PSD AIR QUALITY ANALYSIS

AERMOD MODELING GUIDELINES

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PSD AIR QUALITY ANALYSIS

The purpose of this document is two-fold. First, it summarizes the general modeling requirements that are acceptable within the State of Alabama for Prevention of Significant Deterioration (PSD) Air Quality Analyses. Second, it will provide guidance on the various modeling procedures and input data to be used when performing these analyses. Deviations from the information presented here should always be coordinated with the ADEM Air Division for approval. Please refer to Section IV for significant items required in the PSD Air Quality Analysis.

I. APPLICABLE POLLUTANTS

The PSD air quality evaluation should address all pollutants below. For a major new source, discussion with the Air Division Permitting Staff is recommended to determine PSD applicability. For a major modification, a source is subject if the allowable yearly emissions exceed any of the designated significant emission rates listed below:

TABLE 1
CRITERIA FOR ESTABLISHING PSD SIGNIFICANCE – MAJOR MODIFICATIONS

Pollutant	Significant Emission Rate (Tons/Year)
Carbon Monoxide- CO	100
Nitrogen Oxides- NO_2	40
Sulfur Dioxide- SO_2	40
Particulate Matter- PM_{10}	15
Ozone (volatile organic compounds)	40
Lead	0.6
Fluorides	3
Sulfuric Acid Mist	7
Total Reduced Sulfur (including H_2S)	10
Hydrogen Sulfide	10

The air quality analysis also applies to any pollutant whose emission rate from a proposed new or modified source is considered to be significant because the proposed source would be constructed within 10 kilometers of a Class I Area and would have an ambient impact on the Class I Area of greater than or equal to 1 $\mu g/m^3$ on a 24-hour basis.

Both the applicable National Ambient Air Quality Standards (NAAQS) and the PSD increments are subject to air quality analyses in a typical PSD review. The following table lists the ambient standards and increments.

TABLE 2
PSD INCREMENTS AND NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

Pollutant	Averaging Period	Primary NAAQS*	Secondary NAAQS*	PSD Class II Increment*	PSD Class I Increment*
SO_2	3-Hour	None	1300	512	25
	24-Hour	365	None	91	5
	Annual	80	None	20	2
PM_{10}	24-Hour	150	150	30	8
	Annual	NA	NA	17	4
$PM_{2.5}$	24-Hour	35	35	None	None
	Annual	15	15	None	None
NO_2	Annual	100	100	25	2.5
CO	1-Hour	40,000	40,000	None	None
	8-Hour	10,000	10,000	None	None
O_3	8-Hour	(.075 ppm)	(.075 ppm)	None	None
Pb	Quarterly	1.5	1.5	None	None

*- Expressed in $\mu g/m^3$, unless otherwise noted.

II. PRE-MODELING MEETINGS AND MODELING PROTOCOL

A. Applicants are expected to arrange a meeting with ADEM Air Division staff prior to any modeling effort to avoid any misconceptions. The general discussion should cover the following points:

1. The pollutants applicable to the project.

2. The models to be used in the analysis.

3. The meteorological data required for input to the models and how that data will be shown to be representative of the facility.

4. Any complexities that may cause the analysis to be other than a straightforward application of standard EPA guidelines. Examples of these would include the following:

   a. Building downwash.

b. Use of on-site meteorological data instead of National Weather Service data.

c. Merged parameters for multiple stacks.

d. Modeling merged flows out of a single stack.

e. Property lines, fence lines and ambient air issues.

f. Stack height changes

g. Modeling of non traditional sources, such as buoyant volume and area sources

B. A written modeling protocol **must** be submitted to the ADEM Air Division for review prior to the commencement of the modeling analysis. The protocol should include the items in paragraph A above and serve to document the agreements and understandings resulting from the pre-modeling meeting, if one occurred. The protocol should also include the representative analysis for the meteorological data used. There will be a $1200 charge for the modeling protocol review.

C. Additional consultations with the ADEM Air Division staff may be necessary after initial modeling has been performed. This will allow the staff to keep abreast of the review and aid in resolving any problems that may arise.

III. SOURCE INFORMATION

The PSD Air Quality analysis should include the following source information:

A. A map showing the location of the source under review is required. In addition, figures illustrating the terrain and other identifiable features in the area of the proposed source(s) should be included with the application. This can be handled within the same diagram. All maps and diagrams should be scaled.

B. A scaled map of the facility clearly delineating the locations of all sources modeled, all buildings considered in the downwash analysis and plant property boundaries. Building sizes and shapes on the map should be drawn to scale.

C. A land use analysis, to determine if rural or urban dispersion coefficients should be used in the modeling, is required. It is recommended that the Auer scheme be used for this analysis. See Appendix A for details on using the Auer scheme. The permit applicant is required to demonstrate in a diagram if the surrounding 3-kilometer area can be classified as rural or urban.

D. Tables are required for identifying all baseline and increment sources used in the modeling, including all applicable stack parameters (UTM coordinate locations, emission rate, stack height, exit velocity, exit temperature and inner diameter), area source parameters (emission rate, southwest coordinates, height, width), and volume source parameters (emission rate, center coordinates, height, horizontal and vertical dimensions). For sources with vertically capped or horizontal releases, please contact the ADEM Meteorological Section for revised stack parameters to be used in the dispersion modeling analysis, or follow the AERMOD Implementation Guidelines, which can be found at http://www.epa.gov/scram001.

E. For all sources, please provide a listing of the identifiers assigned to these sources for modeling purposes.

IV. METEOROLOGICAL DATA

A. On-Site (Site-Specific) Data

1. A minimum of one year of meteorological data gathered on-site is preferred for use in air quality analyses, provided that the data meets quality assurance requirements. If it is likely that on-site meteorological data will be used in the modeling analysis, please follow the guidance below for submittal of the data:

2. Protocol for On-Site Meteorological Data Collection Program.
   If on-site meteorological data will be collected for the purpose of performing air quality modeling, a protocol document outlining the overall meteorological data program should be submitted to ADEM **prior** to the commencement of data collection. This protocol should cover the following points: location of the meteorological station relative to structures and stacks as well as terrain features; duration of meteorological data gathering, including beginning and ending dates; reason for collection of the data (models to be used, etc.); types of data to be collected and levels of collection; discussion of the instrumentation used; discussion of the siting and exposure of the instruments for all meteorological variables; details on the processing of the data including:
   a. Replacement of missing data.
   b. Calm wind processing.
   c. Data handling procedures.
   d. Computational methods.

   and Quality Assurance procedures, including discussions on:
   a. Instrument calibration and maintenance.
   b. System audits.
   c. Data validation.

3. Submission of Meteorological Data
   If on-site data are available for use in air quality modeling, the data must be submitted to ADEM for approval **prior** to the commencement of modeling. The submittal should include justification for use of the data as well as the following:

a. A written summary report including a discussion of the overall monitoring program followed by details on: data sources, data quality, data completeness, data handling procedures, and computational methods. In addition, documentation on the following should be included: methods of missing data replacement and quality assurance procedures that will also include discussions of instrument calibration, instrument maintenance (routine and preventative) system audits, and data validation.
b. The actual data, submitted quarterly, as well as a final summary report. These reports will include the raw on-site data converted to hourly averages submitted in ASCII format on CD ROM. If the data is in binary format (such as data generated by RAMMET), then convert the data to ASCII and include a copy of the program used to do the conversion on the CD ROM. Lastly, the data in model ready form should be provided as part of the application.
c. A landuse map should be submitted to ADEM for approval demonstrating the landuse in the 12 sectors around the meteorological tower. Landuse around the tower should be thoroughly discussed in protocol submittal.
d. ADEM will determine if setting for surface moisture in AERSURFACE should reflect wet, dry, or average conditions for the application site.
e. ADEM will provide monthly seasonal information needed to run the AERSURFACE model.
f. Inputs used in the AERSURFACE model should be listed in the modeling protocol for approval by ADEM.

The EPA February 2000 document "Meteorological Monitoring Guidance for Regulatory Modeling Applications" (EPA-454/R-99-005) should be consulted for guidance on the collection, processing and submittal of on-site meteorological data.

B. National Weather Service (NWS) Data

1. In lieu of on-site meteorological data, representative National Weather Service (NWS) data may be used. The most recent readily available five years of representative data are required. See Appendix B to locate the representative NWS station for your facility. It is the responsibility of the applicant to ensure that the correct meteorological dataset is used.

2. The pre-processed, hourly NWS meteorological data can be provided by the ADEM Air Division for a handling fee of $510. These data will consist of AERMET STAGE3 output files (*.pfl & *.sfc) along with AERSURFACE output and log files. A written request is required by the ADEM Air Division to receive the data. This request may also be submitted via fax or e-mail. In most cases the interested party should have their request answered within a week's time.

C. Data Representativeness

Meteorological data used in AERMOD must be shown to be reasonably representative of the meteorological conditions at the facility under review. Because the dispersion of emissions from the facility depends on both the meteorology and the effect the surface characteristics have on the lower layers of the atmosphere in the vicinity of the facility, the representativeness question becomes more complex than when using ISCST3. To help understand that issue better, the following is extracted from the AERMOD IMPLEMENTATION GUIDE (which is available on EPA's SCRAM website (http://www.epa.gov/scram001/)):

"When using National Weather Service (NWS) data for AERMOD, data representativeness can be thought of in terms of constructing realistic planetary boundary layer (PBL) similarity profiles and adequately characterizing the dispersive capacity of the atmosphere. As such, the determination of representativeness should include a comparison of the surface characteristics (i.e., z_o (surface roughness), B_o (Bowen ratio), and r (albedo)) between the NWS measurement site and the source location, coupled with a determination of the importance of those differences relative to predicted concentrations. Site-specific meteorological data are assumed by definition to be representative of the application site; however, the determination of representativeness of site-specific data for AERMOD applications should also include an assessment of surface characteristics of the measurement and source locations and cannot be based solely on proximity. The recommendations presented in this section for determining surface characteristics for AERMET apply to both site-specific and non-site-specific (e.g. NWS) meteorological data.

The degree to which predicted pollutant concentrations are influenced by surface parameter differences between the application site and the meteorological measurement site depends on the nature of the application (i.e., release height, plume buoyancy, design metric, downwash considerations, etc.). For example, a difference in z_o for one application may translate into an unacceptable difference in the design concentration, while for another application the same difference in z_o may lead to an insignificant difference in design concentration. If the reviewing agency is uncertain as to the representativeness of a meteorological measurement site, a site-specific sensitivity analysis may be needed in order to quantify, in terms of expected changes in the design concentration, the significance of the differences in each of the surface characteristics.

If the proposed meteorological measurement site's surface characteristics are determined to NOT be representative of the application site, it may be possible that another nearby meteorological measurement site may be representative of both meteorological parameters and surface characteristics. Failing that, it is likely that site-specific meteorological data will be required."

Applicants are encouraged to use EPA's AERSURFACE program in developing surface characteristics for their facility in order to compare them to the characteristics at the meteorological measurement site. It is highly recommended that ADEM Air Division be consulted early in the PSD

process to discuss meteorological data and the representativeness demonstration. For further guidance on this subject, refer to Appendix C, Meteorological Data Representativeness.

V. MODELING METHODOLOGY

A. Applicable Models

1. The air quality models to be used are those listed in the "Guideline on Air Quality Models", 40 CFR Part 51 Appendix W. To avoid unnecessary modeling efforts, it is strongly recommended that the applicant coordinate with the ADEM Air Division on the types of models to be used. Use of models other than those listed in 40 CFR Part 51 Appendix W must be approved by the Air Division Chief in advance of any modeling. This approval also applies to the use of guideline models in situations where they are not recommended. In either of these scenarios, it must be demonstrated that the recommended models listed in 40 CFR Part 51 Appendix W are not appropriate for a particular situation.

2. All air quality analyses should be performed using the most currently available versions of EPA guideline models. Access to all current models is possible through the EPA Web Page http://www.epa.gov/scram001/ .

B. Significant Impact Area Determination Modeling

Determination of the Significant Impact Area (SIA) is based on modeling of the proposed major new source or modification only. New sources are modeled at their future maximum allowable emission rate. Modified sources may, on a case by case basis, be modeled with their actual emission rate over the last two years input as negative and their future maximum allowable emission rate input as positive. The applicant should consult with the Air Division for the proper emission rates to be used in SIA determination modeling for modified sources. SIA determination modeling at a minimum should be performed utilizing a 10 kilometer (km) receptor grid with appropriate grid spacing and with the AERMOD model in default mode. Additional grids may be necessary based on impacts. Five years of representative NWS data or one or more years of representative near or on site meteorological data should be used in the modeling. Building downwash should also be included.

Receptor elevations should be considered in the modeling. DEM data sets for all USGS quadrangles in and close to Alabama can be downloaded, free of charge, from ADEM's FTP site at ftp://adem.state.al.us/demquads. USER NAME: ftpuser, PASSWORD: ftpuser. Please list all relevant quadrangles in the application.

The cartesian or polar grid used with this modeling should clearly show the distance to where highest short term and long term ambient concentrations fall below the significance levels given in Table 3. For the purposes of this

discussion, we will call this distance the critical distance. The SIA is defined as a circular area centered on the proposed source with a radius equal to the critical distance. The SIA must be established for every averaging period of every applicable pollutant for every year of meteorological data. The SIA, for each applicable pollutant, over which NAAQS and increment compliance modeling is performed, should be the largest of these areas.

If predicted concentrations are below the levels in Table 3 for a given pollutant, then no further modeling is required for that pollutant.

TABLE 3
SIGNIFICANT AMBIENT AIR QUALITY IMPACTS FOR CLASS II AREAS

Pollutant	Annual	24-Hour	8-Hour	3-Hour	1-Hour
SO_2	1 $\mu g/m^3$	5 $\mu g/m^3$	--	25 $\mu g/m^3$	--
PM_{10}	1 $\mu g/m^3$	5 $\mu g/m^3$	--	--	--
NO_2	1 $\mu g/m^3$	--	--	--	--
CO	--	--	500 $\mu g/m^3$	--	2000 $\mu g/m^3$

NOTE: See the section on Federal Class I Areas for the appropriate Class I significance levels.

Once the significant impact area is established for NAAQS/Increment compliance modeling, emission inventories of existing sources within the SIA will then be provided by the ADEM Air Division. The fee for this information includes a $680 flat fee plus $70 **per point per pollutant**. Please allow 4-6 weeks for inventories to be prepared by ADEM. These inventories will identify sources as baseline, increment consuming, or increment expanding and are in model ready format. The ADEM Air Division should be contacted for this information. When requesting an inventory please supply the actual SIA for each pollutant as well as the centroid UTMs and the pollutants of interest. Do not add 50 km to the SIA, as ADEM does that internally when preparing inventories

C. Ambient Monitoring Requirements

1. Preconstruction Monitoring

The initial SIA determination modeling analysis must also address preconstruction monitoring requirements for all proposed sources whose predicted ambient impact exceeds any of the significant monitoring concentrations specified in Table 4.

TABLE 4
DE MINIMIS PRECONSTRUCTION MONITORING CONCENTRATIONS

POLLUTANT	SIGNIFICANT MONITORING CONCENTRATION ($\mu g/m^3$)	AVERAGING PERIOD
CO	575	8-hour average
NO_2	14	Annual average
SO_2	13	24-hour average
PM_{10}	10	24-hour average
O_3	No specific concentration is prescribed[1]	
Pb	0.1	3-month average

[1]No significant monitoring concentration is provided for ozone. However, any source having a net increase of 100 tons per year or more of VOCs will be required to proceed to Paragraph 2 *Pre-Operation/Post-Operation Ozone Monitoring*

The required steps for addressing preconstruction monitoring are outlined below:

Step a Model only the major new or modified sources and compare concentrations against the de minimis monitoring levels (Table 4). Note that the source(s) included in this modeling are the same as those included in the SIA determination modeling. If these levels are not exceeded, monitoring is not required. If the de minimus levels are exceeded, proceed to Step b.

Step b Model the existing sources at the facility and all sources within the significant impact area and compare the modeled concentrations to Table 4. Again, if the de minimis levels are not exceeded, monitoring is not required. If there are no existing sources at the facility or within the significant impact area, monitoring is not required. If the de minimus levels are exceeded, proceed to Step c.

Step c Check with the ADEM Air Division for representative ambient monitoring data, which may exempt the applicant from preconstruction monitoring. If no such data exists, then the applicant may be required by the Air Division Chief to conduct its own monitoring program.

2. Pre-Operation/Post-Operation Ozone Monitoring

As authorized in the Department's regulations, pre or post operation monitoring for ozone may be considered for any source that triggers PSD review for NOx or VOC.

Sources should anticipate discussing the possibility of ozone monitoring early in the permitting process. If monitoring is necessary, applicants should plan to monitor for at least three years. The monitoring system should be compatible with ADEM's data acquisition system. In addition, the data must meet Federal quality assurance procedures and quarterly reports must be submitted to ADEM for review. In the event that monitoring is required, a protocol document should be submitted for review and approval by the ADEM Air and Field Operations Divisions **prior** to the commencement of collection of data. Applicants are strongly encouraged to discuss the possibility of ozone monitoring in a modeling

protocol document or through consultation with ADEM prior to submittal of an application.

D. NAAQS/Class II Increment Compliance Modeling

NAAQS/Class II Increment compliance modeling is performed only if the SIA determination modeling indicates that the new or modified source(s) could have a significant impact on air quality. The purpose of NAAQS/Class II Increment compliance modeling is to demonstrate that the new or modified source(s) will not cause or contribute to a violation of a NAAQS or a PSD Increment. (NAAQS and PSD Class II Increments are listed in Table 2).

NAAQS/Class II Increment compliance modeling must address all areas within the Significant Impact Area (SIA). All maximum predicted concentrations should be resolved to the nearest 100 meters. This includes maximum predicted annual concentrations as well as high-second-high short term concentrations for all pollutants except for the 24 hour PM_{10} NAAQS. The 24 hour PM_{10} NAAQS is achieved when the high-sixth-high concentration over five years is less than the standard. NAAQS/Class II Increment compliance modeling involves the source(s) under review as well as sources from within and near the SIA in the inventory provided by the ADEM Air Division. Modeling to address the NAAQS should include the source(s) under review as well as all increment consumers and baseline sources in the inventory provided. Modeling to address the PSD Increments should include the source(s) under review as well as all increment consumers and increment expanders in the inventory provided by the ADEM Air Division. All AERMOD modeling should be completed with receptor elevations.

Background concentrations are required to be added to modeled ambient impacts when addressing the NAAQS. These background concentrations cannot be used as substitution for refined modeling of additional industrial sources in the area of concern. The following table gives the appropriate statewide background levels.

TABLE 5
BACKGROUND CONCENTRATIONS

Pollutant	Averaging Period	Background Conc. ($\mu g/m^3$)
SO_2	3-Hour	10
	24-Hour	10
	Annual	10
NO_2	Annual	7.5
CO	1-Hour	100
	8-Hour	100
PM10		SEE NOTE

NOTE: Please contact ADEM for background PM_{10} concentrations.

If any violations of the NAAQS or PSD increments are predicted, then the source under review must demonstrate that they do not significantly contribute to any of the predicted violations. If this cannot be demonstrated, contact the ADEM Air Division for further instruction.

E. Good Engineering Practice (GEP) Review

A GEP review must be conducted for each proposed new or modified source to determine if building downwash effects need to be included in the modeling and to determine the appropriate stack heights to be used with the model(s). Any computer software used to obtain the necessary information for GEP stack heights and downwash parameters should be described in the application and input and outputs provided to ADEM for review in electronic form.

In order to facilitate ADEM's review, a scaled plant diagram showing the location of each structure and stack must be included in the application. Also, this diagram should show the plant property boundaries and any fenced areas around the plant.

For details on conducting a GEP analysis, please refer to Appendix D.

F. Federal Class I Areas

Ambient impacts must be determined for any Class I area within 100 km of the proposed source. Proposed sources beyond 100 km from a Class I area should contact ADEM to discuss possible options for modeling.

The two Class I areas of primary concern for most sources locating in Alabama are the Sipsey Wilderness Area in Northwestern Alabama, and the Breton Wildlife Refuge off the coast of Louisiana. See Appendix E to determine the proximity of your facility to any of these areas.

In addition to the two Class I areas addressed above, a small portion of extreme northeast and southeast Alabama are within 100 km of the Cohutta Class I area in northern Georgia and the Bradwell Bay Class I area in northwest Florida, respectively. Any sources in the northeastern portions of Cherokee, Dekalb or Jackson counties, or the southeastern portion of Houston county should contact the ADEM Air Division in order to determine if a Class I analysis should be performed for one of those Class I areas.

Class I Area Modeling:

Modeling to assess impacts at a Class I area beyond 50 km should utilize the regulatory version of the CALPUFF modeling system with appropriate regional meteorology and follow the guidance document entitled "**Interagency Workgroup on Air Quality Modeling (IWAQM) Phase II Summary Report and Recommendations for Modeling Long Range Transport Impacts**" EPA-454/R-98-019, December 1998. ADEM will provide, free of charge, 4 km meteorological data for the years 2001-2003 to be used in the CALPUFF modeling. Please contact Scott Southwick for more information by phone at 334-279-3079 or via email at ssouthwick@adem.state.al.us. Facilities within 50 km of a Class I area should contact the ADEM Air Division for discussion of the appropriate model to use.

There are three key components of a Class I analysis: a Class I increment analysis, a plume blight analysis and an air quality related value (AQRV) analysis.

1. Class I Increment

In general, a Class I Increment analysis consists of an initial "screening analysis" to determine whether the new or modified source will have a significant impact on air quality in the Class I area. This determination is made by comparing the projected impacts from the source under review to the Class I "Significance Levels" (SIL's) proposed by EPA provided in Table 6 below. If impacts are below the Class I SIL's, then the increment portion of the Class I analysis is complete. If impacts are above the Class I SIL's, then a "Cumulative Class I Increment Analysis" will be performed. If this is the case, an inventory of sources within at least 100 kilometers of the Class I area will be developed, **at cost to the facility**, for use in determining total increment consumption for the Class I area. Please contact the ADEM Meteorological Section before proceeding with Class I Increment modeling to ensure that the methodology is consistent with EPA guidance.

TABLE 6
SIGNIFICANCE LEVELS FOR CLASS I AREAS

	Averaging Period		
Pollutant	**Annual***	**24-Hour***	**3-Hour***
SO_2	0.1 $\mu g/m^3$	0.2 $\mu g/m^3$	1.0 $\mu g/m^3$
PM_{10}	0.2 $\mu g/m^3$	0.3 $\mu g/m^3$	- -
NO_2	0.1 $\mu g/m^3$	- -	- -

*- These are proposed changes to the Class I Significance Levels through revisions to the PSD/NSR program. These changes have not been finalized to date.

2. Plume Blight

A plume blight analysis must be performed for any proposed source within 50 km of a Class I area. Output from the visibility models, either VISCREEN or PLUVUEII, as well as a listing of all input parameters for each pollutant should be included in the application. Procedures used in performing this analysis should be consistent with the EPA guideline document entitled, "**Workbook for Plume Visual Impact Screening and Analysis**." (EPA-450/4-88-015- September 1988, rev. 10/92). Additionally, a regional haze analysis may be required, so the ADEM Meteorological Section should be contacted to discuss this possibility. All visibility modeling with CALPUFF should utilize Method 2.

3. Air Quality Related Value Analysis (AQRV)

An AQRV analysis is not currently required by ADEM, but is recommended. The current recommended AQRV analyses consist of an evaluation of regional haze as well as sulfur and nitrogen deposition at all Class I areas with the exception of Bradwell Bay which is only evaluated for deposition. The guidance documents that outline a recommended approach for the evaluation of these AQRV's are: The **"Federal Land Managers' Air Quality Related Values Workgroup (AQRV) Phase I Report" (December 2000)**, as well as **"Guidance on Nitrogen and Sulfur Deposition Analysis Thresholds" (August 2001)**. ADEM should be contacted to discuss the situations in which these analyses will be performed before proceeding. The FLAG guidance is currently being revised. When this guidance is released, ADEM will evaluate and revise the modeling guidelines accordingly.

VI. AIR QUALITY ANALYSIS CONTENTS

A. Text Contents

1. Description of model(s) used and any special assumptions or options employed. Justification should be included for the use of any non-regulatory options. If proprietary software is used, for example to facilitate data input or process output, please identify the software.

2. Description of the meteorological input data used, with an explanation of any modification(s) made. If an alternate set of data is used, please include justification for using a specific set of meteorological data along with a demonstration of data representativeness.

3. A detailed analysis to demonstrate that the surface characteristics in the vicinity of the meteorological collection site (furnished by ADEM) are representative of the surface characteristics in the vicinity of the facility.

4. Overall description of the methodology used in performing the analysis. This includes all steps necessary for identifying the maximum increment consumption and ambient impact values used in comparison with PSD increment levels and ambient standards (NAAQS).

5. Tables identifying the maximum increment consumption and ambient levels (including receptor locations and year of meteorology) for all averaging periods and pollutants considered, including the contribution of the new facility to these maxima.

6. Figures of isopleths that illustrate the aerial extent of increment consumption and ambient levels. Location of maximum predicted concentrations should be clearly noted and a comparison made to the air quality standard of concern. (Preferably the figures should

have a background illustrating terrain or other identifiable features, such as a U.S.G.S. Map, for easy orientation).

B. Appropriate model output files substantiating points of concern, as described in the text, should be submitted.

1. Submit model output needed to verify the identification of the significant impact area and all reported maximum impact values with respect to PSD increments and ambient standards. Modeling runs submitted should include:

a. Source input parameters for all sources modeled.

b. Identification of the meteorology used.

c. List of options used in the particular model run.

d. Concentration tables for averaging periods of concern.

2. The ADEM Air Division requires the applicant to submit results electronically which include all model input and output and preprocessor (i.e. AERSURFACE) files as well as any downwash program input and output files. This will assist both the ADEM Air Division and the applicant by speeding up the review process. Additional modeling files may be required by the ADEM Air Division, as necessary, during the course of the PSD review.

VII. NEW SOURCES OF AIR TOXICS

Increases in emissions of possible air toxics resulting from new or modified sources are required to be addressed according to the following procedures:

A. Model each new or modified source of an air toxic using a screening model. Also, any criteria pollutant which has a Time Weighted Average (TWA), such as Lead, that does not trigger PSD significance should be modeled in the air toxics analysis and compared to the applicable NAAQS.

B. Compare predicted 1-hour concentrations against 1/40 of the Threshold Limit Value (TLV). It should be noted that the TLV used in the analysis should be based on the Time Weighted Average (TWA) for the pollutant. STELs should not be used in lieu of a TWA. TLV's used for this purpose are published yearly by the American Conference of Governmental and Industrial Hygienists (ACGIH).

C. If Step B shows that the predicted 1-hour concentration is greater than 1/40 of the TLV, then perform further modeling with a refined model using each year of the latest five-year representative meteorological data set.

D. Compare modeled annual concentrations to 1/420 of the TLV.

E. If Step D predicts annual concentrations greater than 1/420 of the TLV for one or more toxics, further consultation with the ADEM Air Division is advised before proceeding.

For each air toxic under consideration, a table of all stack and emission parameters, as well as the appropriate TLV, should be included in the application.

VIII. ADDITIONAL IMPACT ANALYSIS

A. An analysis should be prepared to address the impact on visibility, soils and vegetation that would occur as a result of the source or modification and general commercial, residential, industrial, and other growth associated with the source or modification. For local visibility impacts, any State or National Parks, or regional or international airports within the Significant Impact Area (SIA) should be modeled with either the VISCREEN or PLUVUE II model to determine the source's contribution to plume blight at those receptors. Output from the visibility model as well as a listing of all input and source parameters for each pollutant should be included in the application. Procedures used in performing this analysis should be consistent with the EPA guideline document entitled, "**Workbook for Plume Visual Impact Screening and Analysis**." (EPA-450/4-88-015- September 1988, rev. 10/92)

B. The extent of the general commercial, residential, industrial, and related growth associated with the proposed source must also be considered. If significant growth in any of these areas is expected, the effects on the predicted concentrations of each pollutant considered in the application must be addressed.

APPENDIX A

Urban/Rural Classification - Auer Method

The EPA "Guideline on Air Quality Models" EPA-450/2-78-027R-C, Appendix W of CFR Part 51 specifies a procedure to determine whether the character of the modeling area is primarily urban or rural. Two methods that can be used for performing this procedure are based on land use and population density. The land use procedure is the recommended approach.

The land use procedure classifies land use within an area circumscribed by a circle, centered on the source, with a radius of 3 kilometers. Table A-1 acts as a guide to help define the specific types of land use and their corresponding descriptions as defined by Auer (1978). If land use types I1, I2, C1, R2, and R3 account for 50 percent or more of the land use within 3 kilometers of the source, then the modeling regime is considered urban. Please note that the residential and industrial areas are often the pink and purple-colored areas identified on U.S.G.S. 7.5 minute topographic maps.

The population density procedure uses the same 3-kilometer circle as described above. The population within the circumscribed area is determined from Census Bureau Enumeration District data. This population is divided by the area of the circle to give the population density around the source. If the population density exceeds 750 people/km^2, the modeling regime is considered urban. Otherwise it is classified as rural.

Documentation of the Land Use Classification should be included in the application along with an illustrative representation of the area.

The classification of the area as urban will require additional input data in AERMOD. The AERMOD User's Guide should be consulted to determine what additional inputs are needed.

TABLE A-1

IDENTIFICATION AND CLASSIFICATION OF LAND USE TYPES (AUER 1978)

Type	Use and Structure	Vegetation
I1	**Heavy Industrial** Major Chemical, steel & fabrication industries; general 3-5 story buildings, flat roofs.	Grass & tree growth extremely rare. Less than 5% vegetation.
I2	**Light-moderate industrial** Rail yards, truck depots, warehouses, industrial parks, minor fabrications; generally 1-3 story buildings, flat roofs.	Very limited grass, trees almost totally absent. Less than 5% vegetation.
C1	**Commercial** Office & apartment buildings, hotels, 10 story heights, flat roofs.	Limited grass & trees. Less than 15% vegetation.
R1	**Common residential** Single family dwelling with normal easements; generally 1 story, pitched roof structures, frequent driveways.	Abundant common lawns & light-moderate wooded. Greater than 70% vegetation.
R2	**Compact residential** Single, some multiple, family dwelling with close spacing, generally 2 story, pitched roof structures; garages (via alley) and ashpits, no driveways.	Limited lawn sizes & shade trees. Less than 30% vegetation.
R3	**Compact residential** Old multi-family dwellings with close (2m) lateral separation; generally 2 story, flat roof structures; garages (via alley) and ashpits, no driveways.	Limited lawn sizes, old established shade trees. Less than 35% vegetation.
R4	**Estate residential** Expansive family dwelling on multi acre tracts.	Abundant grass lawns & light wooded. Greater than 80% vegetation.
A1	**Metropolitan natural** Major municipal, state or federal parks, golf courses, cemeteries, campuses; occasional single story structure.	Nearly total grass & lightly wooded. Greater than 95% vegetation.
A2	**Agricultural rural**	Local crops (e.g., corn, soybeans). Greater than 95% vegetation.
A3	**Undeveloped** Uncultivated; wasteland.	Mostly wild grasses & weeds, lightly wooded. Greater than 90% vegetation.
A4	**Undeveloped rural**	Heavily wooded. Greater than 95% vegetation.
A5	**Water surfaces** Rivers; lakes.	

APPENDIX B

Representative National Weather Service Data

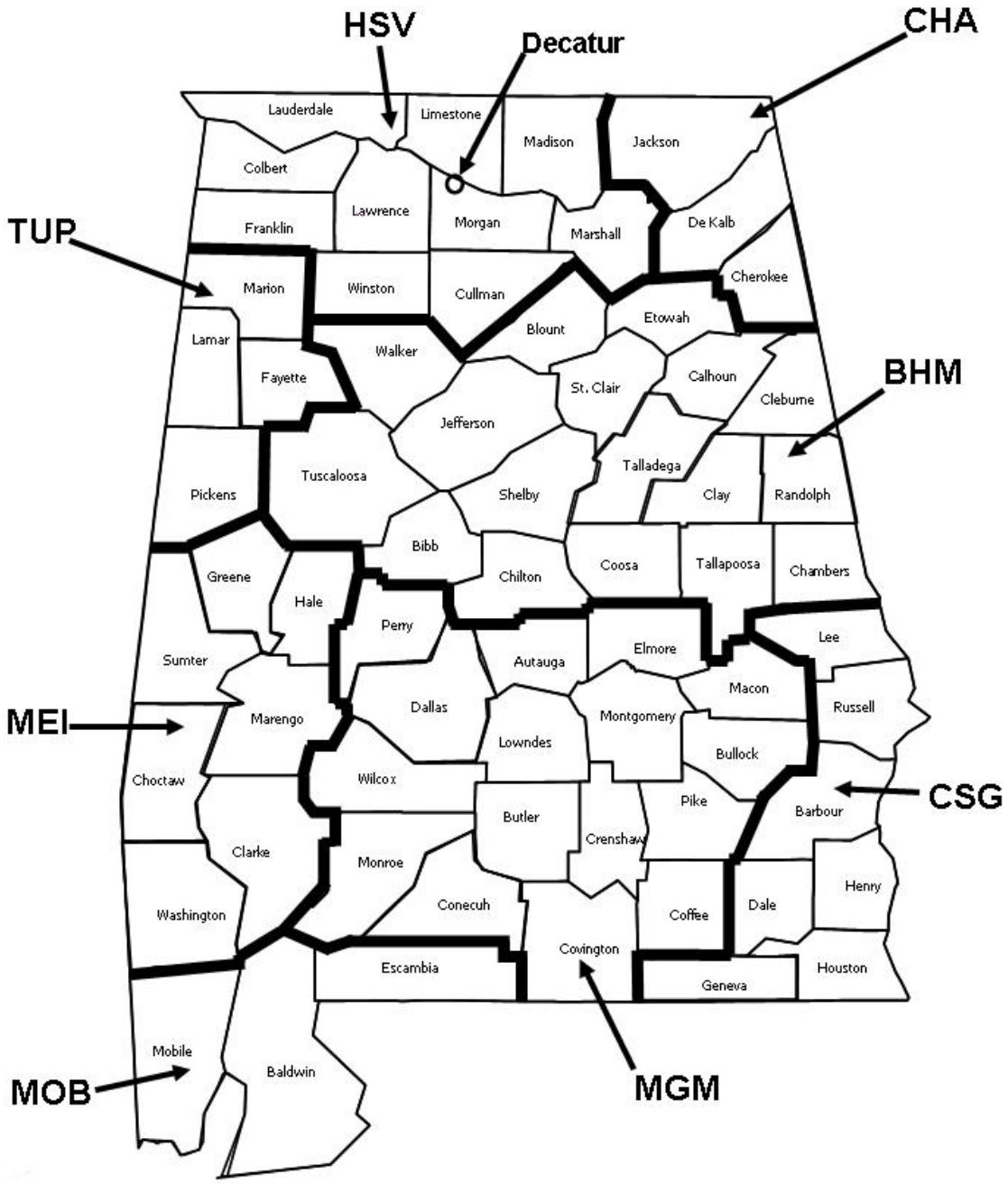
See Attachment 1 to identify the area of the State in which the proposed new source or modified source will be located. Based on this area, use the chart below to determine which National Weather Service (NWS) station data to use in the modeling. The station identification numbers are also indicated:

Area	NWS Surface Station	ID #	Profile Base (m)	NWS Upper Air Station	ID #
HSV	Huntsville, Alabama	72323	190.2	Nashville, Tennessee	13897
CHA	Chattanooga, Tennessee	72324	204.5	Nashville, Tennessee	13897
TUP	Tupelo, Mississippi	72332	110.0	Alabaster, Alabama	53823
BHM	Birmingham, Alabama	13876	187.5	Alabaster, Alabama	53823
CSG	Columbus, Georgia	72225	119.5	Alabaster, Alabama	53823
MEI	Meridian, Mississippi	72234	89.6	Alabaster, Alabama	53823
MGM	Montgomery, Alabama	72226	61.6	Alabaster, Alabama	53823
MOB	Mobile, Alabama	72223	65.5	Slidell, Louisiana	53813
Decatur*	TVA	N/A	178.3	Nashville. Tennessee	13897

* Contact ADEM to determine the applicability of using TVA data in the Decatur area.

Attachment 1 to APPENDIX B

Alabama Modeling Domains



APPENDIX C

Meteorology Data Representativeness Demonstration

Meteorological data used in AERMOD must be shown to be reasonably representative of the meteorological conditions at the facility under review. Because the dispersion of emissions from the facility depends on both the meteorology and the effect the surface characteristics have on the lower layers of the atmosphere in the vicinity of the facility, the representativeness question becomes more complex than when using ISCST3. The following is provided to assist the applicant in demonstrating data representativeness. Sources are expected to submit a representativeness analysis for approval prior to submitting an application.

Preliminary

1. Determine the representative NWS met data location by comparing the county where the facility is located and the appropriate Modeling Domain shown in Appendix B.
2. Obtain the surface characteristics file for the applicable NWS station from ADEM. This file has been created by ADEM, using the AERSURFACE program, and consists of land use/land cover information and surface characteristics applicable to the met site. Following EPA guidance, a 1km radius circle around the met tower was used to determine surface roughness in each of 12 equal sectors. Albedo and Bowen ratio were calculated for a 10km X 10km domain around the met site, without regard to direction. Furthermore, ADEM has taken advantage of AERSURFACE's flexibility to handle year-to-year soil moisture differences and meteorological seasons instead of default calendar seasons. This information will also be provided in the surface characteristics file and is also presented in Attachment 1 of this Appendix.

Surface Characteristics for Facility-Under-Review

1. ADEM strongly recommends the applicant use the AERSURFACE program to create surface characteristics for their facility.
2. Regardless of what method is used, the applicant must follow the guidance in the AERMOD Implementation Guide, paragraph 3.1.2, for developing surface characteristics. Any deviations from these guidelines should be thoroughly documented, justified and discussed prior to submittal of the application..

Comparison of Surface Characteristics

The following are some suggested approaches that may be followed to demonstrate representativeness of the NWS site surface characteristics and the surface characteristics at the facility under review. These approaches would be used in more of a "weight of evidence" sense than in a strictly pass/fail sense. Keep in mind that AERMOD results are generally much more sensitive to surface roughness than to albedo or Bowen ratio, so what follows applies primarily to surface roughness.

1. Tally the dominant land use categories for each sector of the two sites. Evaluate if there are a similar number of sectors with the same characteristics.
2. Calculate the annual surface characteristics for each sector (average the seasons) of the two sites. Evaluate if the annual characteristics are similar (within maybe 30-40%).
3. Calculate the average characteristics for each season (average the sectors) for both sites, thus yielding representative characteristics for the whole circle around

the sites. Evaluate if the average characteristics for each season are similar (within maybe 30-40%).

4. Other suggestions – Create a table of differences in surface characteristics between the two sites and calculate statistics (correlation coefficients, absolute differences, relative differences, etc). The higher the correlations or the smaller the differences, the more closely the AERMET files supplied by ADEM represent the facility under review.
5. Create pie charts of land use categories around the facility and compare them to land use pie charts around the weather station.
6. Use GIS-based (or other graphics tools) software to develop displays of land uses around both locations and discuss similarities/differences.

Additional options for demonstrating meteorological data representativeness are encouraged and may be discussed with the ADEM Meteorological Section. The onus is on the applicant to demonstrate representativeness.

ADEM recognizes the difficulty involved in demonstrating that surface roughness within 1km of an airport meteorological site and within 1km of an industrial site is similar enough to cause no significant differences in AERMOD concentrations. This is especially true when the meteorological site circle of influence may be almost entirely within the boundaries of a large airport, while the industrial site may be surrounded by forests or industrial buildings. For additional options beyond those provided above, please contact the ADEM Meteorological Section.

If the applicant is unable to demonstrate representativeness, ADEM recommends the applicant execute duplicate AERMOD runs – once based on surface characteristics at the applicable NWS site and again at the facility under review. The most conservative results would be used for establishing Significant Impact Areas and also for comparing to NAAQS and PSD Increments.

Attachment 1 to APPENDIX C

This attachment provides input information required when using AERSURFACE to support representative demonstrations in Alabama. The first two tables show which months to be assigned to each season, depending on whether the meteorological station is located in the northern part of the state or the southern part.

Alabama Seasonal Categories – North of Montgomery (BHM, HSV, CHA, TUP)

Category	Season Description	Months
1	Midsummer with lush vegetation	Jun, Jul, Aug, Sep
2	Autumn with unharvested cropland	Oct, Nov
3	Late Autumn after frost and harvest and winter with no snow cover	Dec, Jan, Feb, Mar
4	Winter with continuous snow cover	Not Used
5	Transitional spring with partial green coverage or short annuals	Apr, May

Alabama Seasonal Categories – Montgomery Southward (MGM, CSG, MEI, MOB)

Category	Season Description	Months
1	Midsummer with lush vegetation	Jun, Jul, Aug, Sep
2	Autumn with unharvested cropland	Oct, Nov
3	Late Autumn after frost and harvest and winter with no snow cover	Dec, Jan, Feb
4	Winter with continuous snow cover	Not Used
5	Transitional spring with partial green coverage or short annuals	Mar, Apr, May

The Bowen Ratio varies with the estimated moisture content of the soil. Following EPA guidelines and using 30 years of recent climatology, ADEM has assigned the following annual moisture categories for each of the five years of meteorological data, for each domain represented by that meteorological station.

Bowen Ratio Categories

Domain	2001	2002	2003	2004	2005
HSV	W	D	A	A	D
CHA	A	A	W	W	D
TUP	W	W	W	W	A
BHM	W	W	W	W	A
CSG	D	A	W	A	W
MEI	W	A	W	A	D
MGM	A	D	A	A	A
MOB	D	A	A	W	A
Decatur	W	A	A	W	D

W-Wet, A-Average, D-Dry

APPENDIX D

Good Engineering Practice (GEP) Procedures

A. To determine the Stack Height that should be used in modeling, follow these steps:

1. Determine the maximum creditable GEP stack height, which is the greater of:
   (1) The calculated GEP stack height (from Step 3 below), or
   (2) As calculated by the BPIP program), or
   (3) 65 meters.

2. The stack height which should be used in modeling is the lesser of:
   (1) The maximum creditable GEP stack height (from step 1 above), or
   (2) The actual stack height.

NOTE: Special rules apply for increasing the heights of existing stacks.

B. To manually calculate GEP, follow these steps:

1. Acquire the dimensions (length, width, height) of all structures at the facility. Keep in mind that if you have tiered structures, then the dimensions of each tier are required. A scaled plant diagram showing the location of each structure and stack must be included in the application. Also, this diagram should show the plant property boundaries and any fenced areas around the plant.

2. Determine if a building is located near a stack by examining an area around the building. This area is drawn by going out a distance of 5L from every side of the building. "L" represents the lesser of the height or maximum projected width. There are no specific guidelines for determining a projected width because of the many orientations possible between a stack and building. However, the distance of this maximum projected width is typically the length of the diagonal across the building.

3. Compute a GEP stack height (H_{GEP}) for each influencing structure using the following formula:

For stacks in existence prior to December 31, 1970:

H_{GEP} = Actual Stack Height

For stacks in existence on January 12 ,1979, and for which the owner or operator had obtained all applicable permits or approvals required under 40 CFR 51 and 52:

$H_{GEP} = 2.5H$ (Calculated GEP stack height)

For all other stacks:

$H_{GEP} = H_B + 1.5L$ (Calculated GEP stack height)
H_B is the height of the structure and L is the lesser of the height or maximum projected width of that structure.

4. Determine the controlling building for each stack. This would be the building (within 5L of the stack) with the greatest GEP stack height.

5. Using the controlling building, if the stack height is less than the calculated GEP height, then building wake effects must be considered. If the actual stack height is greater than the calculated GEP stack height, building wake effects are not considered.

6. Building Wake Effects
AERMOD requires input of direction-specific building dimensions for both the Schulman-Scire and Huber-Snyder downwash schemes.

If you have determined in Step 5 that building wake effects must be considered, then a final screen must be performed for each of the possible 36 wind directions. For a particular flow vector, draw a rectangle around the building composed of two lines perpendicular to the flow vector, one at 5L downwind and the other 2L upwind, and two lines parallel to the flow vector, each at 0.5L from each side of the building. If the stack is located within the rectangle, include a building height and width for that direction in the AERMOD input file. If the stack is not located within that rectangle, either assign zero to both building dimensions, or use dimensions from another building whose GEP height is lower but has a region of influence which encompasses the stack.

Various software packages are available which may be used to compute direction-specific building dimensions. If such a software package is used for this purpose, the ADEM Air Division requires that all input and output files be submitted with the application on CD. In addition, any software package used for this purpose is subject to review by the ADEM Air Division. EPA has developed a program called BPIP which may be used to generate direction-specific building dimensions and is available on SCRAM, free of charge.

APPENDIX E

Class I Areas

Class I Areas
(within 100 km radius)