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.
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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:

$2\ NO + O_2 \implies 2\ NO_2$ 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):

$NO + O_3 \implies NO_2 + O_2$ 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

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

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[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 98th 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 98th 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 98th percentile concentrations. Future versions of the model are expected to include the calculation of a 5-year 98th 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** 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: Local Hour ARM: 0.9 Tier I – Maximum 1-hour : Tier II – 8th Highest : Tier III – 98th Percentile : Tier IV – Paired Sum :
Comments		
	Conclusion* 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 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