the stepwise approach necessary to satisfy the requirements in *General Guidance for Implementing the 1-Hour $NO_2$ National Ambient Air Quality Standard in Prevention of Significant Deterioration Permits, Including an Interim $NO_2$ Significant Impact Level*[1] and the *Applicability of Appendix W Modeling Guidance for 1-Hour NO2 National Ambient Air Quality Standard*[2]. Nothing in this protocol should be taken as overriding guidance contained in those two memoranda, or Appendix W of Part 51 of Title 40 of the *Code of Federal Regulations* (40 CFR 51, Appendix W).

The San Joaquin Valley Air Pollution Control District is not currently classified as to its attainment with regard to the new standard. The U.S. Environmental Protection Agency (EPA) will designate attainment/nonattainment areas by January 2012. It is anticipated based upon current air quality design values in the District that the District will be classified as "unclassifiable". Therefore, any new major sources (i.e., with emissions equal to or greater than 250 tons per year or 100 tons per year for certain classes of sources) or major modifications to major sources will be subject to permitting under the Prevention of Significant Deterioration (PSD). Minor sources or minor modifications will continue to be subject to the air quality modeling requirements in Section 4.14 of Rule 2201. In accordance with the requirements of Section 4.14 of Rule 2201, all demonstrations that new sources or modifications will not cause or contribute to the violation of the 1-hour $NO_2$ National Ambient Air Quality Standard (NAAQS) shall use this protocol.

## Project Description

An AERMOD Non-Regulatory Option Checklist shall be completed for each project even if the ozone limiting method (OLM) or plume volume molar ratio method (PVMRM) is not used. Specific information to be provided includes the Facility Information, Project Information, Modeling Information, and Final Results. There is no need to obtain approval from a Supervisor if the ambient ratio method (ARM), OLM or PVMRM are not used. Source Parameters for all sources modeled must also be provided with the Checklist. (See Appendix B.) If the ARM is used, provide the ratio used.

## Model Selection Discussion and Rationale

The latest version of the American Meteorological Society/Environmental Protection Agency Regulatory Model or AERMOD should be used for all $NO_2$ modeling. Use of an

[1] *General Guidance for Implementing the 1-Hour $NO_2$ National Ambient Air Quality Standard in Prevention of Significant Deterioration Permits, Including an Interim $NO_2$ Significant Impact Level,* Anna Marie Wood, Acting Director, Air Quality Policy Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC, June 28, 2010.

[2] *Applicability of Appendix W Modeling Guidance for 1-Hour NO2 National Ambient Air Quality Standard,* Tyler Fox, Leader, Air Quality Modeling Group, Air Quality Assessment Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC, June 28, 2010.

alternative model will require an evaluation as defined in Appendix W. Note that AERMOD is no longer a preferred model if the ambient ratio method (ARM), OLM or PVMRM are used. The use of any of these methods must be justified in accordance with the *Applicability of Appendix W Modeling Guidance for 1-Hour NO2 National Ambient Air Quality Standard.*

**Model Control Option Selection**

A tiered approach must be taken for the analysis. The following tiers will be used:

- **Tier I:** In Tier I, the maximum predicted 1-hour concentration from all sources in the project modeling 5-years of meteorological data is added to the representative background concentration for a comparison with the 1-hour $NO_2$ NAAQS. The following stepwise approach will be used:

    1. The actual emissions for each scenario (e.g., normal, commissioning, emergency, or standby) and source will be modeled using the regulatory options in AERMOD. It will be assumed in this step that all NO is completely converted to $NO_2$. Nothing further need be done if this analysis indicates that the NAAQS will not be exceeded.
    2. The maximum 1-hour contribution from all the sources included in the project (but not any background sources that may be modeled) will be compared to the interim Significant Impact Level (SIL) of 4 ppb if there is a prediction that the NAAQS will be exceeded. If the highest 1-hour maximum concentration predicted by modeling the emissions from all project sources and scenarios using 5-years of meteorological data is less than the SIL, nothing further need be done.
    3. The first and second steps will be duplicated using the ARM. Based on an analysis of $NO/NO_2$ data in the District, a default ratio of 0.9 will be used for the ARM.
    4. OLM or PVMRM will be used to implement the first two steps. Note that the use of ARM, OLM, or PVMRM must be justified using the procedures in *Applicability of Appendix W Modeling Guidance for 1-Hour NO2 National Ambient Air Quality Standard* and approved by a District supervisor. To document such approval, the AERMOD Non-Regulatory Option Checklist will be completed. For OLM, the OLMGROUP ALL option will be used if there are multiple sources in the project. The default $NO_2/NO_X$ ratio will be the appropriate ratio developed by the District for the type of source modeled. (See Appendix C.) If there are multiple types of sources, the appropriate $NO_2/NO_X$ ratio will be used in the SOURCE pathway of the model. The default ozone concentration will be 40 ppb. If Version 09292 of the model is used with the PVMRM option, variable emission rates must not be modeled. The $NO_2/NO_X$ ambient equilibrium ratio for PVMRM will be 0.90.

- **Tier II:** For Tier II, the same procedure as outlined above for Tier I will be used except that the 8$^{th}$ highest 1-hour maximum concentration predicted will be used.

- **Tier III:** The 98$^{th}$ percentile 1-hour predicted concentration will be determined using the post-processor developed by the District, third-party software

developers, or a revised version of the model itself. This value will be used in the same stepwise approach as identified for Tier I.

- **Tier IV:** The predicted concentrations from the model will be paired in time with the monitored $NO_2$ concentrations. The same approach as identified above for Tier III is used to calculate a value to compare with the standard.

(Specific directions for use of the District's post-processor program are given in the users' guide. Third-party software developers or EPA must be consulted to obtain the appropriate guidance for use of other post-processors or versions of the model.)

**Model Emission Inventory**

For sources modeled to determine compliance with the 1-hour $NO_2$ NAAQS, the maximum 1-hour emission rates must be used. Table 8-2 in Appendix W provides specific guidance for calculating specific emission rates. The following is an extract from Table 8-2:

| Emission Limit (lbs/MMBtu) | X | Operating Level (MMBtu/hr) | X | Operating Factor (e.g., hr/yr, hr/day) |
|---|---|---|---|---|
| *Proposed New or Modified Source* | | | | |
| Maximum allowable emission limit or enforceable permit limit | | Design capacity or enforceable permit condition | | Continuous operation (i.e., all hours of each time period under consideration) for all hours of the meteorological data base |
| *Nearby Source(s)* | | | | |
| Maximum allowable emission limit or enforceable permit limit | | Actual or design capacity (whichever is greater) or enforceable permit condition | | Continuous operation (i.e., all hours of each time period under consideration) for all hours of the meteorological data base |
| *Other Source(s)* | | | | |
| Maximum allowable emission limit or enforceable permit limit | | Annual level when actually operating averaged over the most recent 2 years | | Continuous operation (i.e., all hours of each time period under consideration) for all hours of the meteorological data base |

**Model Scenarios**

Note that multiple scenarios may need to be run. For example, scenarios should include emissions and operating conditions for 100 percent operation, 75 percent, and 50 percent. For some sources, emissions and operating conditions during commissioning or startup or shutdown may be important as well.

**Other Non-Project Sources**

The analysis may include sources in addition to those that are part of the project. In accordance with Appendix W, "all sources expected to cause a significant concentration

gradient in the vicinity of the source or sources under consideration for emission limit(s) should be explicitly modeled." Professional judgment should be used to identify non-project sources to include in the analysis. The following are some examples:

1. A source with a short-stack subject to downwash is located in an area where there are a number of other sources with short stacks subject to downwash. Unless there is another source within 100-meters, this source could be modeled alone.
2. A source with a relatively tall stack not subject to downwash is located in an area where there are other sources. The impact area (i.e., the area in which the source will have an impact equal to the SIL) should be determined. Other sources that are within that impact area should be included in the analysis. Consideration of Appendix W's guidance regarding the concentration gradient should be given to selecting sources to model.

**Background Concentration**

All ambient air quality analyses that are intended to determine the total pollutant concentration for comparison with the standard will include explicit modeling of the project sources and other non-project sources as discussed above. In addition, a background concentration must be included that represents the contribution from sources that are not modeled.

The most recent air quality design value (i.e., the three-year average of the 98$^{th}$ percentile of the daily maximum 1-hour concentrations) of a representative monitoring site should be used for the background concentration. The representativeness of the monitoring site will depend upon the following factors:

1. Proximity to the source(s) modeled. In general, the nearest monitoring site is preferable.
2. Similarity of surrounding source(s). Sources in the vicinity of the monitor should be similar to those near the source(s) modeled.
3. Conservativeness of the background concentrations. The intent of any analysis is to ensure that it is "conservative" (i.e., ambient concentrations are overestimated). Thus, an effort should be made to select a background monitoring site where the measured concentrations are equal to or greater than those that would be measured were a monitor to be located in the vicinity of the source(s) to be modeled.

Another issue that must be considered is the contribution by sources in the vicinity of the background monitor to concentrations at the monitor. Because many of the District's existing monitors are located in urban and suburban areas, numerous small sources in the vicinity of the monitor may be contributing to the concentrations measured at the monitor. The analysis of a source that is located in a similar area would not need to include additional sources. But, the analysis of a source located in a remote area using background data from a monitor that is not affected by sources surrounding it may need to include additional sources to ensure that proper consideration is given.

Selection of the background monitoring site and the factors that led to its selection should be documented.

**Downwash Characterization**

Care should be exercised to ensure that downwash is properly considered. When there is reason to believe that inclusion of downwash in the analysis will result in a higher estimate of pollutant concentrations, downwash should be included. Otherwise, the analysis can proceed without downwash.

**Receptor Selection**

Receptors should be selected to ensure that the maximum concentration is predicted. It may be necessary to model a nested refined grid if the original coarser grid does not identify the maximum concentration.

**Meteorological Data**

The District has processed data for all National Weather Service (NWS) sites in the Valley for which data are available. These include Bakersfield, Fresno, Hanford, Lemoore, Madera, Merced, Modesto, Porterville, Visalia, and Stockton. Five-years of data are available for most of these sites. Data availability for these sites will expand in the future as additional years of data are processed. In addition, the District has purchased and processed data from the MM5 meteorological model for 5 sites: Fellows, Los Banos, Missouri Triangle, Tracy, and Turk. These data can be used for any analysis that is not being performed to comply with PSD requirements. The meteorological data used in an analysis should be representative of the area in which the source(s) is located. To determine representativeness, consideration should be given to the land uses in the vicinity of the meteorological site versus that near the source(s). For example, it may be appropriate to use Madera or Hanford data rather than data from the Fresno airport to model a source that is located near Fresno but is in the rural area of Fresno County. Written justification for the choice of a meteorological data set should be provided on the checklist.

**Post-Processing of the Results**

As discussed above, some analytical tiers may require the use of a post-processor. The District has developed a post-processor for use with Version 09292 of AERMOD. To use this post-processor, formatted post files must be output by the model. This post-processor will calculate the 5-year average 98$^{th}$ percentile concentration. It will also perform the paired-sums calculations for Tier IV. Third-party software companies have developed post-processors to calculate the 5-year average 98$^{th}$ percentile concentrations. Future versions of the model are expected to include the calculation of a 5-year 98$^{th}$ percentile concentration internally.

**Documentation of the Results**

The District's documentation of ambient air quality analyses will include the standard memorandum from the specialist to the engineer that requested the analysis, this

protocol, the completed AERMOD Non-Regulatory Option Checklist, and the justification for the use of ARM, OLM, or PVMRM.

# Appendix B
## Checklist

# AERMOD Non-Regulatory Option Checklist (ARM / OLM / PVMRM)

| Approved | **Site Specific Parameters**<br>Items that are required for a Case – By – Case determination are noted with an * | |
|---|---|---|
| | **Facility Information** | |
| | Permit ID | |
| | Name | |
| | Address | |
| | City / State | |
| Comments | | |
| | **Project Information** | |
| | Project ID | |
| | Unit ID / Mod (s) | |
| | Description | |
| Comments | | |
| | **Modeling Information*** | |
| | Model | EPA AERMOD Version (**XXXXX)** |
| | Operating Scenario | Normal or Commissioning or Emergency or Standby |
| | Met Data | |
| | Site Name | |
| | Years | Start: End: |
| | Type | NWS or MM5 |
| | Terrain | Flat or Elevated: |
| | Site Location | Zone: UTME: UTMN: |
| | Ozone Limiting | ARM or OLM or PVMRM |
| | Source Parameter | See Tables Below |
| | Background Site | |
| | Name | |
| | Location | Zone: UTME: UTMN: |
| | Years | Start: End: |
| | Location Type | Urban or Rural |
| | Distance From Project (km) | |
| Comments | | |
| | **Final Results*** | |
| | Averaging Period / Concentration (Background + Model) | SIL:<br>Local Hour ARM: 0.9<br>Tier I – Maximum 1-hour :<br>Tier II – 8$^{th}$ Highest :<br>Tier III – 98$^{th}$ Percentile :<br>Tier IV – Paired Sum : |
| Comments | | |
| | **Conclusion***<br>It has been determined that enough information has been provided to conclude that OLM or PVMRM are appropriate for the above modeling scenario. | |

| | | |
|---|---|---|
| | Supervisor Name | |
| | Supervisor Signature | |
| Comments | | |

**Source Parameter:**

Each different source that is modeled should have a separate table.

| Source Parameters For Unit 1-0 or Unit 1-0,2-0 | | | |
|---|---|---|---|
| **Source Type** | Point | **Location Type** | Urban / Rural |
| **Stack Height (m)** | | **Max Hours per Year** | |
| **Stack Diameter. (m)** | | **Fuel Type** | |
| **Stack Exit Velocity (m/s)** | | **$NO_2$ / $NO_x$ Ratio (%)** | / |
| **Stack Exit Temp. (°K)** | | | |
| **Rating (MMBtu/hr)** | | | |

# Appendix C
## In-Stack $NO_2/NO_x$ ratios

| Table 1<br>Recommend In-stack NO2/NOx Ratios | | |
|---|---|---|
| Emission Source | Range of $NO_2$/NOx Ratios (%) | Recommended $NO_2$/NOx Ratio (%) |
| Boilers (NG) | 10 | 10 |
| Compressors / Turbines (NG) | 3-6 | 6 |
| Glass Furnace | 2.45 – 11.59* | 4.32** |
| IC Engines (Diesel) | 20 | 20 |
| IC Engine (Lean Burn NG) | 5-10 | 10 |
| Truck / Cars | 3-6 | 6 |

*Data is based on CEMs, source test, and portable analyzer data collected in the San Joaquin Valley.
**Value represents the statistical average of all data points

# ATTACHMENT B

## SJVAPCD, REVISED TABLE 1, RECOMMEND IN-STACK $NO_2/NO_X$ RATIOS, DRAFT EMAIL FROM GLENN REED TO JULIE MITCHELL

## AUGUST 24, 2010

Table 1
Recommend In-stack NO2/NOx Ratios

| Refer # | Equipment Category (Controls) | Range of $NO_2$/NOx Ratios (%) | Recommended $NO_2$/NOx Ratio (%) |
|---|---|---|---|
| | Boilers - NG | | |
| 1 | Default | 10 | 10 |
| 2 | 7.6 MMBtu/Hr (SCR / FGR)* | 3.45 – 15.79 | 9.65** |
| 3 | Turbines - NG | 8.33 – 9.1 | 9.1 |
| 1 | Compressors - NG | 60 | 60 |
| 2 | Glass Furnace | 2.45 – 11.59 | 4.32** |
| 1 | IC Engines - Diesel | 20 | 20 |
| | IC Engine - NG | | |
| 4 | Lean Burn | 5-10 | 10 |
| 2 | 2,775 BHP (SCR)* | 14.53 – 26.33 | 19.46** |
| 2 | 4,175 BHP (SCR,CO & VOC CATALYSTS)* | 0.0 – 21.28 | 1.15** |
| 5 | Transportation Refrigeration Units (TRUs)<br><br>CARB= CARB Diesel<br>GTL = Gas To Liquid | | |
| 6 | Truck / Cars | | |
| | Light / Medium Duty (Gas/Diesel) | 16-25 | 25 |
| | Heavy Duty | 6-11 | 11 |

| Fuel | Eng Speed | Exhaust | $NO_2$/ $NO_x$ Ratio |
|---|---|---|---|
| CARB | High | Muffler | 15.37 |
| GTL | High | Muffler | 16.17 |
| CARB | High | pDPF | 25.71 |
| CARB | Low | Muffler | 22.66 |
| GTL | Low | Muffler | 25.12 |
| CARB | Low | pDPF | 12.98 |

* Samples taken each minute or several minutes
**Value represents the statistical average of all data points

**References**


1. Barrie Lawrence, Environmental Scientist, Government of Newfoundland and Labrador, "Guideline for Plume Dispersion Modeling" 1st Revision: November 20, 2006, Page 14
2. District Database "NO2 -NOx Ratio.mdb" - Data is based on CEMs, source test, and portable analyzer data collected in the San Joaquin Valley
3. Roointon Pavri and Gerald D. Moore, GE Energy Services Atlanta, GA, "Gas Turbine Emissions and Control" March 2001 Page 63
4. Nigel N. Clark, Center for Alternative Fuels, Engines and Emissions Department of Mechanical and Aerospace Engineering West Virginia University Morgantown, WV 26506, "Selective NOx Recirculation for Stationary Lean-Burn Natural Gas Engines" April 30, 2007 Page 64
5. Robb A. Barnitt, National Renewable Energy Laboratory, "Emissions of Transport Refrigeration Units with CARB Diesel, Gas-to-Liquid Diesel, and Emissions Control Devices", May 1, 2010
6. P G Boulter, I S McCrae, and J Green, Transportation research Laboratory, "Primary NIO2 Emissions From Road Vehicles in the Hatfield and Bell Commons Tunnels", July 2007

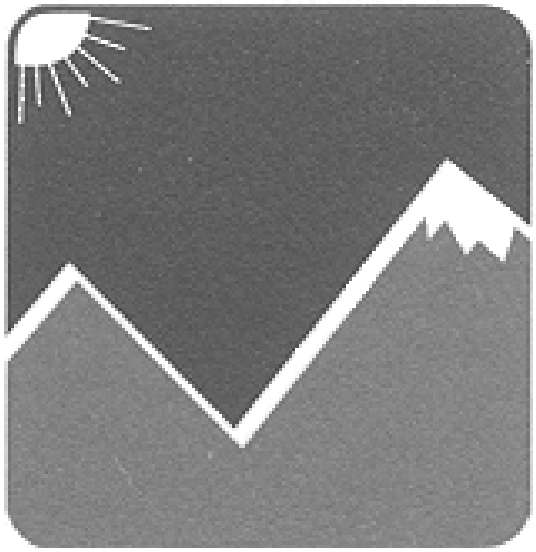
# ATTACHMENT C

**SJVAPCD, PERMIT SERVICES DEPARTMENT.**
**VILLALVAZO, LELAND AND ESTER DAVILA**

# PROCEDURES FOR DOWNLOADING AND PROCESSING NCDC METEOROLOGICAL DATA

**MAY 2010**

# Procedures for Downloading and Processing NCDC Meteorological Data



Prepared by
San Joaquin Valley APCD
Permit Services Department

Leland Villalvazo, Supervising AQS
Ester Davila, Supervising AQS

# *NCDC General Statement:*

Due to various Federal Laws and Regulations, NOAA National Climatic Data Centers (NCDC) is required to charge for some of its online data to recover the cost of data dissemination. This includes hardware and personnel costs incurred by each Data Center. Charges are required for most domains (e.g., .com, .org, .net). All online data are now free for all .gov, .edu, .k12, .mil, .us, and a few other specific domains. Please see NNDC's Free Data Distribution Statement (**http://www.ncdc.noaa.gov/oa/nndc/freedata.pdf)** (PDF Format) for further information on our FREE data policy. For information on how free access is granted via our web systems, please visit the Free Access (***http://www.ncdc.noaa.gov/oa/about/ncdchelp.html#FREE***) section of the NCDC help page (***http://www.ncdc.noaa.gov/oa/about/ncdchelp.html***)

Questions/Comments can be directed to: nndc.webmaster@noaa.gov

## *Introduction:*

The following procedures are designed in a cookbook fashion to provide the user a step by step approach to downloading and processing local meteorological data. We hope that this approach will allow large and small Districts the ability to generate their own AERMOD data without the cost of hiring a third party. Or if a third party is hired, we hope that this approach will provide enough information to understand the steps that may be taken to process the raw data collected at the met tower(s) into the final met data used in AERMOD.

## *Where to Start:*

The user needs to determine if their organization has FREE access rights to the online NCDC data. The user should go to the following website **Listing of REMOTE Environment Variables** (http://www.ncdc.noaa.gov/whoami/whoami) to determine if the user has one of the acceptable extensions (gov, edu, k12, mil, and us). The user should see his/her *Host Name* and the extension that has been determined.


If the *Host Name* does not have one of the acceptable extensions the user has two options 1) Contact their IT department for assistance or 2) email nndc.webmaster@noaa.gov and explain in the email 1) that you work for an APCD or AQMD in California, 2) that your IP does not have one of the acceptable extensions, 3) what the data is going to be used for (Regulatory Dispersion Modeling with AERMOD), 4) Your contact information, and 5) Request an account or other means that can be used to download the data for free. If NCDC accepts your explanation they will issue a user name and password that can be used to access the online NCDC data.

## *I have Access, Now What?*

Now that you have access to the NCDC's data you will need to follow the steps below to download the quality controlled data.

## *NCDC Access Type:*

There are two types of access rights we will be dealing with in the following steps: 1) Free Access and 2) Free Account Access.

**Free Access:** Users that have one of the acceptable IP extension determined above:
**Free Account Access:** Users that have been given an account by NCDC to access the online data

**Free Access:**
Users with this type of access should use the following steps to access the online data provided by NCDC.

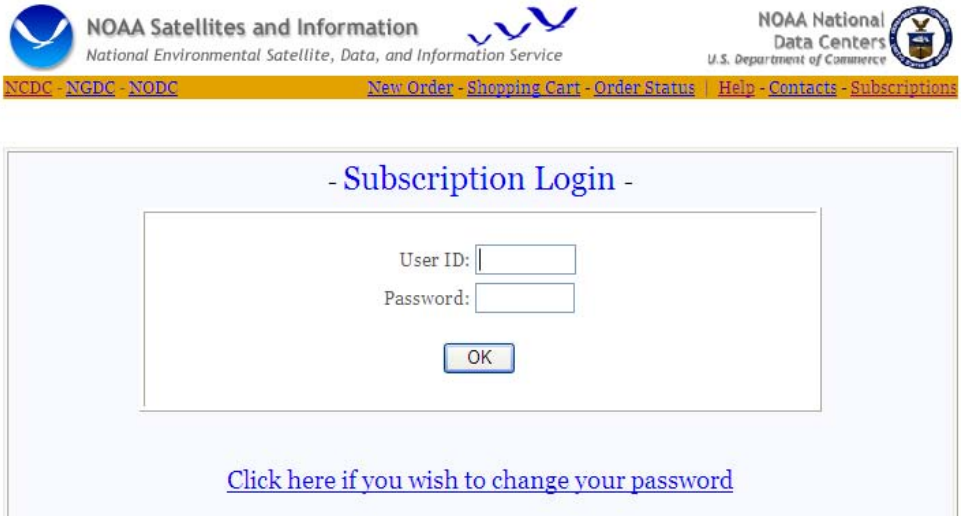
**Option 1:**
To access data prior to Jan 2005 use this link
**Unedited**(http://cdo.ncdc.noaa.gov/ulcd/ULCD)

**Option 2:**
To access data after Jan 2005 use this link **Quality Controlled**
(http://cdo.ncdc.noaa.gov/qclcd/QCLCD?prior=N)

Now skip to Step 5 below (The screen shots below are based on Option 2)

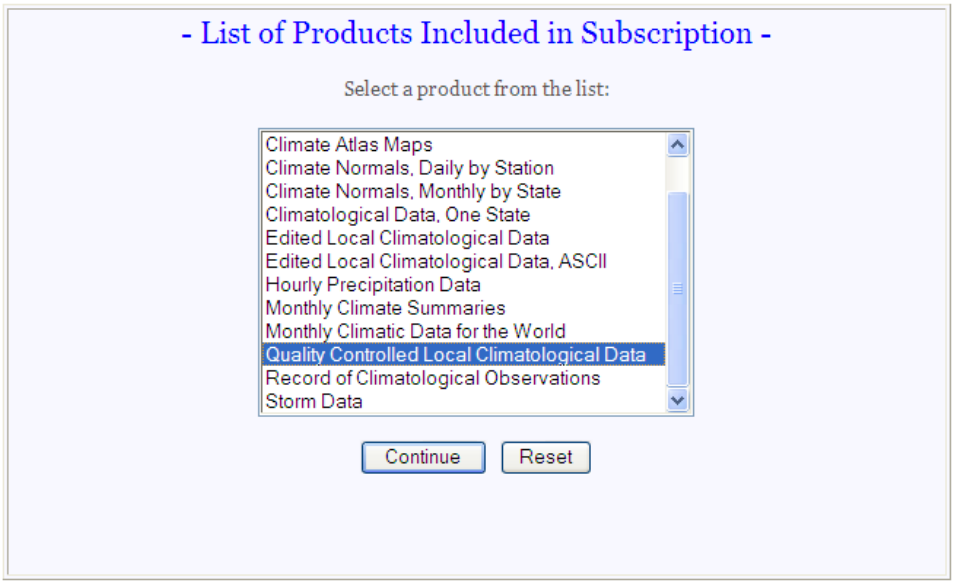
**Free Account Access:**
Users with this type of access should use the following steps to access the online data provided by NCDC.

Step1 - Login into the NCDC https://ols.nndc.noaa.gov/sub-login.html



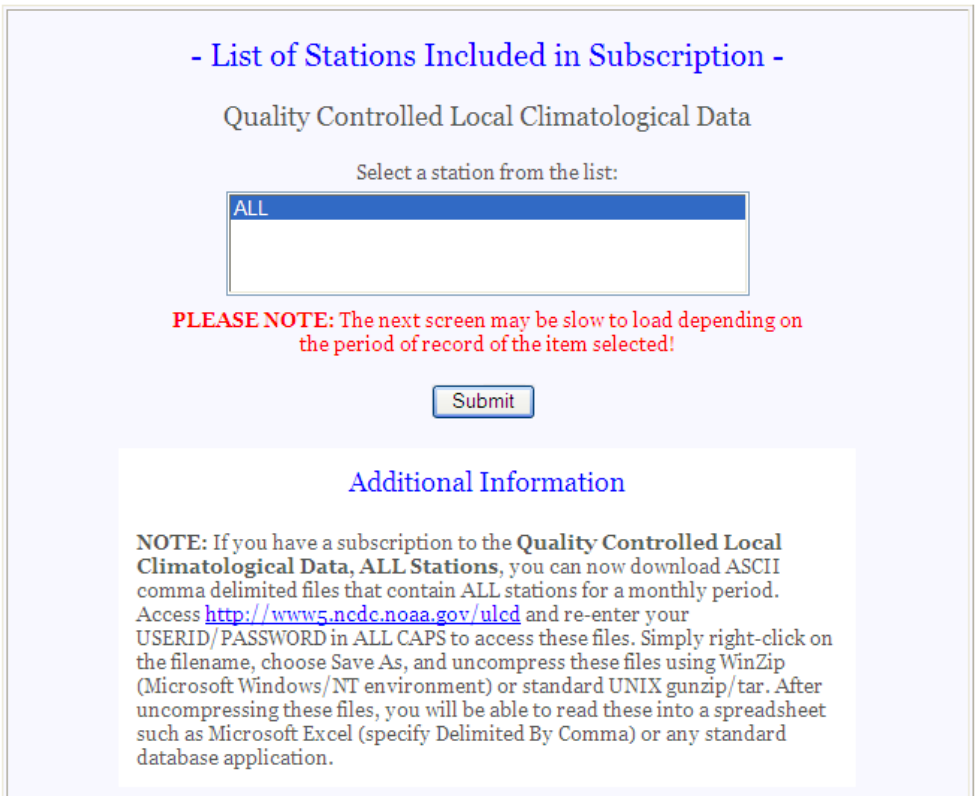

Enter your User ID and Password then click “OK”

Step 2 – Select data type "**Quality Controlled Local Climatological Data**"

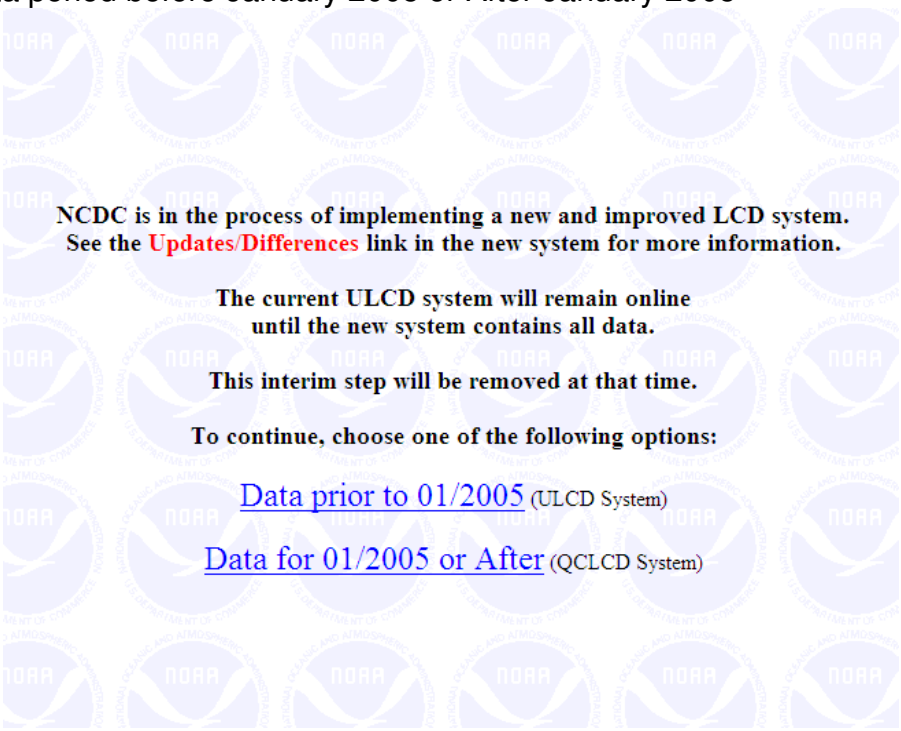

Select "Quality Controlled Local Climatological Data" then click "Continue"

Step 3 – Select "**All**" or a specific station if available




Select "ALL" then click "submit"

Step 4 – Select data period before January 2005 or After January 2005

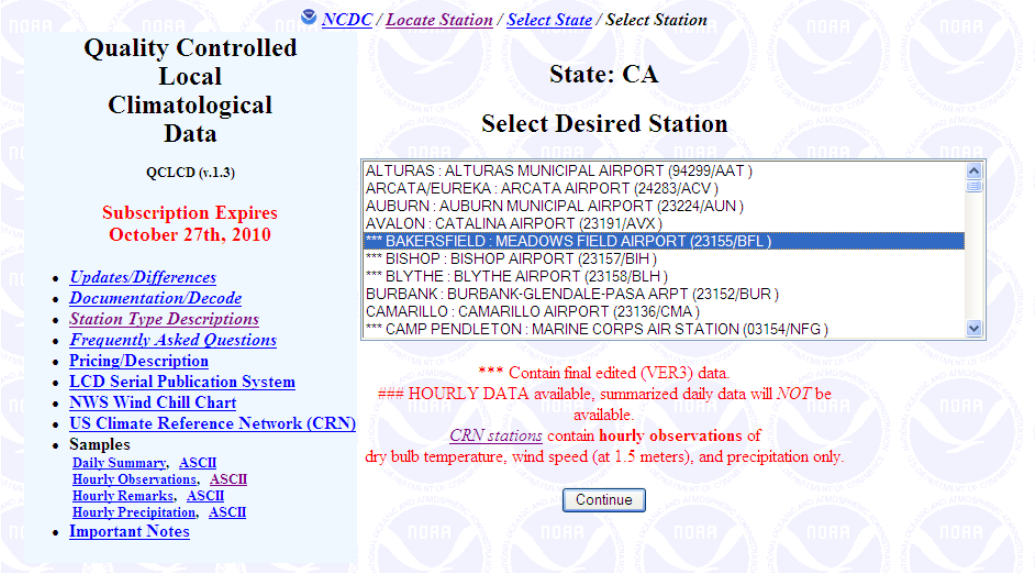



For this walk through click “Data for 01/2005 or After”

Step 5 – Select a state


Select “California” from the list then click “Continue”

Step 6 – Select the meteorological station of interest.



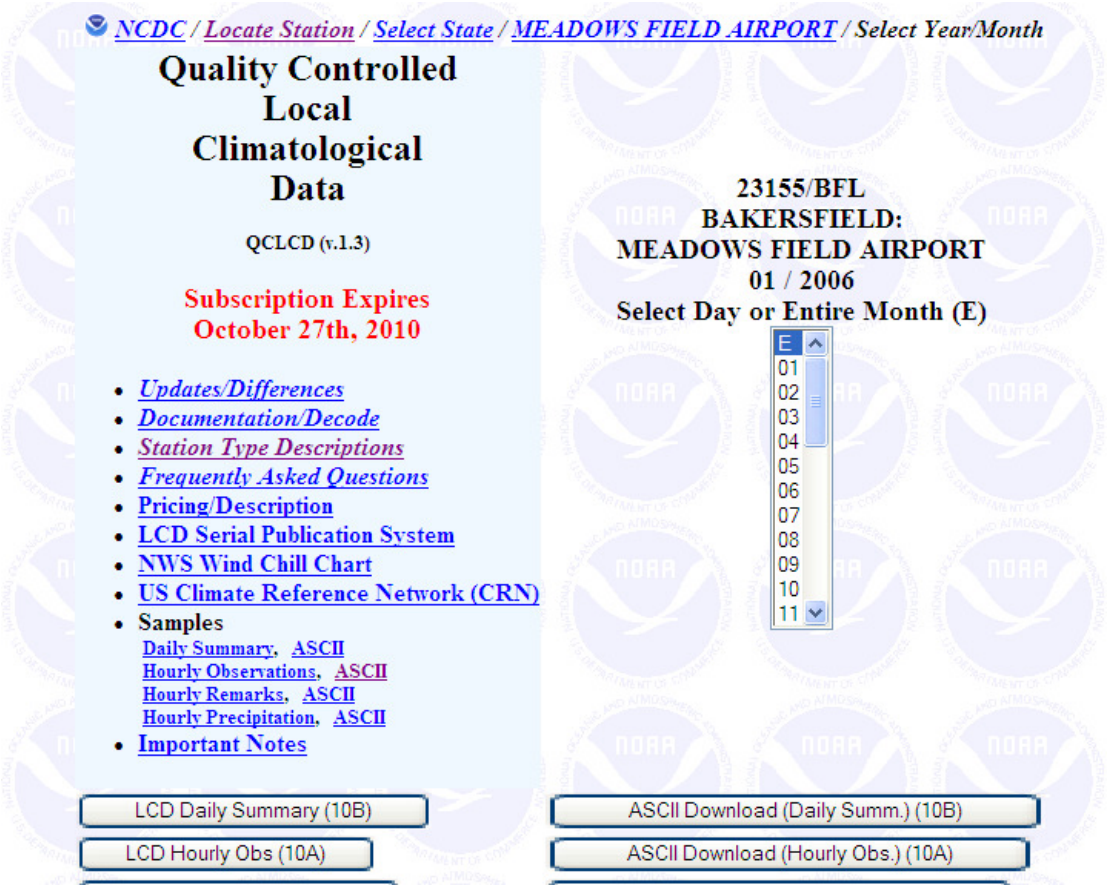

Review the list of available meteorological stations and select the station of Interest, then click “Continue”.

Step 7 – Select the meteorological data to open (12 files for each year)

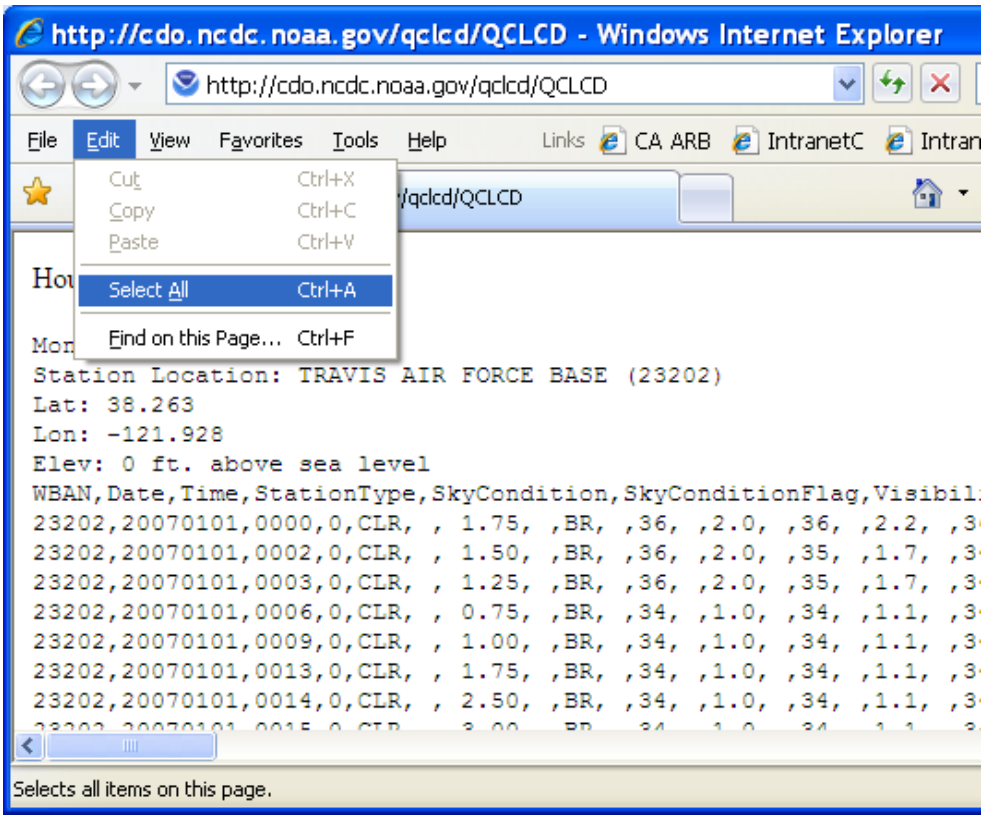

Please note: 1 year of meteorological data is broken into 12 files, one for each month.

From the list of available data select a file to open then click “Continue”

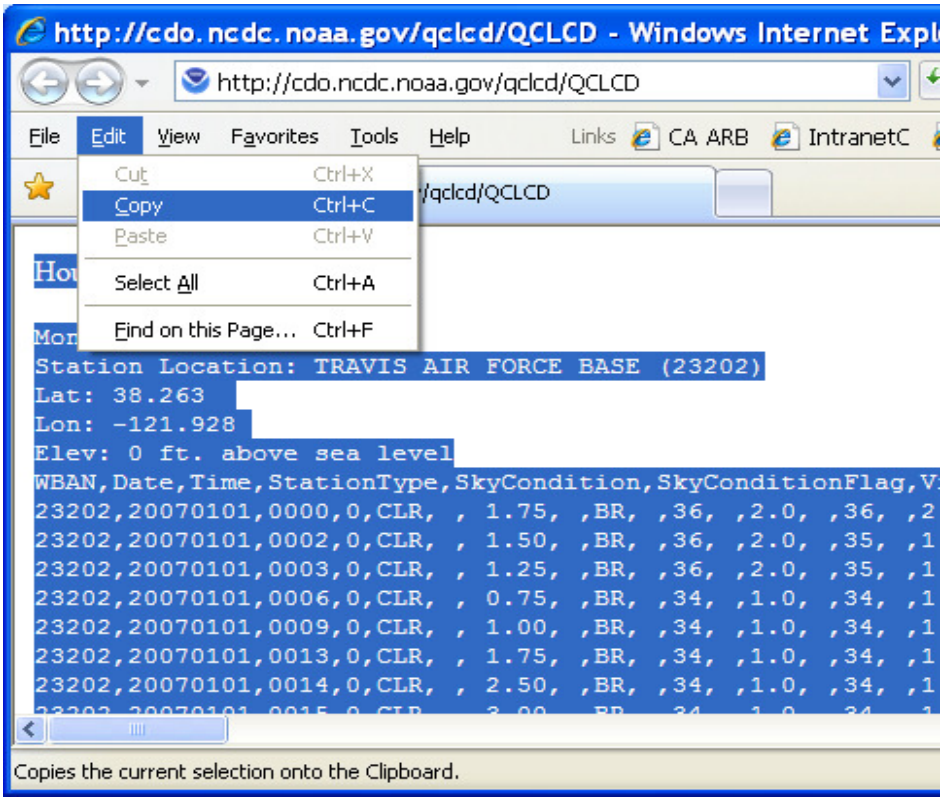
Step 8 – Select E (Entire month) then click on “ASCII Download (Hourly Obs) (10A)”. This will open a second browser window.




Step 9 – From the browser menu select EDIT --> Select All

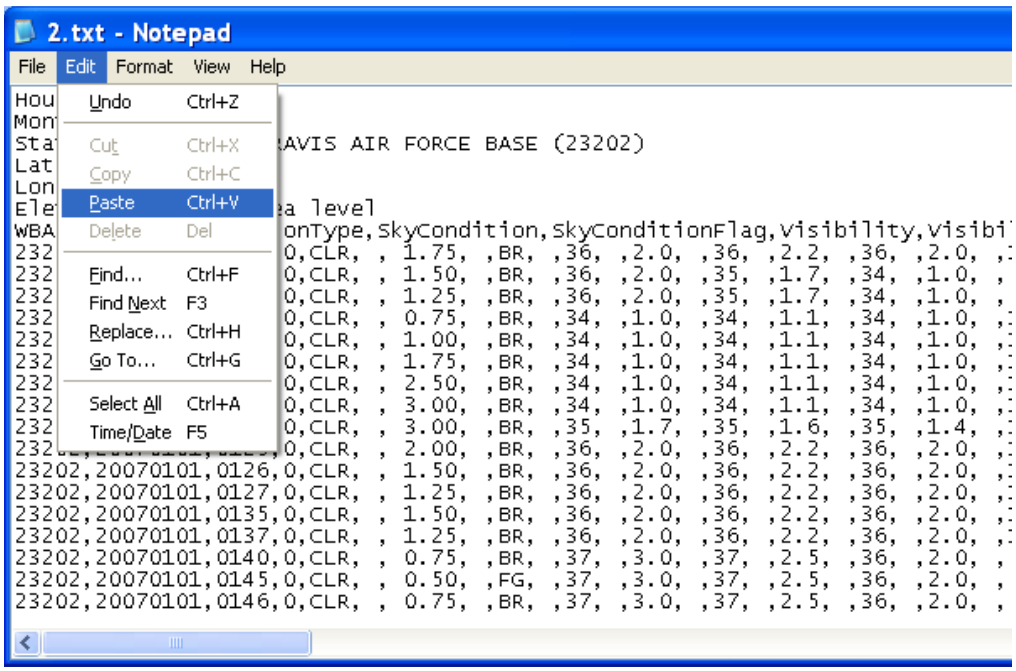


Step 10 – From the browser select EDIT --> COPY

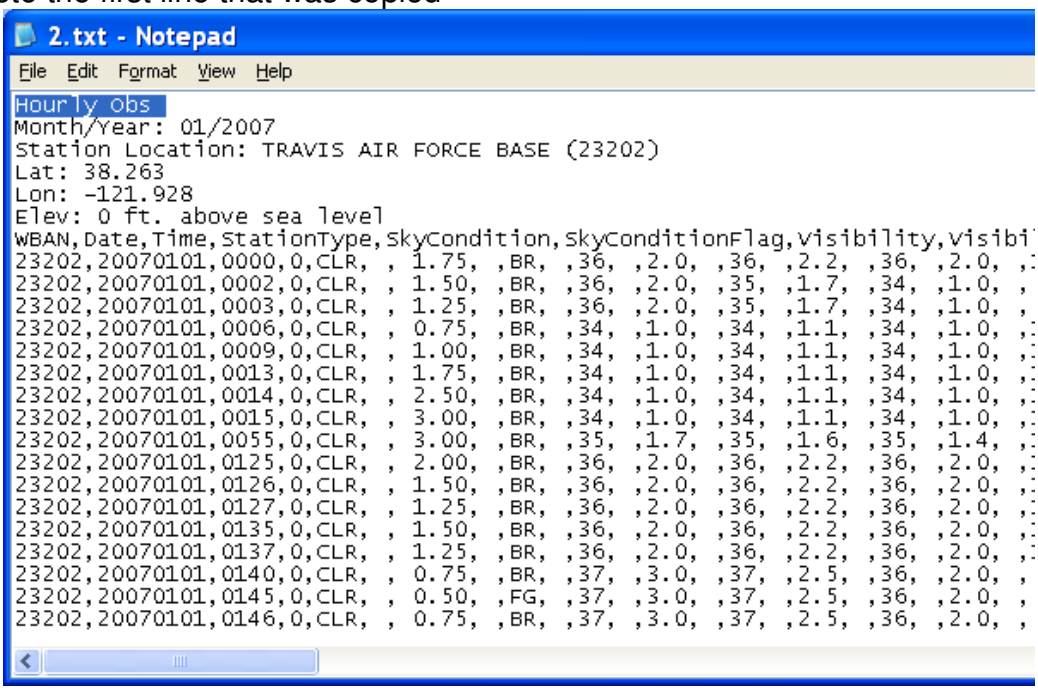



**Please note:** Steps 9 and 10 can be performed using the following quick keys CTL + A = Select ALL and CTL + C = Copy

Step 11- Open a text editor like WORD PAD and select EDIT --> PASTE. If you are going to use the data in the section entitled "**How to Process My Data**" then it is recommended that you use the template files included on the CD. Copy the folder called "YEAR" and rename it to represent the year of the meteorological data being downloaded. Within this folder are 12 files numbered 1 thru 12, one for each month of the year. Open the corresponding file for the month being downloaded and paste the data.

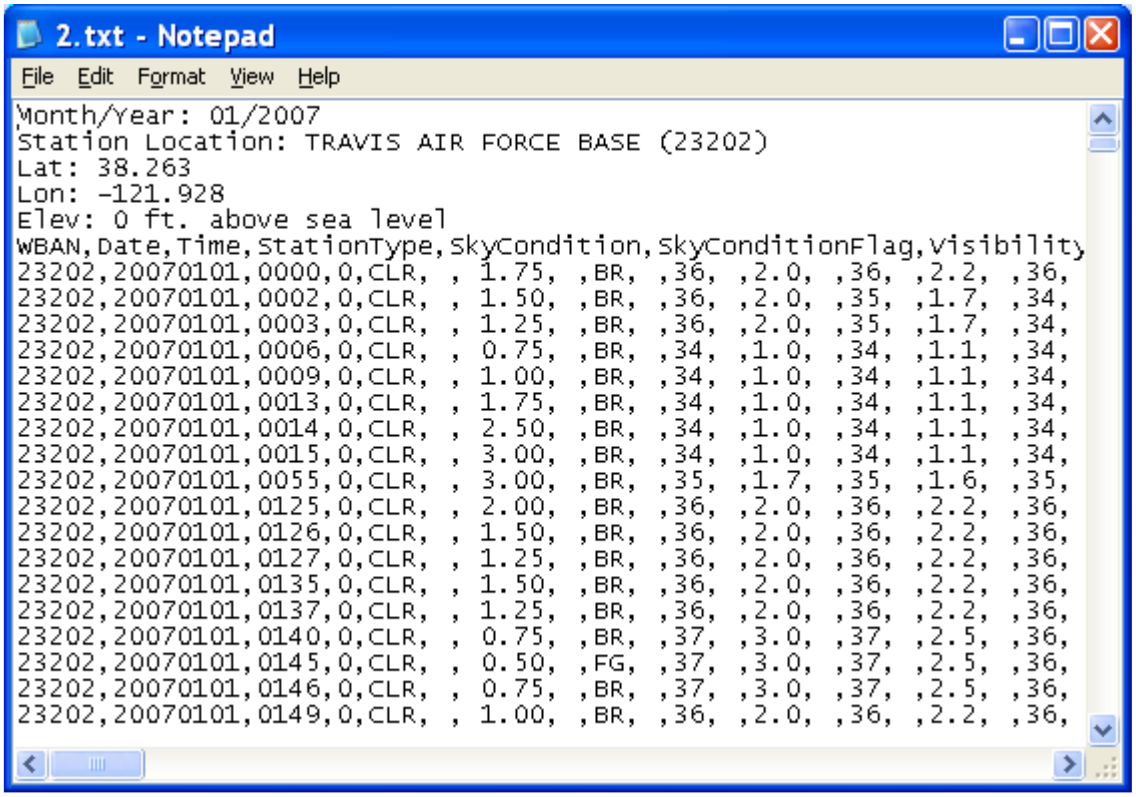


Step 12 – Delete the first line that was copied




Highlight the first line as seen above and press the “Delete” key

Step 13 – The final file should look like below




Step 14 – Save and Close the file. Additionally close the second browser window open in Step 8.

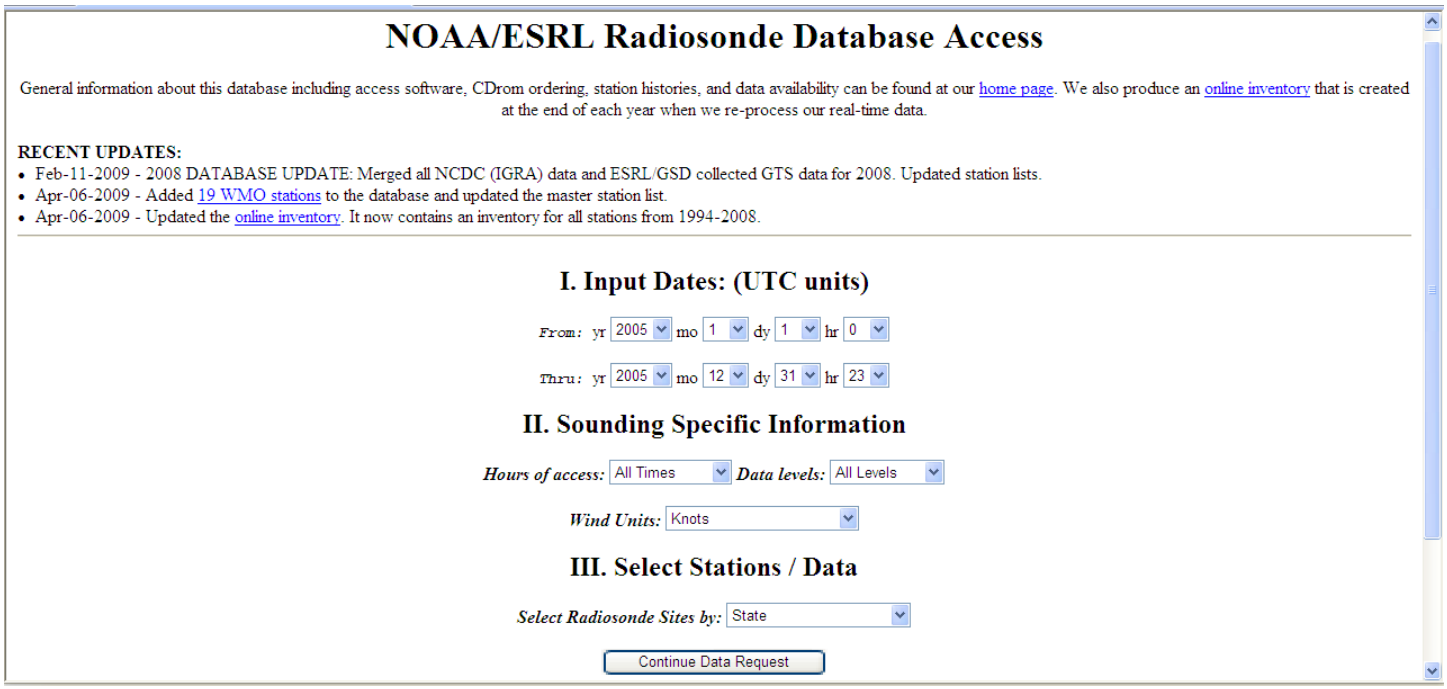
Step 15 – Click the “BACK” button on the browser and Repeat Steps 8 through 14 for each month that is to be downloaded.

# *Where’s My Upper-Air Data?*

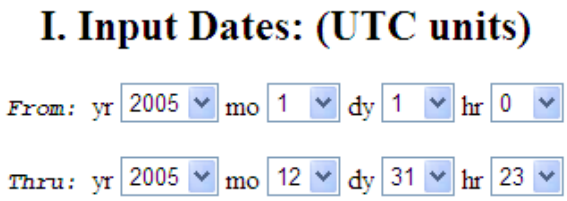
Now that the surface data has been downloaded, the matching upper-air data will also need to be retrieved. This data is freely available without restriction.

## *Where To Start:*

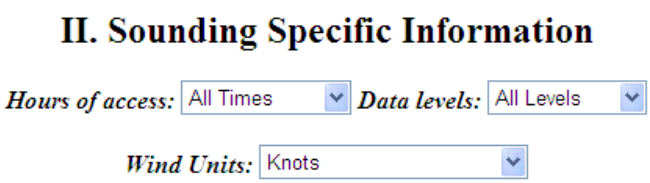
The upper-air data can be downloaded from http://esrl.noaa.gov/raobs/,



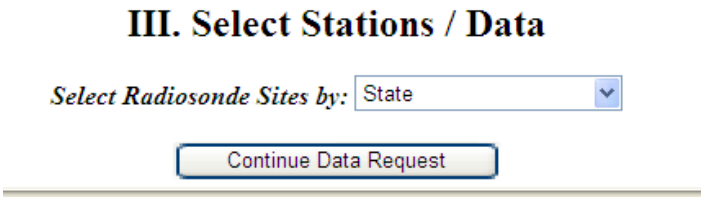

Step 1 – Select the time period to download. Set **From** inputs to: Year = (User define year), Month =1, Day = 1, and Hour=0 (midnight = morning). Set **Thru** inputs to: Year = (same as **From**), Month = 12, Day = 31, Hour = 23.



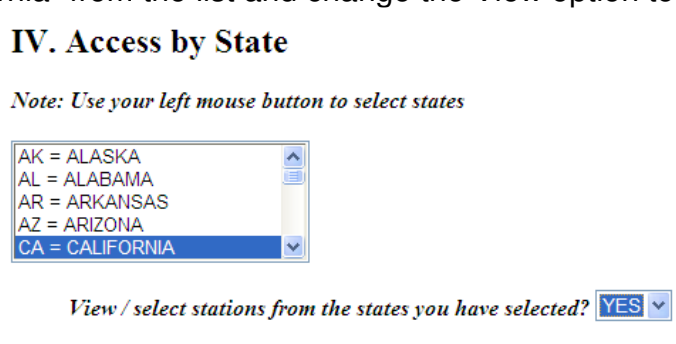

Step 2 – These options do not need to be altered.



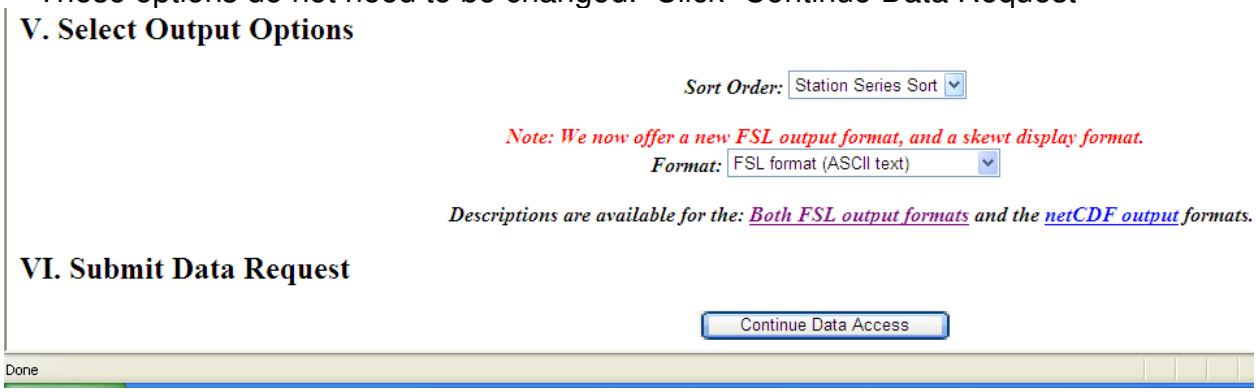
Step 3 – Change Radiosonde Site to “State” then click “Continue Data Request”



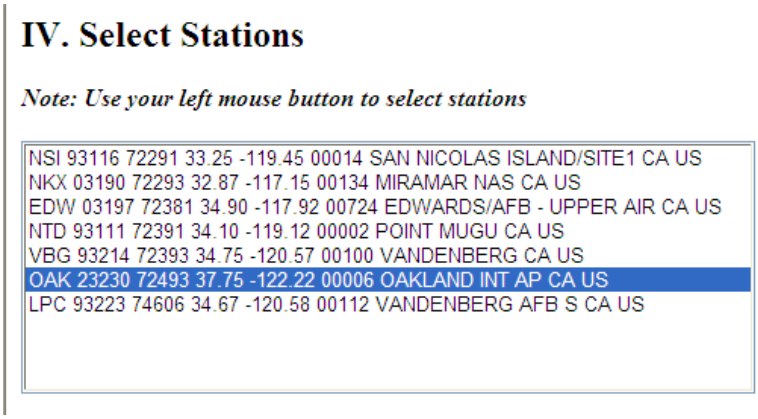

Step 4 – Select “CA-California” from the list and change the View option to “YES”



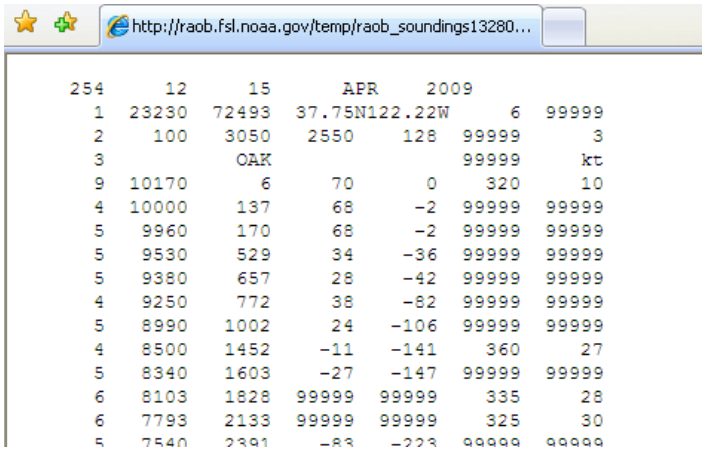

Step 5 – These options do not need to be changed. Click “Continue Data Request”




Step 6 – Select the station to download. The other options on this page do not need to be changed. Click “Get Radiosonde Data”



Step 7 – From the browser menu select EDIT → SELECT ALL then EDIT → COPY




Step 8 – Paste the contents into a text file with a naming of XXXX.FSL. Where XXXX represents the year of the upper-air data. This will make it easier for AERMET to find the file.

Repeat steps 1 thru 8 for each year upper-air data set needed.

# *How to Process My Data*

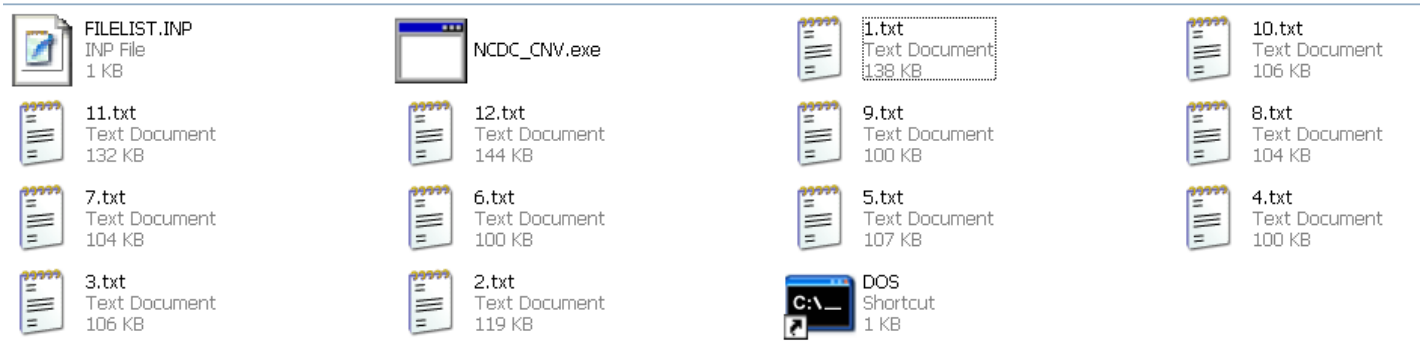
Now that you have downloaded the local meteorological data, it's time to QA/QC the data and convert it into a Samson file format. This will allow AERMET to read and process the data into an AERMOD ready meteorological file.

## *QA / QC and Converting Local Met Data into Samson Format:*

EPA has several requirements for QA/QC meteorological data which are described in "Procedures for Substituting Values for Missing NWS Meteorological Data for Use in Regulatory Air Quality Models" by Dennis Atkinson and Russell F. Lee, 1992. (http://www.rflee.com/RFL_Pages/missdata.pdf). This document describes the EPA-recommended procedures for filling missing data for use in such air quality models as ISCST3 and AERMOD. It is identical to the text file "missdata.txt" available from the EPA SCRAM website, except that formatting has been applied to the text.

Mr. Russell F Lee has also developed a DOS based program that implements the above procedures as well as converts the data into a Samson file format, which AERMET can read. The NCDC_CNV (http://www.rflee.com/RFL_Pages/NCDC_CNV.zip) is a program which can convert the abbreviated hourly surface meteorological data provided online by NCDC in comma-separated ASCII format, and the Integrated Surface Hourly Weather Observations (ISHWO, aka ISH, ISHD) to the SAMSON format. The file is a zipped file containing the program, instructions, and a sample input file. This is being made available "as is" without charge by the developer, and may be freely distributed as long as the instruction file is included intact. The NCDC_CNV zip file has been included with this document for convenience.

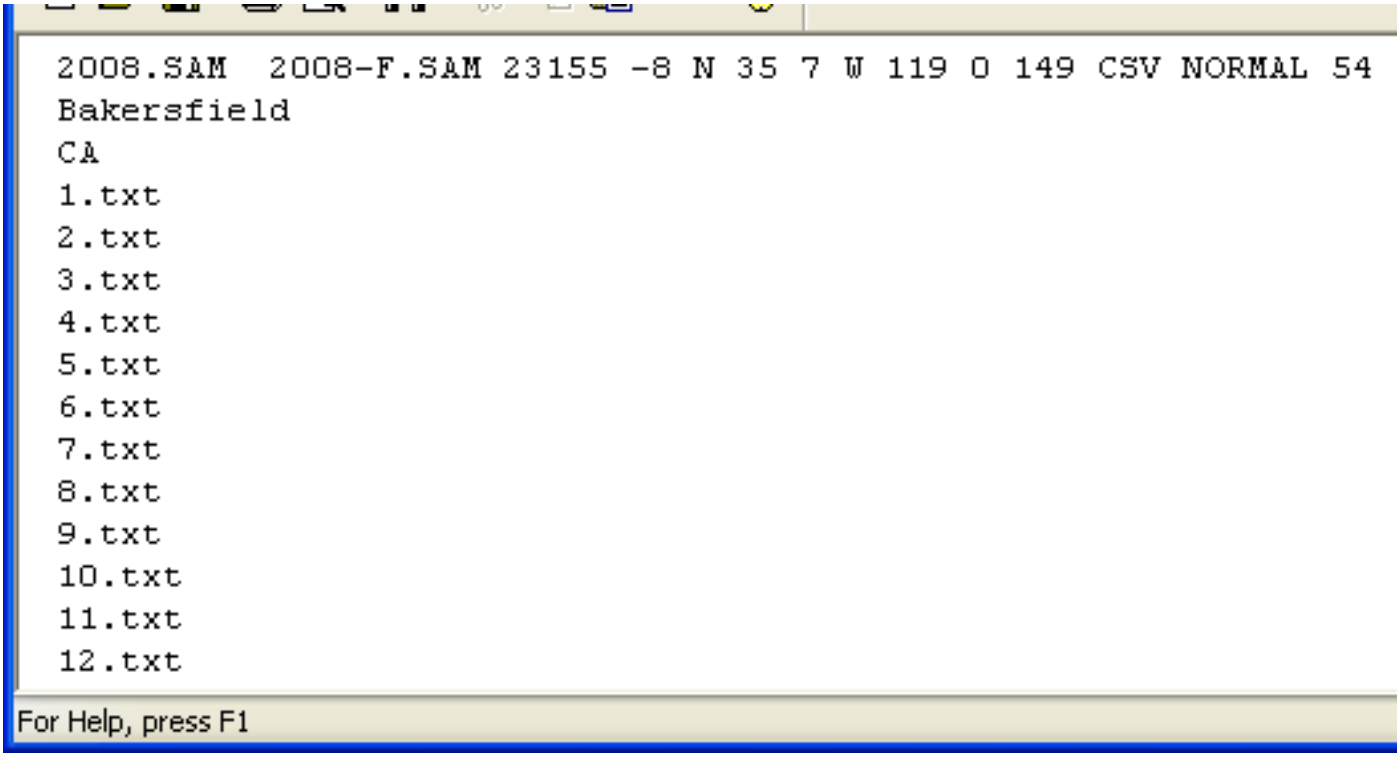
For this part of the walk through we will be using the files located in the “SAMPLE YEAR” directory on the included CD, see below.




**Please note:** the FILELIST.INP and the NCDC_CNV.exe file will need to be located in the same directory as the files to be QA/QC in order to run properly.

## The Input File Review:

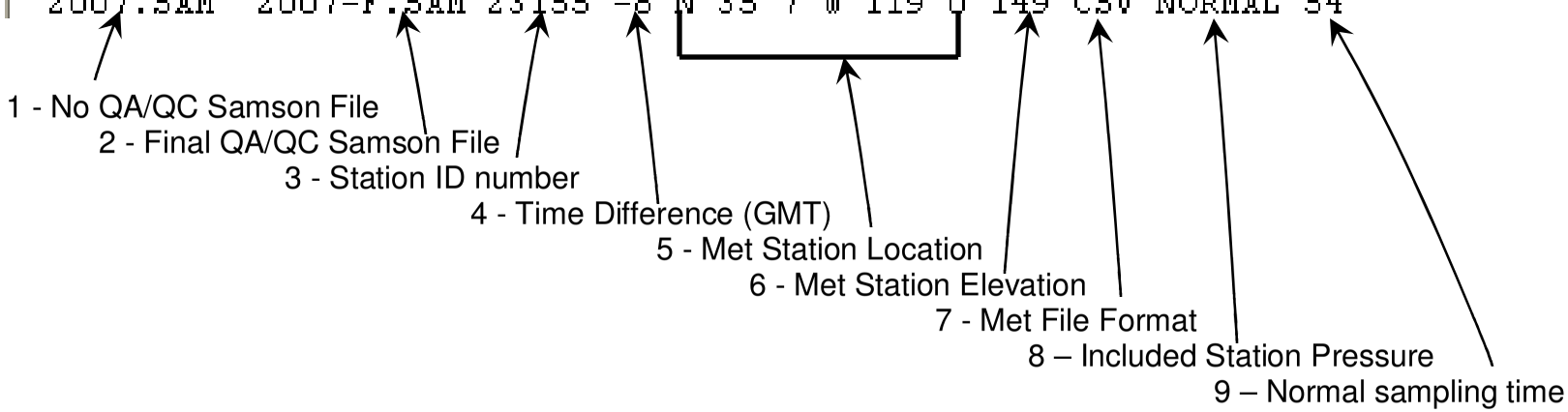
For a detailed explanation of the NCDC_CNV input file please refer to the file entitled “INSTRUCTIONS_VERS_2008-09-17.txt” located on the provided CD




The Input file can be broken down into three basic parts; Program Control Line, Station Name and State, and the Meteorological File(s) to Read.

**Program Control Line:**

```
2007.SAM  2007-F.SAM 23155 -8 N 35 7 W 119 0 149 CSV NORMAL 54
```




Detailed Item Description:

1) Filename of the output file converted to SAMSON format.
   Missing hours are not filled in this file.
2) Name of output file with missing data filled per Atkinson & Lee.
3) Station ID (5-digit number). This number will appear in the output SAMSON file.
4) Time zone (EST = -5, CST = -6, MST = -7, PST = -8, etc.)
5a) 'N' or 'S' to indicate North or South latitude.
5b) Latitude--whole degrees portion.
5c) Latitude--minutes portion.
5d) 'E' or 'W' to indicate East or West longitude.
5e) Longitude--whole degrees portion.
5f) Longitude--minutes portion.
6) Elevation of station above mean sea level, in meters.
7) Type of input data:
   CSV, csv: Comma-separated values from NCDC online store. This accommodates all known variants of the format, and will likely accommodate future ones as well.
8) NORMAL or SUBSLP. NORMAL gives the SAMSON format the station pressure.
   SUBSLP substitutes sea level pressure for station pressure. CAUTION: Use SUBSLP only for stations fairly near sea level, when the station pressure is missing.
9) Code to identify minutes value(s) used for regular hourly (not special) data.
   This is only used for space-delimited data (ABBRDS), but must always be present.

### Station Name and State:

```
Bakersfield
CA
```

The City or Station name, up to 22 characters

State or province abbreviation, 2 characters

### Meteorological File(s) to Read:

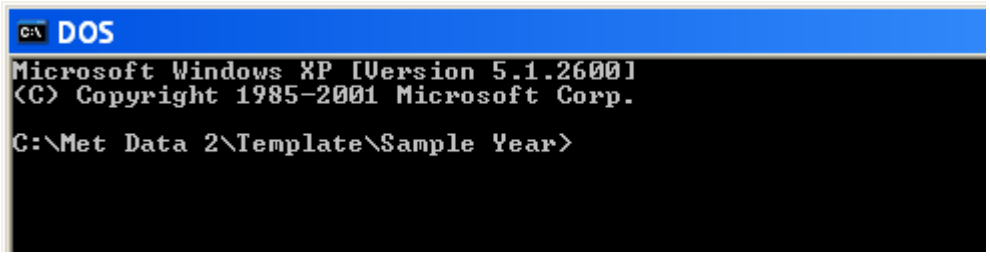
List of input files to be read and converted. These files will be concatenated in the order listed into the Samson output files noted in the Control Line.

```
1.txt
2.txt
3.txt
4.txt
5.txt
6.txt
7.txt
8.txt
9.txt
10.txt
11.txt
12.txt
```

Local meteorological file downloaded from NCDC

Step 1 – Updating the Input File
For each year of meteorological data to be processed the Control Line should be adjusted to reflect the parameters of the station to be processed.

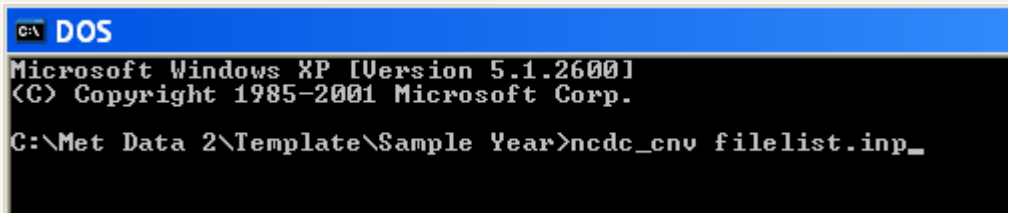
Step 2 – Open a DOS Window and go to the directory that contains the files to be processed.



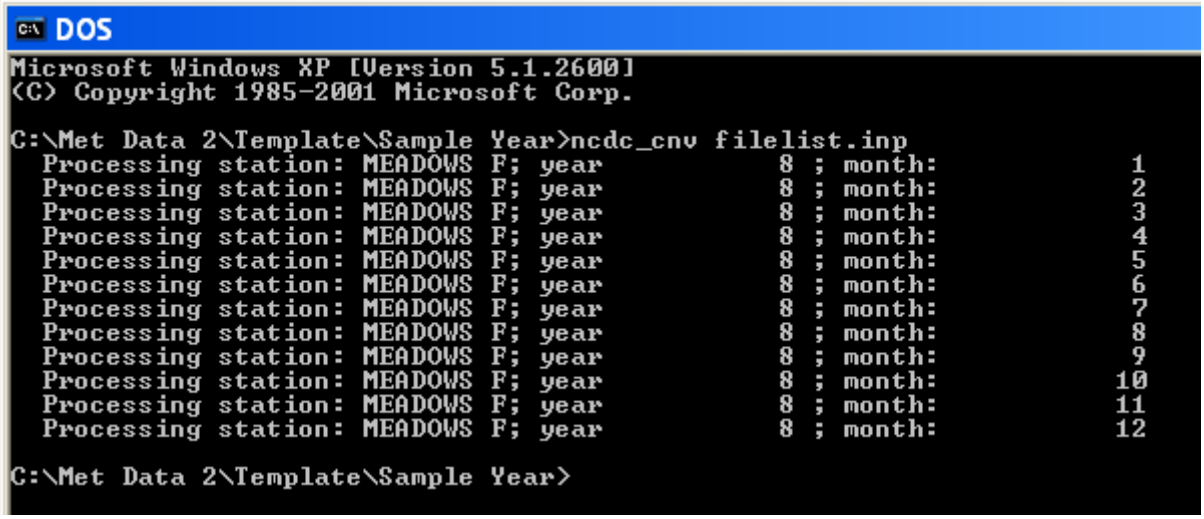
Step 3 – Run the NCDC_CNV.exe program. By typing

**NCDC_CNV filelist.inp**

Then pressing Enter on the keyboard

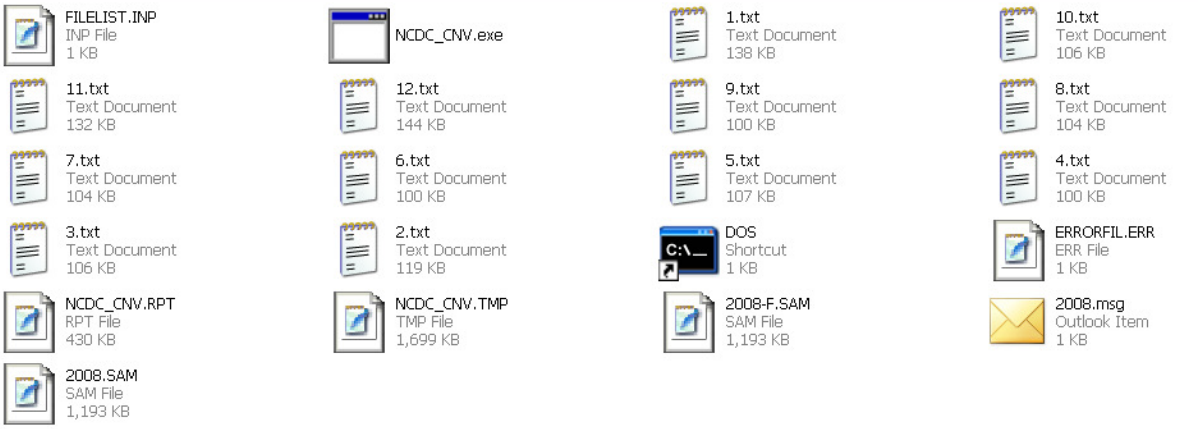



This will start the program. It should read each file listed in the INP file, one for each month of the year. Below is an example of the screen output after the program has run successfully.




Station Name Year Month

## Files Created by the NCDC_CNV Program:




### List of Files Created:

2008.SAM – Downloaded meteorological data converted into Samson format
2008-F.SAM – The 2007.SAM file that has been QA/QC
2008.msg – Provides a list of the missing data that has been filled using EPA guidance
Errorfil.err – Provides a list of program errors, if any.
NCDC_CNV.RPT – Detailed list of each hour for each month that was read.
NCDC_CNV.TMP – Temporary file used when reading data from the 12 individual files before converting it into the Samson Format.

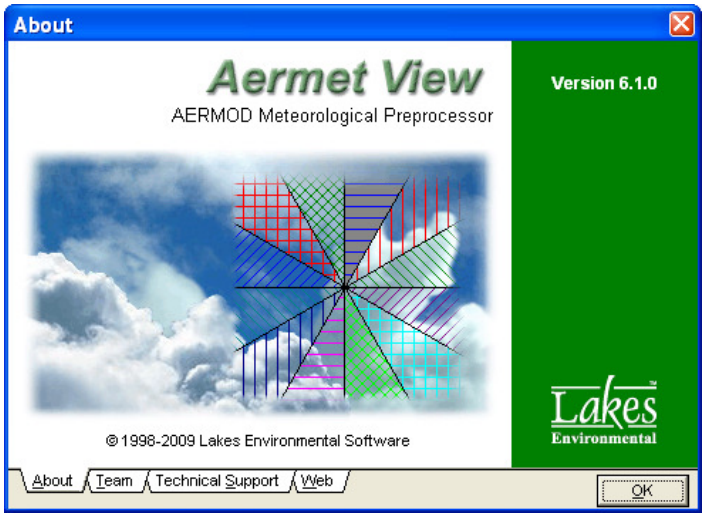
Step 4 – Close the DOS window by typing “Exit”

## *AERMET Processing:*

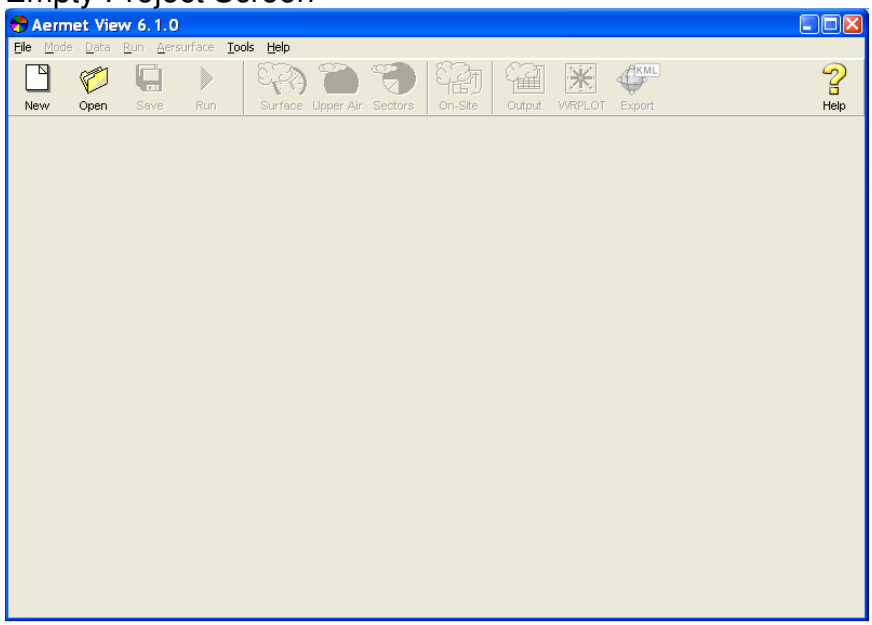
The final step in processing the meteorological data is to run AERMET with both the upper-air data and Samson file created in the previous section. For this part of the walk through we will be using the Lakes Environmental AERMET user interface.

Step 1 – Create a new AERMET project file using Lakes Environmental AERMET View.

On starting the AERMET View program the “ABOUT” screen will appear. Click the “OK” button to continue.

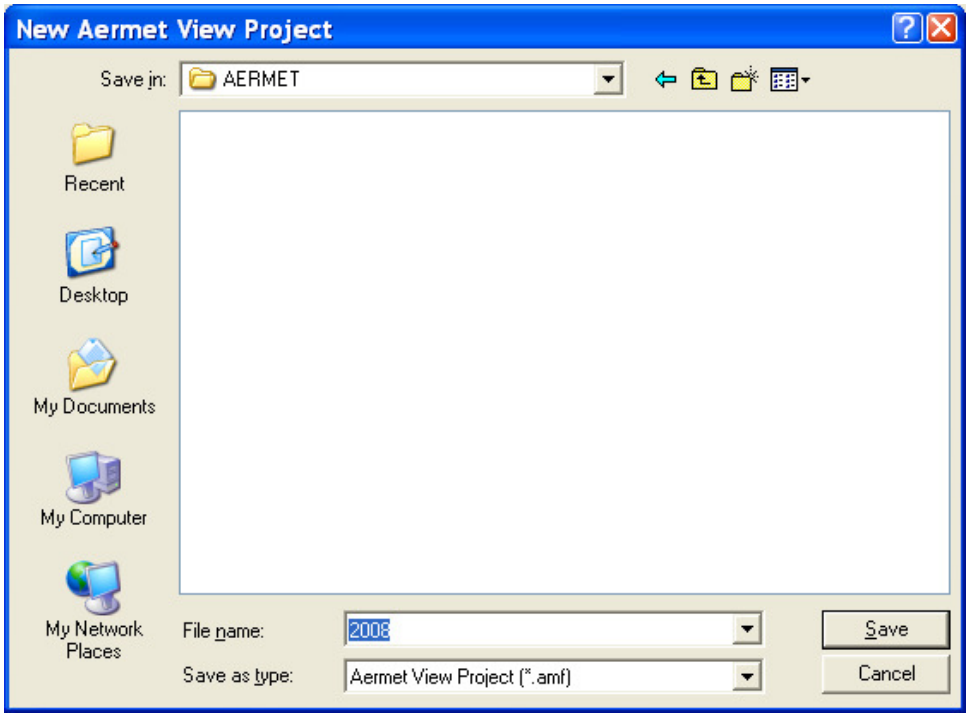



Empty Project Screen



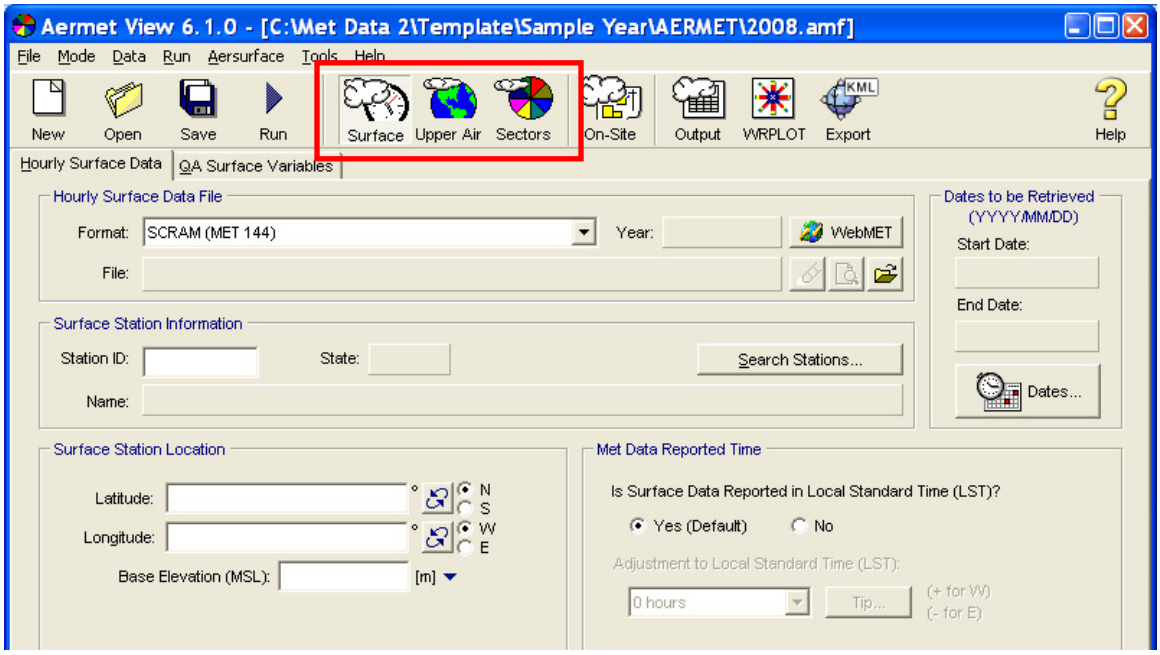

Click the “NEW” button or from the menu select File →New Project

On the “New Aermet View Project“ screen, enter a file name that will be used to store your inputs. It is recommended that you use the year for the meteorological data as the name for the project. It is also recommended that you create a separate directory for the other files downloaded and generated in the previous sections. Once the file name has been entered click “SAVE”.



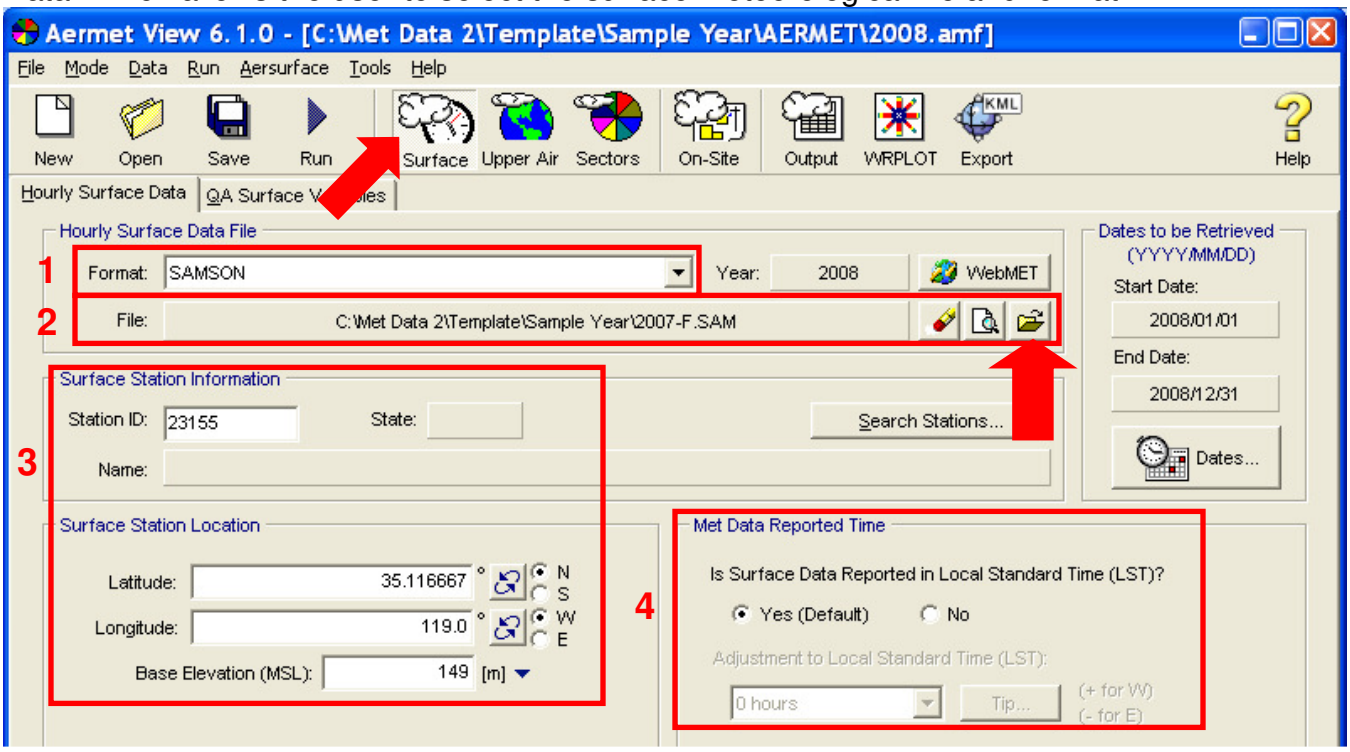

## AERMET Input Screen

For this part of the walk through we will be dealing with three main screens Surface, Upper Air, and Sectors.



## Surface Screen

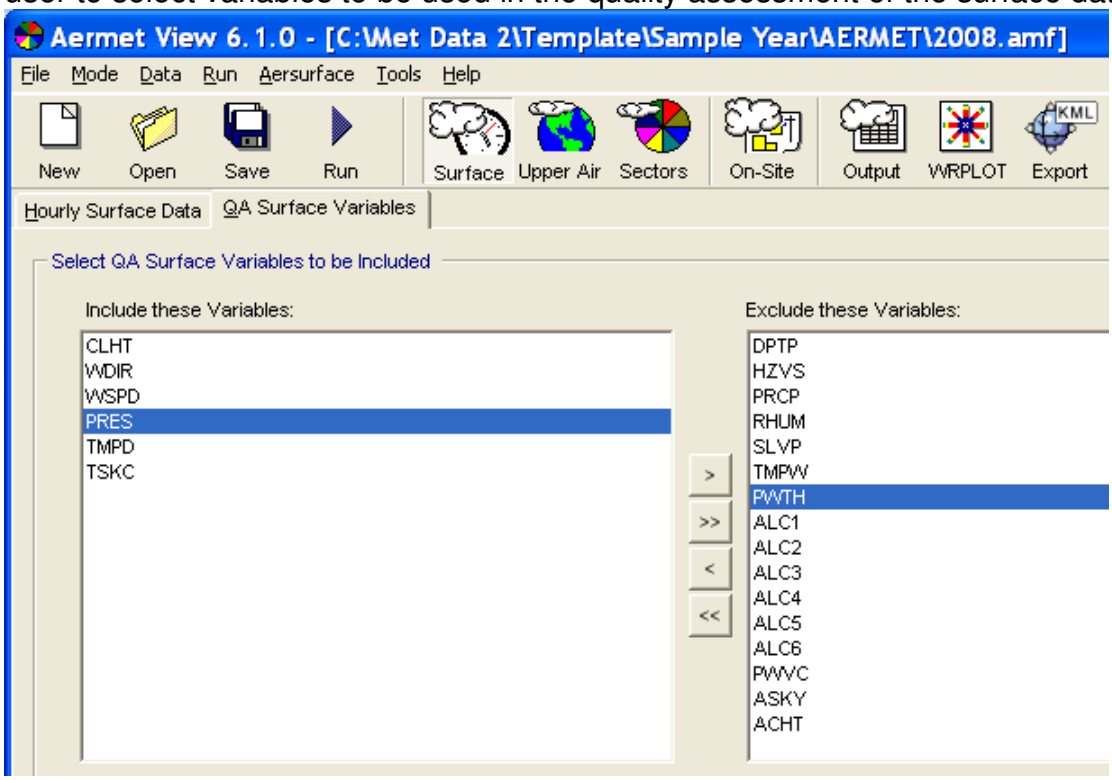
The Surface screen has two tabs that need to be reviewed. The first tab is the "Hourly Surface Data" which allows the user to select the surface meteorological file and format.




Screen Details:

| Detail # | Description |
|---|---|
| 1 | From the pull down select the "SAMSON" option. |
| 2 | Using the Open File button navigate to, and select the Samson file created by the NCDC_CNV program in the previous section. |
| 3 | The data in this section will be entered automatically after the Samson file is selected. |
| 4 | Insure that the "Yes (Default)" option is selected. |

The Second tab on the Surface Screen is the “QA Surface Variable” tab. This tab allows the user to select variables to be used in the quality assessment of the surface data.



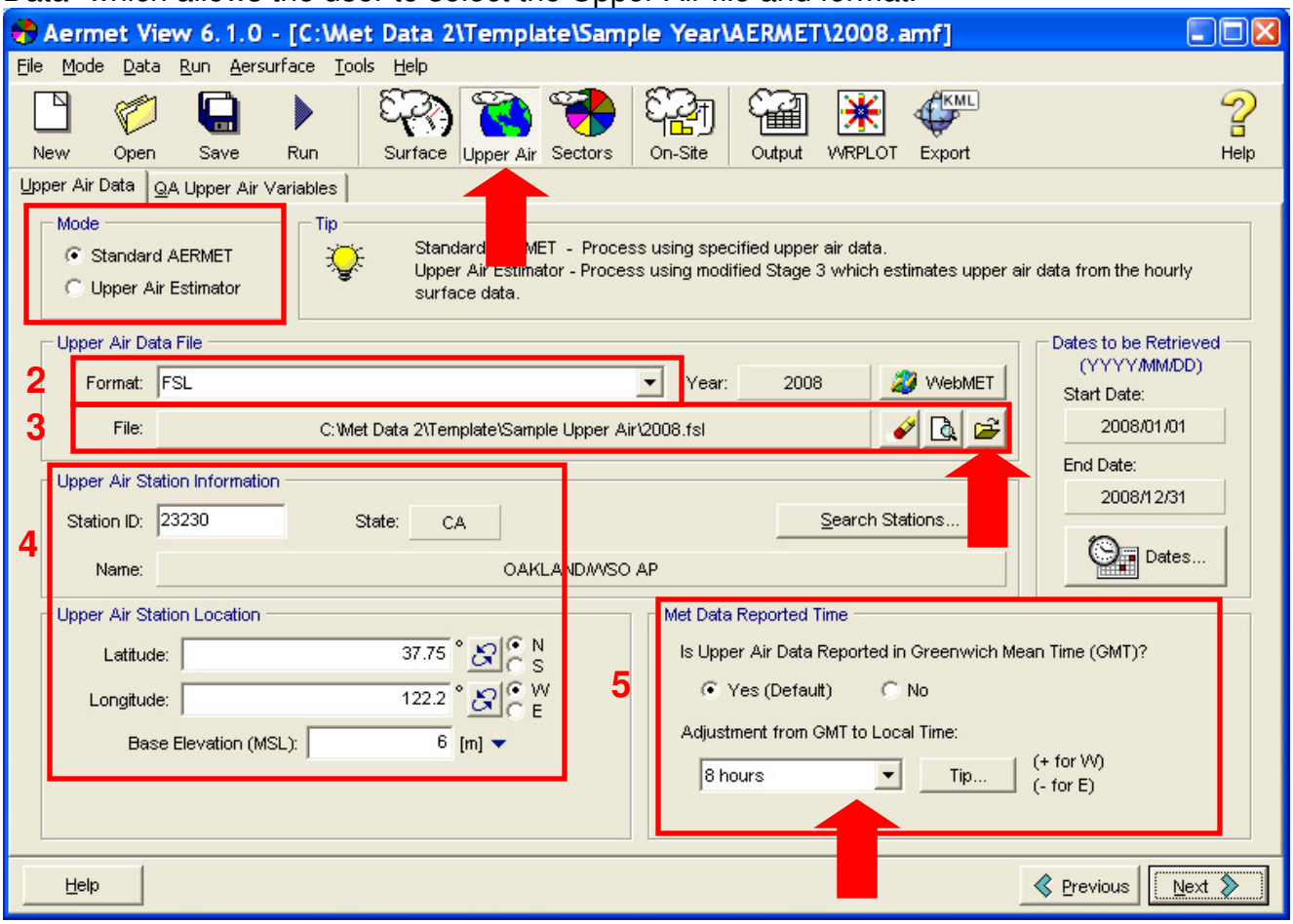

Detailed descriptions of the available variables.

**Hourly Surface QA Variables**

| Variable Name | Description | Units | Boundary Type | Missing Indicator | Lower Bound | Upper Bound |
|---|---|---|---|---|---|---|
| CLHT | Ceiling height | kilometers * 10 | Include (<=) | 999 | 0 | 300 |
| DPTP | Dew-point temperature | deg C * 10 | Exclude (<) | 999 | -650 | 350 |
| HZVS | Horizontal visibility | kilometers * 10 | Include (<=) | 99999 | 0 | 1640 |
| PRCP | Precipitation amount | millimeters * 1000 | Include (<=) | -9 | 0 | 25400 |
| PRES | Station pressure | millibars * 10 | Exclude (<) | 99999 | 9000 | 10999 |
| RHUM | Relative humidity | whole percent | Include (<=) | 999 | 0 | 100 |
| SLVP | Sea level pressure | millibars * 10 | Exclude (<) | 99999 | 9000 | 10999 |
| TMPD | Dry bulb temperature | deg C * 10 | Exclude (<) | 999 | -300 | 360 |
| TMPW | Wet bulb temperature | deg C * 10 | Exclude (<) | 999 | -650 | 350 |
| TSKC | Total // opaque sky cover | tenths // tenths | Include (<=) | 9999 | 0 | 1010 |
| WDIR | Wind direction | tens of degrees | Include (<=) | 999 | 0 | 36 |
| PWTH | Present weather | | Include (<=) | 9999 | 0 | 9800 |
| WSPD | Wind speed | meters/second * 10 | Include (<=) | 999 | 0 | 500 |
| ALC1 | Sky cond // height, level 1 | code // hundredths ft | Include (<=) | 9999 | 0 | 7300 |
| ALC2 | Sky cond // height, level 2 | code // hundredths ft | Include (<=) | 9999 | 0 | 7300 |
| ALC3 | Sky cond // height, level 3 | code // hundredths ft | Include (<=) | 9999 | 0 | 7300 |
| ALC4 | Sky cond // height, level 4 | code // hundredths ft | Include (<=) | 9999 | 0 | 7850 |
| ALC5 | Sky cond // height, level 5 | code // hundredths ft | Include (<=) | 9999 | 0 | 7850 |
| ALC6 | Sky cond // height, level 6 | code // hundredths ft | Include (<=) | 9999 | 0 | 7850 |
| PWVC | Present weather (vicinity) | | Include (<=) | 9999 | 0 | 9800 |
| ASKY | ASOS Sky condition | tenths | Include (<=) | 99 | 0 | 10 |
| ACHT | ASOS Ceiling | kilometers * 10 | Include (<=) | 999 | 0 | 888 |

## Upper AIR Screen:

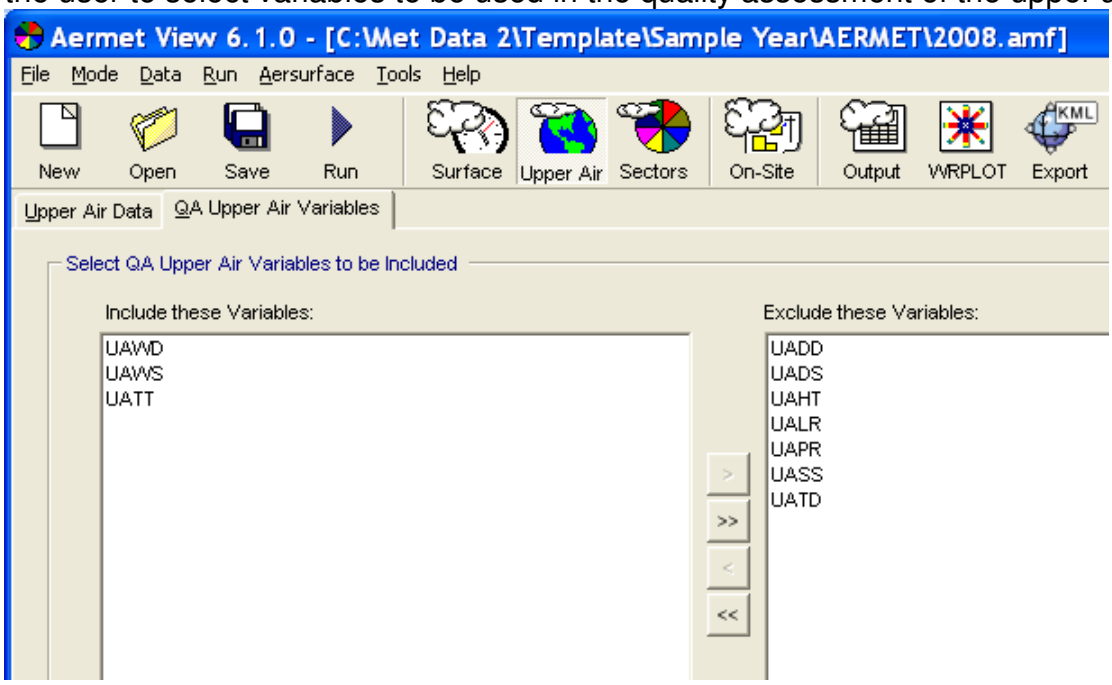
The Upper Air screen has two tabs that need to be reviewed. The first tab is the "Upper Air Data" which allows the user to select the Upper Air file and format.



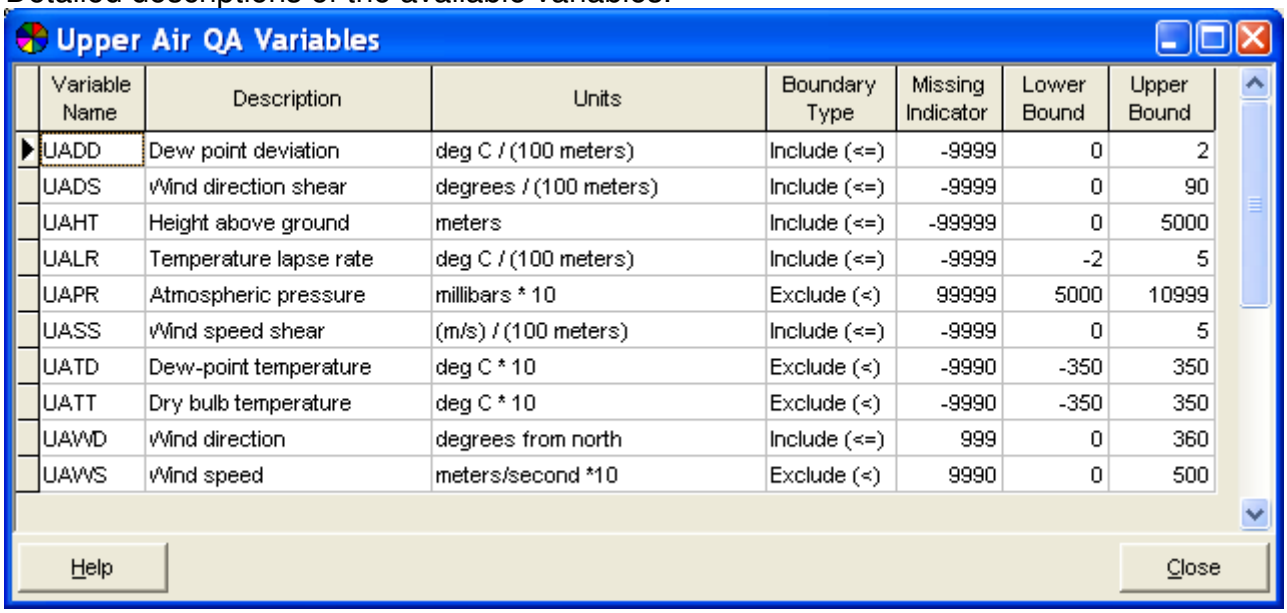

Upper Air Details:

| Detail # | Description |
|---|---|
| 1 | Select "Standard AERMET". |
| 2 | From the pull down select the "FSL" option. |
| 3 | Using the Open File button navigate to, and select the FSL file (upper air data) that was previously downloaded. |
| 4 | The data in this section will be entered automatically after the FSL file is selected. |
| 5A | Insure that the "Yes (Default)" option is selected. Upper air data is reported in GMT (Greenwich Mean Time) and need to be adjusted to local time. |
| 5B | In the pull down select the "8 hours" option. California is 8 hours behind GMT. This will adjust the upper air data to match the surface data being processed (LST- Local Standard Time). |

The Second tab on the Upper Air Screen is the “QA Upper Air Variable” tab. This tab allows the user to select variables to be used in the quality assessment of the upper air data.



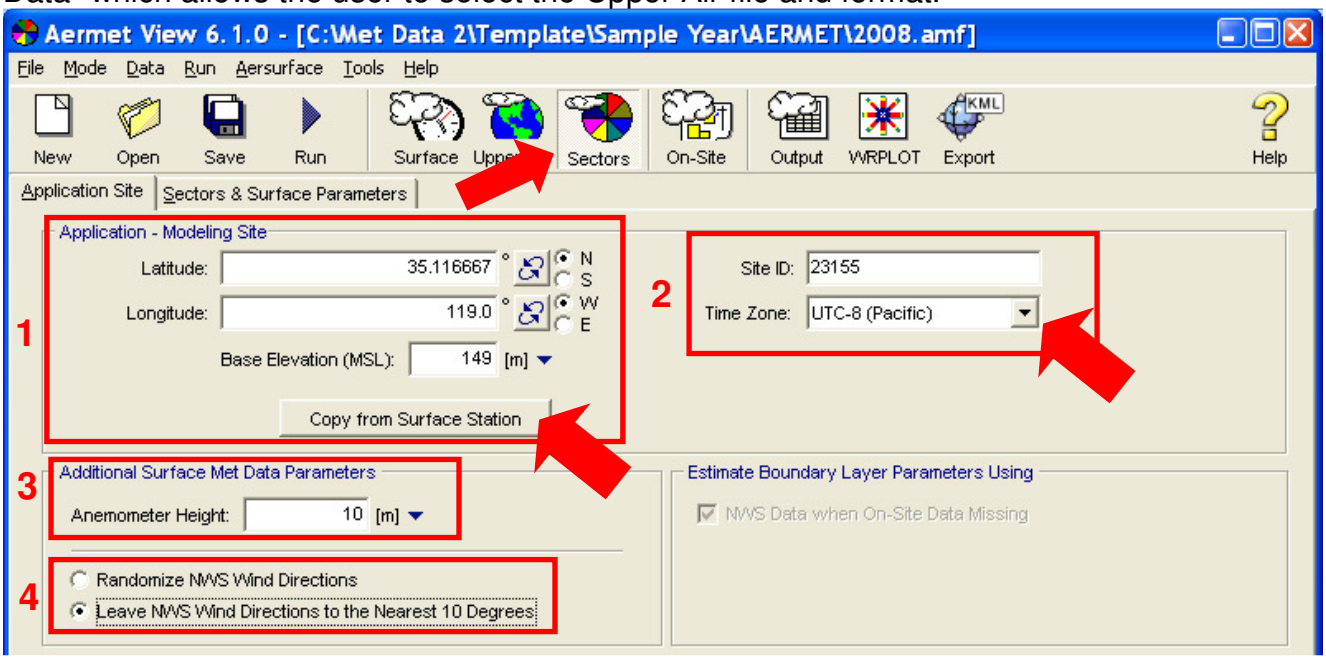

Detailed descriptions of the available variables.




| Variable Name | Description | Units | Boundary Type | Missing Indicator | Lower Bound | Upper Bound |
|---|---|---|---|---|---|---|
| UADD | Dew point deviation | deg C / (100 meters) | Include (<=) | -9999 | 0 | 2 |
| UADS | Wind direction shear | degrees / (100 meters) | Include (<=) | -9999 | 0 | 90 |
| UAHT | Height above ground | meters | Include (<=) | -99999 | 0 | 5000 |
| UALR | Temperature lapse rate | deg C / (100 meters) | Include (<=) | -9999 | -2 | 5 |
| UAPR | Atmospheric pressure | millibars * 10 | Exclude (<) | 99999 | 5000 | 10999 |
| UASS | Wind speed shear | (m/s) / (100 meters) | Include (<=) | -9999 | 0 | 5 |
| UATD | Dew-point temperature | deg C * 10 | Exclude (<) | -9990 | -350 | 350 |
| UATT | Dry bulb temperature | deg C * 10 | Exclude (<) | -9990 | -350 | 350 |
| UAWD | Wind direction | degrees from north | Include (<=) | 999 | 0 | 360 |
| UAWS | Wind speed | meters/second *10 | Exclude (<) | 9990 | 0 | 500 |

## Sectors Screen:

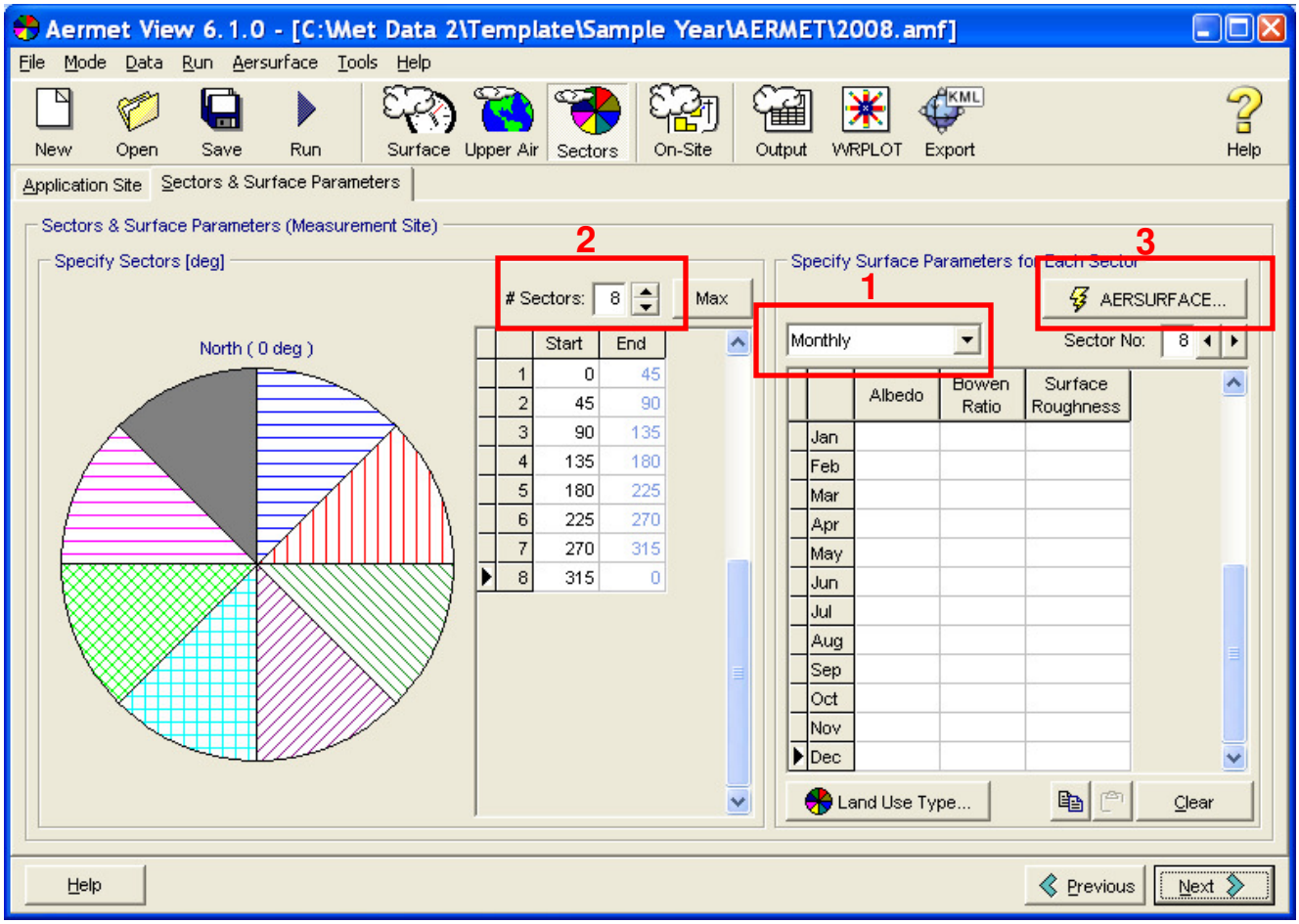
The Sectors screen has two tabs that need to be reviewed. The first tab is the "Upper Air Data" which allows the user to select the Upper Air file and format.




Sectors Details:

| Detail # | Description |
|---|---|
| 1 | Click the "Copy From Surface Station". This information will be used to determine the Bowen Ratio, Albedo, and Surface roughness parameters on the second tab. Current EPA guidance suggests that the sector parameters be based on the location where the surface meteorological data was collected. |
| 2A | Ensure that the Site ID field contains the surface station ID found on the "Hourly Surface Data" tab under the Surface screen. |
| 2B | Ensure that the Tome Zone field contains the appropriate value. For California it should read "UTC–8 (Pacific)". UTC (coordinated universal time) is basically the 20th century GMT better know as the atomic clock. |
| 3 | The anemometers at ASOS station are typically set at 10 meters. |
| 4 | **Randomize NWS Wind Directions:** Select this option to randomize the NWS wind directions in order to avoid a bias toward the cardinal compass points (N, S, E, and W). The wind directions are randomized for each 10 degree sector to one degree increments. A bias would occur for the un-randomized wind directions because three 10-degree sectors would contribute to the N, S, E, and W sector statistics (e.g., 350, 360 and 10 degrees for the north sector), while only two 10-degree sectors would contribute to the other 22.5 degree sectors.<br>**Leave NWS Wind Directions to the Nearest 10 Degrees:** This is the default option and reports the NWS wind directions to the nearest 10 deg. For example, a direction of 164 deg would be reported as 160.<br><br>**Please Note:** this value should be set to Randomize NWS Wind Direction as required by EPA |

The Second tab on the Sectors Screen is the “Sector & Surface Parameters” tab. This tab allows the user to enter surface parameters for sectors surrounding the meteorological station. EPA recommends that a 1 km radius be used to develop surface roughness parameters per sector and a 10 km radius be used to develop the Albedo and Bowen Ratio. Therefore it is recommended that AERSURFACE be used. The latest version of AERSUFACE incorporates the above recommendations.

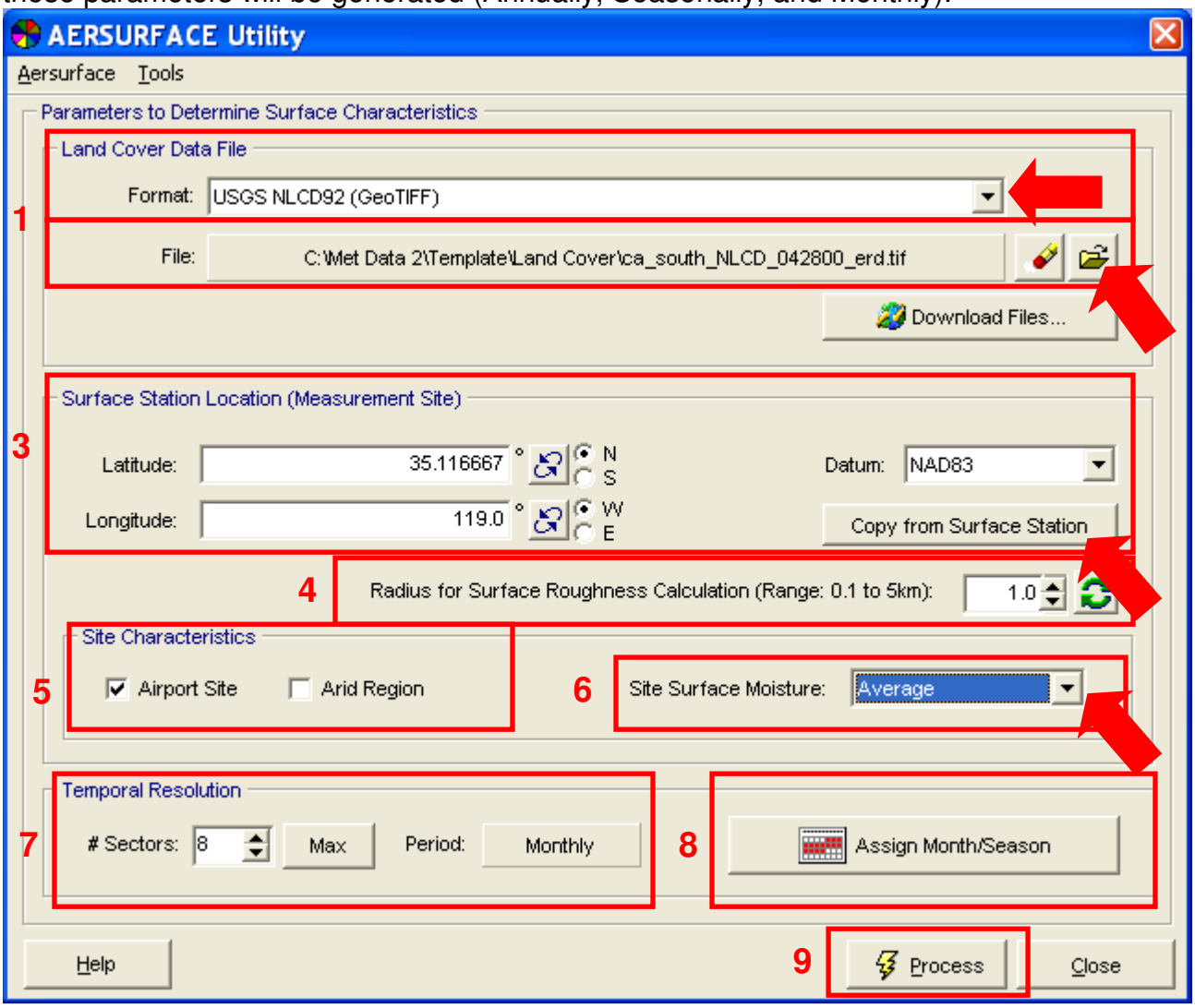



Sectors Details:

| Detail # | Description |
|---|---|
| 1 | It is recommended that the surface parameters be based on a monthly basis. |
| 2 | It is recommended that the “# Sectors” field not be set to a value less than eight sectors. |
| 3 | Click on the AERSURFACE button to import surface parameters using land cover data. Land cover data is included on the CD for all of California and is located in a folder call “Land Cover”. |

## AERSURFACE Utility Screen:

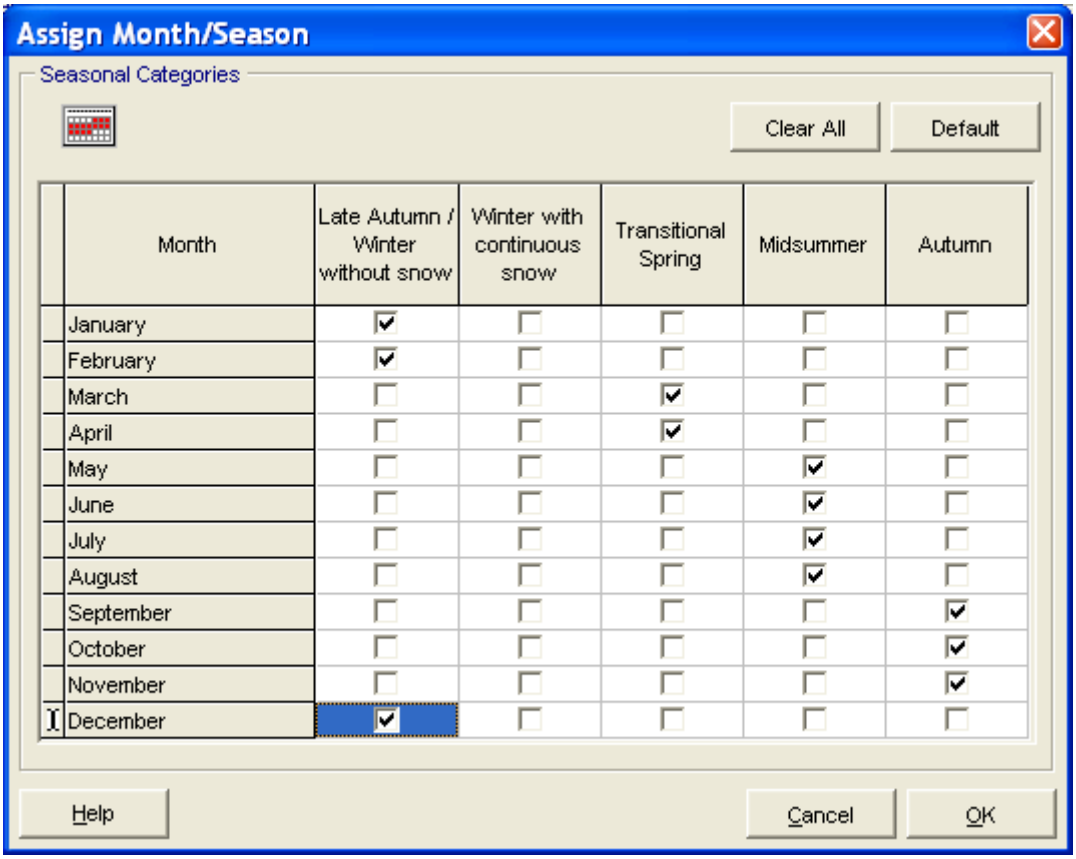
The AERSURFACE program is used to read land cover data contained in the Tiff files, which are included, using EPA guidance discussed above. It also allows the user to determine how those parameters will be generated (Annually, Seasonally, and Monthly).




Sectors Details:

| Detail # | Description |
|---|---|
| 1 | From the pull down select “USGS NLCD92 (GEOTII)” |
| 2 | Using the Open File button navigate to, and select the Tiff file to be used to determine the site specific surface parameters for this project. |
| 3 | EPA guidance is to use the location of the monitoring site to determine surface parameters. Therefore, click the “Copy from Surface Station” button to copy the location information from the Surface screen. |
| 4 | As discussed above, EPA guidance as of Jan 9, 2008 is to us a 1km radius around the surface station to determine surface roughness. |
| 5 | Most ASOS sites are located at an airport. AERSURFACE will use surface characteristics that reflect an area more dominated by transportation land cover. |
| 6 | Project surface moisture conditions compared to a 30 year average<br>○ **Wet** if precipitation is in the upper 30th-percentile |

| Detail # | Description |
|---|---|
| | ○ **Dry** if precipitation is in the lower 30th-percentile<br>○ **Average** if precipitation is in the middle 40th-percentile.<br>The monthly and annual 30 year averages (1971 – 2000) are located in the LAND Cover folder on the CD. |
| 7 | This information comes from the previous screen and should not be altered. |
| 8 | If you are calculating **Annually** or **Monthly**, you have the option to assign the months of the year to seasons other than the default, see screen shot below. AERSURFACE will use the surface parameters based on the month vs. the season allocated on this screen. |
| 9 | To start AERSURFACE running Click the "Process" button. AERSURFACE will access the Tiff file for the location selected and derive the necessary parameters based on the month/season allocation determined by the user. |



## Land Cover Data:

### Spatial Domains for Land Cover Files:

**California – North (ca_north_NLCD_042800_erd.tif)**

Bounding Coordinates:

West Bounding Coordinate: -125.091
East Bounding Coordinate: -118.088
North Bounding Coordinate: 41.826
South Bounding Coordinate: 37.660

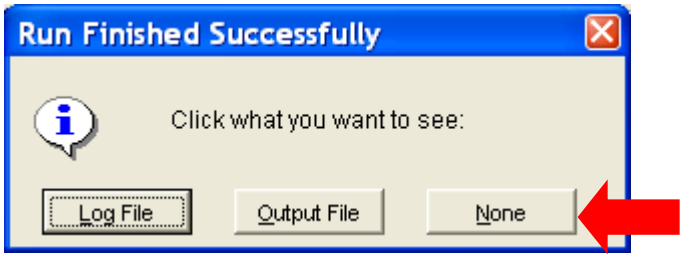
**California – South (ca_south_NLCD_042800_erd.tif)**

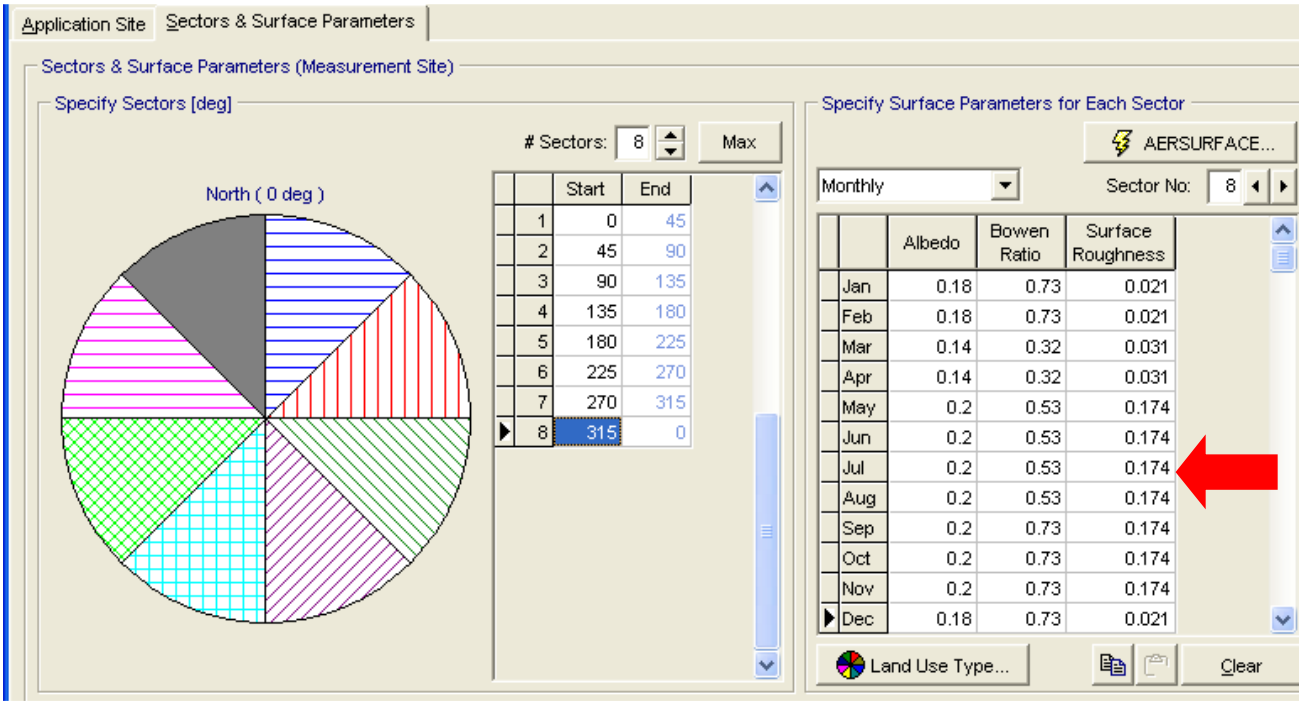
Bounding Coordinates:

West Bounding Coordinate: -123.029
East Bounding Coordinate: -113.800
North Bounding Coordinate: 36.651
South Bounding Coordinate: 32.858

## Surface Parameters Have Been Derived:

Once AERSURFACE completes running the user should see the following screen and the parameters on the "Sectors & Surface Parameters" tabs should be filled in, see the second screen shot below.



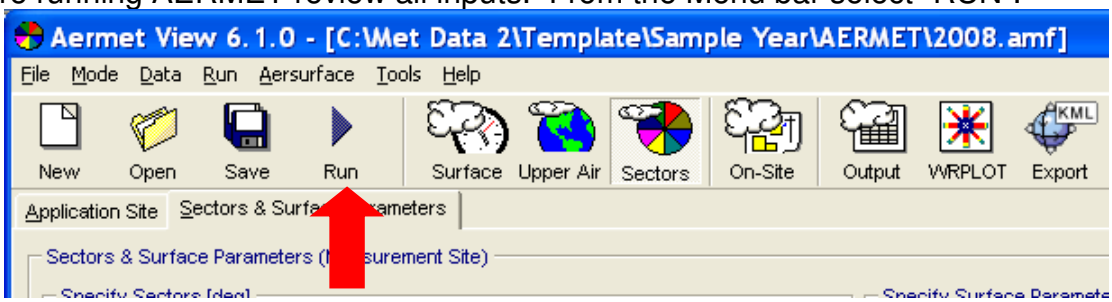



## *Are We There Yet?*

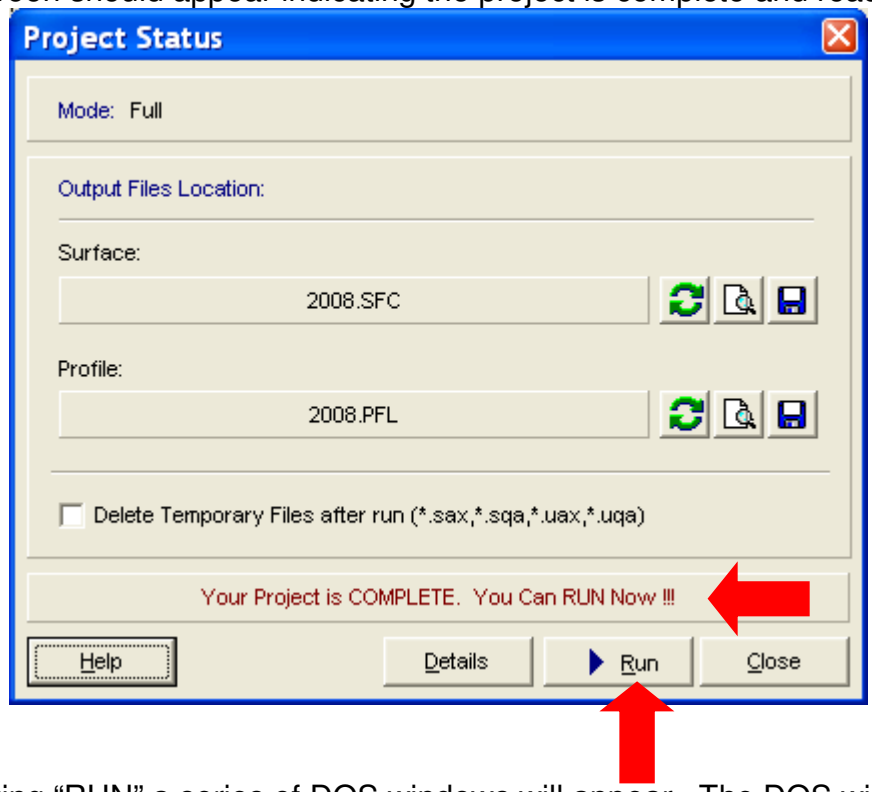
We are almost done. There are two final steps to completing the process. The first is to run AERMET and generate the Surface and Profile data files for AERMOD.

### Running AERMET

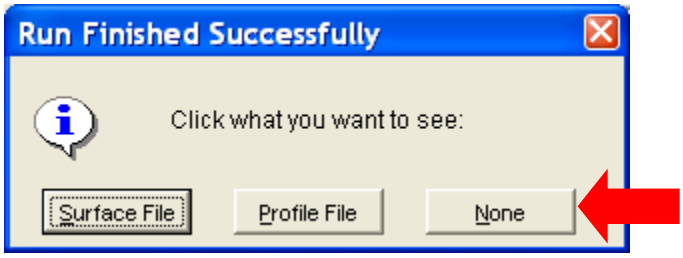
Before running AERMET review all inputs. From the Menu bar select "RUN".




The following screen should appear indicating the project is complete and ready to run.

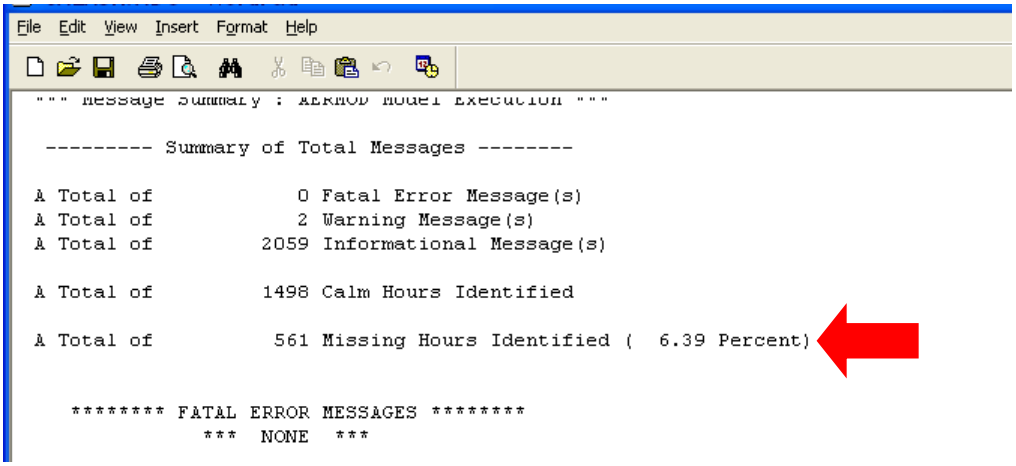



After clicking "RUN" a series of DOS windows will appear. The DOS windows represent the three stages OF THE AERMET process. The following screen should appear once the process is completed, allowing the user to view the new surface and profile files generated.




You are **DONE**. Close the AERMET program.

The Final Step is to run AERMOD and ensure that the number of missing hours is not greater than 10 percent. If your AERMOD run indicates that you have more than 10 percent missing hours, the data should not be used for regulatory purposes. An Air District can decide that this data is acceptable on a case by case basis.



BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT
COMMISSION OF THE STATE OF CALIFORNIA
1516 NINTH STREET, SACRAMENTO, CA 95814
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APPLICATION FOR CERTIFICATION
FOR THE ***HYDROGEN ENERGY CALIFORNIA, LLC PROJECT***

**Docket No. 08-AFC-8**

**PROOF OF SERVICE LIST**
**Rev. 10/21/10**

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## DECLARATION OF SERVICE

I, Dale Shileikis, declare that on October 21, 2010, I served and filed copies of the attached Memo to EPA: Model Parameter Selection for HECA Project 1-Hour $NO_2$ NAAQS Regional Modeling, dated October 11, 2010. The original document, filed with the Docket Unit, is accompanied by a copy of the most recent Proof of Service list, located on the web page for this project at: **[www.energy.ca.gov/sitingcases/hydrogen_energy]**.

The documents have been sent to both the other parties in this proceeding (as shown on the Proof of Service list) and to the Commission's Docket Unit, in the following manner:

***(Check all that Apply)***

### FOR SERVICE TO ALL OTHER PARTIES:

_____ sent electronically to all email addresses on the Proof of Service list;

_____ by personal delivery;

**X** By delivering on this date, for mailing with the United States Postal Service with first-class postage thereon fully prepaid, to the name and address of the person served, for mailing that same day in the ordinary course of business; that the envelope was sealed and placed for collection and mailing on that date to those addresses **NOT** marked "email preferred."

***AND***

### FOR FILING WITH THE ENERGY COMMISSION:

**X** sending an original paper copy and one electronic copy on CD, mailed to the address below (***preferred method***);

***OR***

_____ depositing in the mail an original and 12 paper copies, as follows:

**CALIFORNIA ENERGY COMMISSION**
Attn: Docket No. 08-AFC-8
1516 Ninth Street, MS-4
Sacramento, CA 95814-5512

docket@energy.state.ca.us

I declare under penalty of perjury that the foregoing is true and correct, that I am employed in the county where this mailing occurred, and that I am over the age of 18 years and not a party to the proceeding.