

# **AMBIENT IMPACT ANALYSIS GUIDELINE**

## **A Guideline for Performing Stationary Source Air Quality Modeling in Connecticut**

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## **1.0 INTRODUCTION**

The Connecticut Department of Environmental Protection (CTDEP), Bureau of Air Management is replacing the 1989 CTDEP document entitled “Ambient Impact Analysis Guideline” (AIAG1989) with an up-to-date guideline based on recent advancements in regulatory air quality modeling techniques. This document supersedes the AIAG1989, the “Stationary Source Stack Height Guideline” (SSSHG) as revised April 1996, and the addendum to the SSSHG entitled “Screening Procedures for Sources of Nitrogen Oxides...” and dated December 12, 1990. This revised Ambient Impact Analysis Guideline (AIAG) has been written as a detailed supplement to the modeling procedures contained in the Environmental Protection Agency’s (EPA’s) Guideline on Air Quality Models (GAQM), as incorporated in Appendix W of 40 CFR Part 51 (EPA, 2005). EPA’s guideline addresses a broad range of modeling issues such as model selection, input data requirements, and technical considerations that are appropriate for assessing impacts from mobile sources, stationary sources, photochemical processes and long-range transport. CTDEP’s guidance document focuses on modeling procedures that pertain to short-range (i.e., <50 kilometers) stationary source modeling. CTDEP will, from time to time, update this guidance document to reflect any substantive changes to EPA or CTDEP preferred modeling techniques. Readers should check EPA’s and CTDEP’s websites to ensure that modeling analyses are conducted in accordance with the latest revisions to their modeling guidelines. This document is available on the CTDEP website at: [http://www.ct.gov/dep/cwp/view.asp?a=2684&Q=416998&depNav\\_GID=1619](http://www.ct.gov/dep/cwp/view.asp?a=2684&Q=416998&depNav_GID=1619). **Users of this document are encouraged to contact CTDEP staff before undertaking any regulatory modeling analysis in Connecticut.**

### **1.1 WEB- BASED MODELING GUIDANCE**

In addition to this document in portable document format, the CTDEP website has been expanded to include links to pre-processed meteorological data, criteria air pollutant data bases, and links to other relevant CTDEP and EPA guidance and support documents not explicitly contained herein. Our web-based interface has been created to enhance efficiency and consistency in regulatory modeling. The public and regulated-community are encouraged to use our web-based modeling guidance and data bases at their convenience.

Data bases currently available on the website are:

- latest modeling guidance updates;
- links to EPA’s SCRAM website that contains general modeling guidance, recommended models and their users’ guides, and relevant dispersion model pre-processors programs;
- most recent design value background concentrations at all CTDEP operated monitoring locations for all criteria pollutants; and
- latest five years of available daily (24-hour) measured PM<sub>2.5</sub> levels at all CTDEP operated monitoring locations.

## **1.2 SUMMARY/OVERVIEW**

Section 22a-174-3a of the Regulations of Connecticut State Agencies (RCSA) requires the owner of certain stationary sources of air pollution to apply for and obtain a permit prior to the construction, modification and operation of the source. Permit applicability is defined in RCSA section 22a-174-3a(a). RCSA section 22a-174-3a(d)(3)(B) and (C) requires the owner of any source for which an application for an air permit has been submitted to demonstrate that the operation of the source will not cause or contribute significantly to a violation of any federal or state air quality standard or prevention of significant deterioration (PSD) increment. RCSA section 22a-174-3a(i)(2) requires this demonstration to include estimates of air quality impacts that follow procedures approved by the CTDEP Commissioner. This document describes the current, approved procedures for performing stationary source air quality impact analyses; the recommended procedures also conform to EPA's modeling guidance contained in Appendix W of 40 CFR Part 51.

Many of the terms used in the Connecticut air quality regulations and in this document are terms of art, including: "allowable emissions," "actual emissions," "dispersion technique," and "good engineering practice stack height." Section 2 of this document contains a list of definitions that are useful in understanding some of the requirements and procedures described herein.

Section 3 contains model applicability rules including major and minor source emission threshold requirements for Prevention of Significant Deterioration (PSD) and National Ambient Air Quality Standards (NAAQS) modeling.

Section 4 contains the air quality criteria including the NAAQS, PSD increments, and Significant Impact Levels (SILs) for all regulated pollutants.

Section 5 contains Good Engineering Practice Stack Height (GEP) recommended analyses, modeling analyses that include user-supplied input data to characterize the source of emissions, meteorology, and receptor geometry and background air quality. Section 5 also contains recommendations on the preparation and use of model input data, and the interpretation of results via a three step process that includes a screening assessment, modeling of the subject source alone, compliance demonstration with the SILs, and, if necessary, defining the significant impact area (SIA) for cumulative multiple-source modeling.

Section 6 contains the multi-source refined modeling and inventory requirements for NAAQS and PSD analyses.

Background air quality procedures and analyses for all regulated pollutants are provided in Section 7.

Multi-source modeling analyses, interpretation of results and compliance with the NAAQS and PSD increments is presented in Section 8

A list of referenced literature is provided in Section 9.

## **2.0 DEFINITIONS**

The definitions provided in this section are intended as a convenient reference to help interpret requirements discussed in this document. In order to assist the reader, the definitions in this section may have been modified from the formal definitions in RCSA section 22a-174-1. Where differences in language exist, the definitions found in RCSA section 22a-174-1 or in Title 40 of the Code of Federal Regulations (CFR) take legal precedence.

### **2.1 ACTUAL EMISSIONS**

“Actual emissions” is the rate of emissions from a source including fugitive emissions quantified by permit order or by registration information, after application of air pollution control equipment, of a particular air pollutant where the rate of emissions is calculated using:

- real or expected production rates, hours of operation, and types of materials processed stored or combusted for the period specified; and
- information from the “Compilation of Air Pollutant Emission Factors,” AP-42, published by the U.S. Environmental Protection Agency, relevant source test data or other information deemed more representative by the Commissioner.

The Commissioner shall determine the actual emissions from a stationary source over the two (2) year period prior to the date of an application for a permit to be issued under RCSA section 22a-174-3a. The Commissioner may allow the use of another period deemed more representative.

For the purposes of the definition of actual emissions, if the Commissioner deems certain data or other information are more representative, the Commissioner shall briefly state the reasons for such determination in writing. If an applicant seeks to have the Commissioner determine that certain data or other information is more representative, the burden of establishing that such data is more representative shall be on the applicant.

### **2.2 ALLOWABLE EMISSIONS**

“Allowable emissions” as defined in 40 CFR 51.165(a)(1)(xi) means the emissions rate of a stationary source calculated using the maximum rated capacity of the source (unless the source is subject to federally enforceable limits that restrict the operating rate, hours of operation, or both) and the most stringent of the following:

- (A) the applicable standards set forth in 40 CFR 60 or 61;
- (B) any applicable State Implementation Plan emissions limitation including those with a future compliance date; or
- (C) the emissions rate specified as a federally enforceable permit condition, including those with a future compliance date.

## **2.3 AMBIENT AIR**

“Ambient air” means that portion of the atmosphere external to buildings, to which the general public has access.

## **2.4 DISPERSION TECHNIQUE**

“Dispersion technique” is defined in 40 CFR 51.100(hh) and is reiterated below.

(1) Any technique which attempts to affect the concentration of a pollutant in the ambient air by: (i) Using that portion of a stack which exceeds good engineering practice stack height; (ii) Varying the rate of emission of a pollutant according to atmospheric conditions or ambient concentrations of that pollutant; or (iii) Increasing final exhaust gas plume rise by manipulating source process parameters, exhaust gas parameters, stack parameters, or combining exhaust gases from several existing stacks into one stack; or other selective handling of exhaust gas streams so as to increase the exhaust gas plume rise.

(2) The preceding sentence does not include: (i) The reheating of a gas stream, following use of a pollution control system, for the purpose of returning the gas to the temperature at which it was originally discharged from the facility generating the gas stream; (ii) The merging of exhaust gas streams where: (A) The source owner or operator demonstrates that the facility was originally designed and constructed with such merged gas streams; (B) After July 8, 1985 such merging is part of a change in operation at the facility that includes the installation of pollution controls and is accompanied by a net reduction in the allowable emissions of a pollutant. This exclusion from the definition of dispersion techniques shall apply only to the emission limitation for the pollutant affected by such change in operation; or (C) Before July 8, 1985, such merging was part of a change in operation at the facility that included the installation of emissions control equipment or was carried out for sound economic or engineering reasons. Where there was an increase in the emission limitation or, in the event that no emission limitation was in existence prior to the merging, an increase in the quantity of pollutants actually emitted prior to the merging, the reviewing agency shall presume that merging was significantly motivated by an intent to gain emissions credit for greater dispersion. Absent a demonstration by the source owner or operator that merging was not significantly motivated by such intent, the reviewing agency shall deny credit for the effects of such merging in calculating the allowable emissions for the source; (iii) Smoke management in agricultural or silvicultural prescribed burning programs; (iv) Episodic restrictions on residential wood burning and open burning; or (v) Techniques under 51.100(hh)(1)(iii) which increase final exhaust gas plume rise where the resulting allowable emissions of sulfur dioxide from the facility do not exceed 5,000 tons per year.

## **2.5 GOOD ENGINEERING PRACTICE STACK HEIGHT**

Good Engineering Practice (GEP) stack height is defined as the greater of:

- 65 meters, measured from the ground-level elevation at the base of the stack;
- 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, provided the owner or operator produces evidence that this equation was actually relied on in designing the stack or establishing an emission limitation to ensure protection against downwash;

$$H_g = 2.5H$$

- for all other stacks;

$$H_g = H + 1.5L$$

where:

$H_g$  = good engineering practice stack height, measured from the ground-level elevation at the base of the stack.

$H$  = height of nearby structure(s) measured from the ground-level elevation at the base of the stack.

$L$  = lesser dimension, height or projected width, of nearby structure(s); or

- the height demonstrated by a fluid model or a field study approved by the EPA, state or local control agency, which ensures that the emissions from a stack do not result in excessive concentrations of any air pollutant (see 40 CFR 51.1) as a result of atmospheric downwash, wakes, or eddy effects created by the source itself, nearby structure or nearby terrain features.

## 2.6 NEARBY

“Nearby” as used in the definition of GEP stack height is defined for a specific structure or terrain feature:

- for the purpose of applying the GEP formulae, means that distance which is up to five times the lesser of the height or the width dimension of a structure, but not greater than 0.8 km (0.5 mile); and
- for conducting fluid model or field study demonstrations of GEP stack height, means not greater than 0.8 km (0.5 mile), except that the portion of a terrain feature may be considered to be nearby which falls within a distance of up to 10 times the maximum height (h) of the feature, not to exceed 3.2 km (2 miles) if such feature achieves a height 0.8 km (0.5 mile) from the stack that is greater than or equal to 40 percent of the GEP stack height determined by the formulae or 26 meters, whichever is greater, as measured from the ground-level elevation at the base of the stack.

## 2.7 PREMISES

“Premises” means the grouping of all stationary sources at any one location and owned by, or under the control of, the same person or persons.

## 2.8 STATIONARY SOURCE

“Stationary source” means: point (stack), area and volume type sources which are owned, or operated by



the same person, or by persons under common control, which emits or may emit any air pollutant and which does not move from location to location during normal operation, including any portable emission unit which is moved from site to site, but remains stationary during operation.

### **3.0 MODELING APPLICABILITY**

As mentioned in Section 1.2 above, RCSA section 22a-174-3a(d)(3)(B) and (C) requires the owner of any source applying for an air permit to demonstrate that the operation of the source will not cause or contribute significantly to a violation of any federal or state air quality standard or PSD increment. RCSA section 22a-174-3(a)(i) requires this demonstration to include estimates of air quality impacts that follow procedures approved by the CTDEP Commissioner.

Owners of sources that are not required to obtain an air permit, such as sources that limit their emissions under RCSA section 22a-174-3b, are not subject to the modeling requirements of RCSA section 22a-174-3a.

### **4.0 AIR QUALITY CRITERIA**

#### **4.1 NATIONAL AMBIENT AIR QUALITY STANDARDS**

National ambient air quality standards (NAAQS) have been established for the criteria air pollutants as shown in Table 4-1. In addition, a single Connecticut ambient air quality standard (CAAQS) was established for total Dioxin (see RCSA section 22a-174-24(m)). This CAAQS is also listed in Table 4-1. Each NAAQS is defined in terms of pollutant, averaging time and level above which health is at risk (primary standard).

Modeled compliance with each NAAQS is determined by adding background levels (for the appropriate pollutant and averaging time) to modeled levels and comparing the highest value (from the set of receptors modeled) to the NAAQS. For short-term averages the appropriate modeled impact is added to background levels and the appropriate values (see Table 4-1 footnotes) for each receptor are compared to the NAAQS. The modeled levels used in this determination represent impacts not only from the applicant source, but also other nearby sources (source inputs are provided by CTDEP), plus background levels, which are also provided by CTDEP, unless monitoring is required.

**TABLE 4-1  
National and Connecticut Ambient Air Quality Standards**

Pollutant	Primary Standards		
	Level	Averaging Time	Notes
Carbon Monoxide (CO)	10,000 $\mu\text{g}/\text{m}^3$	8-hour	Not to be exceeded more than once per year
	40,000 $\mu\text{g}/\text{m}^3$	1-hour	Not to be exceeded more than once per year
Dioxin	1.0 picogram/ $\text{m}^3$	Annual Average	Not to be exceeded
Lead (Pb)	0.15 $\mu\text{g}/\text{m}^3$ <sup>(2)</sup>	Rolling 3-Month Average	Not to be exceeded
Nitrogen Dioxide (NO <sub>2</sub> )	(100 $\mu\text{g}/\text{m}^3$ )	Annual (Arithmetic Mean)	Not to be exceeded
Particulate Matter (PM <sub>10</sub> )	150 $\mu\text{g}/\text{m}^3$	24-hour	Not to be exceeded more than once per year on average over 3 years.
Particulate Matter (PM <sub>2.5</sub> )	15.0 $\mu\text{g}/\text{m}^3$	Annual (Arithmetic Mean)	Not to be exceeded
	35 $\mu\text{g}/\text{m}^3$	24-hour	To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 $\mu\text{g}/\text{m}^3$
Ozone (O <sub>3</sub> )	0.075 ppm	8-hour <sup>(1)</sup>	O <sub>3</sub> NSR modeling not required
Sulfur Dioxide (SO <sub>2</sub> )	80 $\mu\text{g}/\text{m}^3$	Annual (Arithmetic Mean)	Not to be exceeded
	365 $\mu\text{g}/\text{m}^3$	24-hour	Not to be exceeded more than once per year.
	1300 $\mu\text{g}/\text{m}^3$	3-hour (Secondary Standard)	Not to be exceeded more than once per year.

<sup>(1)</sup> To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm. (effective May 27, 2008)

<sup>(2)</sup> National lead standard, rolling 3-month average, signed October 15, 2008.

## 4.2 PREVENTION OF SIGNIFICANT DETERIORATION

Connecticut's New Source Review (NSR) Prevention of Significant Deterioration (PSD) program is implemented by CTDEP as a federally approved program. The objectives of the PSD program are: to ensure that economic growth will occur in harmony with the preservation of existing clean air resources; to protect public health and welfare at air quality levels that are cleaner than the NAAQS; and to preserve and protect air quality in natural recreational, scenic or historical areas including but not limited to national parks and wilderness areas. These objectives are mainly accomplished by not allowing significant incremental degradation of air quality beyond baseline concentrations in an area. A Baseline concentration is essentially the ambient concentration level of an air pollutant at the time of the first PSD permit application submittal affecting an area.

PSD applicability determination is based on whether a source is a new major stationary source or if a modification to an existing source is considered a major modification. However, the PSD program also requires an assessment of minor source growth on increment consumption. An increment is the maximum allowed increase in a pollutant concentration above the baseline concentration in an area. Connecticut's approach to tracking increment consumption from minor sources is to require every permitted source to demonstrate compliance with existing PSD increments regardless of its level of annual emissions.

CTDEP maintains PSD inventories for each pollutant for the purpose of tracking PSD increment consumption. An applicant must assess PSD increment consumption from the subject source and from the inventory of nearby increment consuming sources. The baseline concentration for PSD modeling purposes is defined as the minor source baseline date. These dates are June 7, 1988 for nitrogen dioxide (NO<sub>2</sub>) and particulate matter (PM), and December 17, 1984 for sulfur dioxide (SO<sub>2</sub>). The PSD increments have been promulgated for PM<sub>10</sub>, SO<sub>2</sub> and NO<sub>2</sub> as shown in Table 4-2 below.

**TABLE 4-2**  
**Class II PSD Increments (µg/m<sup>3</sup>)**

<b>POLLUTANT</b>	<b>Annual<sup>1</sup></b>	<b>24-Hour<sup>2</sup></b>	<b>3-Hour<sup>2</sup></b>
SO <sub>2</sub>	20	91	512
NO <sub>2</sub>	25		
PM <sub>10</sub>	17	30	
PM <sub>2.5</sub>	*	*	

<sup>1</sup> Not to be exceeded.

<sup>2</sup> Not to be exceeded more than once per year.

\* promulgation of PM<sub>2.5</sub> PSD increments expected before 2011.

Additional PSD requirements for a new or major modification source also include an analysis of impairment of visibility, soils and vegetation. Visible emissions from the source are typically minimized

by controlling the emissions through the implementation of Best Available Control Technology (BACT) for new sources or modifications of existing sources.

#### 4.3 SIGNIFICANT IMPACT LEVELS

Significant Impact Levels (SILs) have two primary purposes. First, SILs are used to determine if a proposed new or modified stationary may cause or contribute to a violation of the NAAQS or PSD increments. Second, SILs are used to determine if a proposed new or modified stationary source needs to perform a cumulative impact analysis. A cumulative impact analysis takes into account other nearby sources that may have a significant impact gradient in the significant impact zone of the proposed stationary source as well as existing ambient pollution background levels. Modeled impacts from a source of air pollution are considered significant if they equal or exceed the values listed in Table 4-3. If maximum source impacts are predicted to be below the SIL, additional multi-source modeling is not required and compliance with the applicable NAAQS or PSD increment is demonstrated.

**TABLE 4-3**  
**Class II Significant Impact Levels ( $\mu\text{g}/\text{m}^3$ )<sup>1</sup>**

<b>POLLUTANT</b>	<b>Annual</b>	<b>24-Hour</b>	<b>8-Hour</b>	<b>3-Hour</b>	<b>1-Hour</b>
SO <sub>2</sub>	1.0	5.0		25.0	
NO <sub>2</sub>	1.0				
PM <sub>10</sub>	1.0	5.0			
PM <sub>2.5</sub> <sup>2</sup>	0.3	1.2			
CO			500		2,000

<sup>1</sup> Source impacts must be less than the appropriate significance levels to be considered “insignificant”.

<sup>2</sup> EPA is expected to promulgate new SILs for PM<sub>2.5</sub> before 2011.

#### **5.0 MODELING ANALYSES FOR NAAQS/PSD COMPLIANCE DEMONSTRATION**

This section provides applicants detailed requirements and procedures for performing an ambient impact analysis for the purpose of demonstrating compliance with the NAAQS and PSD increments. Although CTDEP intends to update this document periodically, applicants are encouraged to consult with CTDEP prior conducting ambient impact analyses to confirm that guidance given herein reflects all current modeling requirements.

Two EPA-approved regulatory air dispersion models are needed to predict ambient impacts from proposed new and modified existing stationary sources in Connecticut: 1) EPA’s SCREEN3 (AERSCREEN will replace SCREEN3 upon promulgation by EPA) model to perform screening modeling analyses to determine worst-case operating conditions for proposed new and modified existing sources and to test for adverse impacts from minor sources; and 2) AERMOD, a refined single and multi-source model, to predict ambient impacts on simple, intermediate and complex terrain. SCREEN3 and AERMOD input requirements and modeling procedures are discussed in more detail below.

## 5.1 SCREENING MODELING ANALYSES

The EPA SCREEN3 model is the preferred regulatory screening model for air permitting applications. SCREEN3 is used to estimate ambient impacts from point, area, and volume sources and flares to a distance of 50 kilometers. The model has the capability to handle downwash and complex terrain situations.

AERSCREEN is a single-source screening version of AERMOD that will produce conservative impact estimates without the need for refined meteorological or detailed terrain data. AERSCREEN is not yet an EPA-approved guideline screening model. Therefore, SCREEN3 will continue to be the preferred screening tool until AERSCREEN is released by EPA. The SCREEN3 model is available for download at EPA's [SCRAM](#) webpage.

Screening modeling can be performed to assess worst case impacts from new minor sources or minor modifications whose annual allowable emissions fall within the following ranges:  $\geq 3$  &  $< 15$  TPY of SO<sub>2</sub> and PM<sub>10</sub>;  $\geq 1$  &  $< 10$  TPY of PM<sub>2.5</sub>;  $\geq 5$  &  $< 40$  TPY of NO<sub>x</sub>; and  $\geq 5$  &  $< 100$  TPY of CO. Sources with emissions within these ranges can demonstrate compliance with the NAAQSs and PSD increments by simply demonstrating that the maximum predicted impacts (without the addition of background concentrations) are below the adverse impact levels shown in Table 5-1a below. If a source cannot demonstrate that maximum impacts are below these values, refined modeling is required.

**TABLE 5-1a**  
**Adverse Impact Levels ( $\mu\text{g}/\text{m}^3$ )**

Pollutant	Annual average	24-hour average	8-hour average	3-hour average
NO <sub>2</sub>	12.5			
SO <sub>2</sub>	10.0	45.6		162.5
PM <sub>10</sub>		18.7		
PM <sub>2.5</sub>	1.8	4.3		
CO			1,250	

Sources that emit below the above cited emission ranges may opt-out of screening modeling by meeting the following minimum stack height requirements:

- the greater of ten (10) meters, or
- the lesser of 1.3 times the building height or maximum projected width.

Screening modeling is also conducted for larger sources to determine if maximum predicted impacts are below the SILs listed in Table 4-3 above. Each source should be modeled at a minimum of 50, 75 and 100% loads when determining if maximum impacts are below the SILs. If a maximum impact is below its respective SIL, refined modeling is not required for that pollutant and averaging time and compliance with the NAAQS and PSD increment (if applicable) is demonstrated.

### 5.1.1 SCREENING MODELING INPUTS

General input requirements for running SCREEN3 can be found in the SCREEN3 model user's guide (see [SCRAM](#)). Additional guidance is discussed in the remainder of Section 5.1.1 below. A user's guide will be made available for AERSCREEN once the model has been fully developed and tested. The SCREEN3 and AERSCREEN models calculate impacts for a single source only. When modeling two or more sources, consult with CTDEP modeling staff to determine the best screening modeling approach.

#### Emissions

A source should be modeled (at a minimum) at its 50, 75 and 100% hourly load rates in order to determine the maximum short-term impacts for simple and complex terrain. Alternatively, a 1.0g/s unitized emission rate may be used for multiple pollutants. However, care must be taken when converting the maximum unitized predicted impacts to the impacts based on the allowable emissions of the regulated pollutant analyzed. A simple spreadsheet is acceptable and must be submitted to CTDEP electronically to check the calculations.

#### Stack Parameters

The following inputs parameters must be used in SCREEN3 (AERSCREEN):

- user defined proposed stack location coordinates as 0,0;
- pollutant or unitized emission rate (g/s);
- stack base elevation (height (m) of stack base above mean sea level);
- stack height - height of stack-top above stack base (m);
- stack top exit temperature (°K) of effluent exiting the stack;
- stack gas velocity (m/s) of effluent exiting the stack;
- stack inside diameter at top of stack (m); and
- worst-case building dimensions (see next section).

#### Building Downwash/Cavity Considerations

The presence of structures in the vicinity of a stack can influence the behavior of the plume emitted from that stack. In order to determine the extent to which local structures effect plume dispersion, a GEP stack height analysis must be performed.

GEP stack height is defined above in Section 2.5. EPA's "Guideline for the Determination of GEP Stack Height" (EPA, 1985) is the recommended procedure to assess whether emissions from a stack will be influenced by the turbulent wake zones created by nearby buildings or terrain. If a stack height is less than its formula GEP height, then the stack is considered to be subject to building downwash. The building height, the maximum horizontal dimension and minimum horizontal dimension of all nearby buildings on or near the premise should be used in the SCREEN3 model. In many instances it may be necessary to run the SCREEN3 model multiple times for the same source (stack) in order to assess impacts from multiple structures on or off the premise.

In the future, when running AERSCREEN, if a stack is found to be subject to building downwash (i.e., stack height less than GEP), the latest version of EPA's building Profile Input Program (BPIP-PRIME) or equivalent model should be used to generate wind-direction-specific building dimensions as necessary for downwash calculations in AERSCREEN (and, for that matter, AERMOD). Since AERSCREEN/AERMOD will have/has the ability to determine if the stack effluent will be re-circulated into the part of the building wake known as the cavity zone, additional receptors should be placed in at least 20 meter increments within that area to estimate maximum concentrations within the cavity zone.

When documenting a GEP stack height analysis, a scaled plot plan of the facility that shows the location of each structure and stack must be included. The plan should also include: a north arrow, an accurate scale ruler, all structure heights and horizontal dimensions, the facility boundaries and any fenced areas in/around the facility. Great care must be taken with photocopied plot plans that the scale is accurate and correct across the entire plot plan.

### **Screening Receptors**

Receptors for screening modeling should be selected to provide detailed horizontal and vertical resolution of the terrain surrounding the source being modeled. For screening purposes, receptors typically are arrayed along a single axis or radial, and a wind direction selected so that the emissions from the source or sources will be directed towards the receptors. Each receptor is specified by a distance from the source and its elevation (as used in the current version of the SCREEN3 model along with the worst-case meteorological conditions).

A recommended approach for receptor selection consists of placing receptors downwind along a single radial from the source, spaced at 100 meter intervals to 2 km, 500 m intervals to 5 km and at 1 km intervals to 10 km. Assign a "worst-case" terrain height to each radius by identifying the highest elevation within the band formed by circles of radii midway between the two adjoining receptor circle radii. Additional discrete receptors should be placed at the property line and may also be needed within the cavity/wake region of the controlling building (if the cavity/wake areas are accessible to the general public, the receptor should be placed at a distance 3L).

In the unlikely event that screening modeling results show that concentrations are still increasing at the 10 kilometer receptor ring, then the grid must be extended further until concentrations begin to decrease.

### **Meteorological Data**

The set of 54 worst-case meteorological conditions built into the current version of the SCREEN3 model should be used for all screening modeling analyses. In addition, the following default values must be used when using the current version of SCREEN3:

- ambient temperature of 293°K must be used;
- default Anemometer Height is 10 meters; and
- mixing heights are automatically calculated.

## 5.1.2 SCREENING MODELING RESULTS

NAAQS, PSD increments and SILs cover a variety of averaging periods depending on the air pollutant in question. Therefore, EPA developed conversion factors to adjust screening modeling results to get the appropriate averaging time depending on the pollutant being modeled.

The SCREEN3 simple terrain model produces 1-hour concentration values that need to be converted to other averaging periods using the conversion factors listed in Table 5-1b below:

**TABLE 5-1b**  
**Conversion Factors for 1-Hour Concentrations**

<b>Multiply 1-hour result by:</b>	<b>To get the:</b>
0.9	3-hour concentration
0.7	8-hour concentration
0.4	24-hour concentration
0.08	Annual concentration

The conversion factors of Table 5-1b originate in Section 4.2 (page 4-15) of “Screening Procedures for Estimating the Air Quality Impact of Stationary Sources” (EPA, 1992).

The SCREEN3 complex terrain model (Valley-Equivalent Mode) produces a 24-hour concentration value that can be used for reporting 24-hour averaging period impacts directly. The one-hour modeled impact can be obtained by multiplying the 24-hour prediction by a factor of 4. To obtain the 3-hour, 8-hour and annual average predictions in complex terrain, multiply the 24-hour average by 4 to obtain the one hour average, then multiply that average by the factors as shown in the above table, respectively.

## 5.2 REFINED MODELING PROCEDURES

Refined modeling is required for all sources with allowable annual emissions that are above the screening modeling emission ranges listed in Section 5.1 of this document. Refined modeling is also required for sources with allowable annual Pb emissions of  $\geq 0.6$  tons and allowable total Dioxin emissions of  $\geq 0.6 E^{-7}$  tons per year.

### 5.2.1 AERMOD Modeling System

In 2006, EPA promulgated AERMOD as the all-terrain steady-state dispersion model for determining ambient impacts within 50 km of a stationary source. AERMOD is based on the Gaussian and planetary boundary layer concepts, designed for flat, simple, intermediate and complex terrain applications. Therefore, applicants seeking an air permit must use AERMOD if refined modeling is required as part of Connecticut’s permit application process.



The AERMOD modeling system contains the following pre-processors:

- **AERMOD** - regulatory refined dispersion model that requires various user-selected parameters, as well as incorporates the data created in AERMAP and AERMET;
- **AERMAP** - terrain pre-processor for AERMOD;
- **AERMET** - meteorological pre-processor for AERMOD; and
- **AERSURFACE** - utility program designed to calculate estimates of surface characteristics based upon Land Use/Land Cover (LULC) information.

### **AERMOD Modeling System Guidance documents**

The AERMOD modeling system, including preprocessors, users' guides and associated guidance are available for download on EPA's [SCRAM](#) website. The users guides for AERMOD (EPA, Sept. 2004, Addendum, October 2009) and its preprocessor programs AERMAP (EPA, Oct. 2004, Addendum, Feb. 2009), AERSURFACE (EPA, 2008), and AERMET (EPA, Nov. 2004, Addendum, Dec. 2006) are also referenced in Section 9 of this document. The "AERMOD Implementation Guide" (EPA, 2009) provides guidance on the implementation of AERMOD for regulatory PSD and NAAQS modeling applications.

It is the intention of the CTDEP to periodically revise this document so that it remains relevant to current accepted modeling guidance and procedures. *However, users of the AERMOD modeling system are encouraged to check the SCRAM website for any new or revised guidance before undertaking regulatory modeling in Connecticut.*

### **AERMAP**

AERMAP is the terrain pre-processor to AERMOD. AERMAP processes Digital Elevation Model (DEM) data and creates an elevation and height scale (the terrain height and location that has the greatest influence on dispersion) for each receptor in the domain. AERMAP automatically selects the closest node elevation in each quadrant with respect to the receptor or source and then weights that elevation with respect to the distance from the receptor or source. The closer the node elevation, the more weight it is given. Conversely, further distances are weighted less.

The latest version of AERMAP is designed to process National Elevation Dataset (NED) data in GEO-TIFF format, which is accessible through the U.S. Geological Survey (USGS) Seamless Data Server <http://seamless.usgs.gov/index.php>. The program also has the ability to process Digital Elevation Model (DEM) data in the USGS DEM format. AERMAP does not have the capability of processing both formats within a single application. Applicants are encouraged to document the source of elevation data processed in AERMAP.

### **AERMET**

AERMET processes available National Weather Service (NWS) surface and upper air data and/or on-site meteorological data, representative of the modeling domain, for use in AERMOD. AERMET uses meteorological measurements of several boundary layer parameters to compute vertical profiles of: wind direction, wind speed, temperature, vertical potential temperature gradient, vertical turbulence (sigma-w) and horizontal turbulence (sigma-theta).

At the present time, AERMET is designed to accept data from any of the following sources:

- standard hourly NWS data from the most representative site;
- hourly on-site wind, temperature, turbulence, pressure, and radiation measurements (if available); and
- morning soundings of winds, temperature, and dew point from the nearest NWS upper air station.

AERMET processes meteorological data in three stages:

- **Stage 1** extracts meteorological data from archived data files and processes the data through various quality assessment checks;
- **Stage 2** merges all data available for 24-hour periods (surface data, upper air data, and on-site data) and stores these data together into a single file; and
- **Stage 3** reads the merged meteorological data and estimates the necessary boundary layer parameters for use by AERMOD.

AERMET produces a profile file that consist of multiple-level observations of wind speed, wind direction, temperature, standard deviation of the fluctuating wind direction, and vertical wind speed. These files are read into AERMOD. AERMET also produces an hourly surface file of boundary layer parameters estimates and surface characteristics (albedo, Bowen ratio and surface roughness length) of the area being modeled. Surface characteristics generated for AERMET should reflect the land use characteristics in the immediate vicinity of where the meteorological data are collected (see discussion under “AERSURFACE” immediately below).

## AERSURFACE

When applying the AERMET pre-processor, the applicant must specify monthly (seasonal) variations of three surface characteristics for up to 12 different contiguous non-overlapping sectors. Each wind sector can have a unique albedo ( $\alpha$ ), Bowen ratio ( $B_o$ ), and surface roughness  $z_o$  value. The AERSURFACE pre-processor tool is used to obtain realistic and reproducible surface characteristic values. The preprocessor uses publicly available national land cover datasets and look-up tables of surface characteristics that vary by land cover type and season. Currently, AERSURFACE requires the input of land cover data from the USGS National Land Cover Data 1992 archives (NLCD92) to determine the land cover types for user-specified locations (future revisions to AERSURFACE will be able to accept NLCD 2001 and shall be required upon promulgation). The following methodologies are recommended to derive the three aforementioned surface characteristics:

- **Bowen ratio** is based on a simple un-weighted geometric mean for a representative domain, with a default of 10km by 10km region centered on the meteorological site;
- **albedo** is based on a simple un-weighted arithmetic mean for the same 10km by 10km domain defined by the Bowen ratio; and
- **surface roughness length** is determined based on an inverse-distance weighted geometric mean for a default upwind distance of 1km relative to the meteorological site and divided up by sectors to account for variations in land cover; however, the sector widths should be no smaller than 30°.

Sectors are defined clockwise, as the direction from which the wind is blowing from with north at 0°/360°. For each of the sectors, the various land use data points (pixels) are summed and the percentage of occurrence for each of the land-cover categories is calculated as shown in Table 5-2a.

Section 3.1.2 of EPA’s AERMOD Implementation Guide (March 19, 2009) discusses in detail the determination of surface characteristics.

**Table 5-2a  
USGS NLCD92 Land Cover Categories**

<b>Classification</b>	<b>Class Number</b>	<b>Land Cover Category</b>
Water	11	Open Water
	12	Perennial Ice/Snow
Developed	21	Low Intensity Residential
	22	High Intensity Residential
	23	Commercial/Industrial/Transportation
Barren	31	Bare Rock/Sand/Clay
	32	Quarries/Strip Mines/Gravel Pits
	33	Transitional
Forested Upland	41	Deciduous Forest
	42	Evergreen Forest
	43	Mixed Forest
Shrubland	51	Shrubland
Non-natural Woody	61	Orchards/Vineyards/Other
Herbaceous Upland	71	Grasslands/Herbaceous
Herbaceous Planted/Cultivated	81	Pasture/Hay
	82	Row Crops
	83	Small Grains
	84	Fallow
	85	Urban/Recreational Grasses
Wetlands	91	Woody Wetlands
	92	Emergent Herbaceous Wetlands

CTDEP recommends that the surface characteristics be developed on a monthly basis consistent with Table 5-2b below. Connecticut frequently experiences winter months where only a fraction of the month is snow covered. A review of the climate data for the meteorological station and years to be used in the modeling should be made to determine the number of days per month that experienced snow cover. If the number of snow cover days exceeds 50%, then the month can be assigned the seasonal category of 4. If the monthly data show less than or equal to 50% snow cover, then the seasonal category of 3 is appropriate.

**TABLE 5-2b**  
**Seasonal Land Use Categories by Month**

<b>CATEGORY</b>	<b>DEFINITION</b>	<b>MONTHS</b>
1	Midsummer with lush vegetation	June – August
2	Autumn with un-harvested cropland	September and October
3	Late autumn after frost and harvest, or winter with no snow	November - March
4	Winter with continuous snow on the ground	December - March
5	Transitional spring with partial green coverage or short annuals	April and May

## 5.2.2 AERMOD INPUT REQUIREMENTS

### AERMOD Control Options

Control options contain the keywords that effectively control AERMOD to calculate maximum impacts based on such options as dispersion, averaging times and terrain height. CTDEP recommends the following regulatory control options in order to demonstrate compliance with both the NAAQS and PSD increments:

- use elevated terrain algorithms;
- stack-tip downwash (except for building downwash cases);
- calm and missing meteorological data processing routines;
- use of a 4-hour half-life for exponential decay of SO<sub>2</sub> (for urban sources only); and
- default vertical potential temperature gradients.

### Source Emissions

CTDEP requires that proposed and existing sources must input the permitted maximum allowable, hourly emission rates for compliance with the NAAQS and PSD increments with averaging times of less than a year. The maximum allowable annual emission rates may be used to show compliance for annual average based standards.

### Source Parameters

The following input source location and parameters are required to be modeled in AERMOD:

- stack location - X coordinate (UTM-X grid in meters or user based of 0), Y coordinate (UTM-Y grid in meters, or user based of 0);
- stack base elevation - height (m) of stack base above mean sea level,
- pollutant emission rate (g/s);
- stack height - height of stack-top above stack base (m);
- stack top exit temperature - temperature (°K) of effluent exiting the stack;
- stack gas velocity - (m/s) of effluent exiting the stack; and
- stack diameter - at the inside top of stack (m).

## **Good Engineering Practice Stack Height**

CTDEP recommends procedures described in the EPA's "Guideline for Determination of Good Engineering Practice Stack Height" (EPA, 1985) for GEP stack height calculations. To address building downwash, a GEP stack height must be determined for each source to be modeled at the applicant's premise. The lesser of actual or GEP stack height should be used for modeling each source. In addition, the latest version of EPA's Building Input Program (BPIP with PRIME) must be used to generate wind-direction-specific building dimensions for calculating downwash impacts in AERMOD from each source subject to building downwash.

## **Receptor Grid**

The AERMAP pre-processor should be used to determine all near and far field receptor elevations. See Section 5.2.1 above for a short description of the AERMAP receptor elevation preprocessor. As an initial starting point, construct a receptor grid (preferably Cartesian) centered on the source with 50 or 100 meter spacing out to a distance of 2 kilometers (km). For a distance from the source of 2 km to 5 km, place receptors with 500 meter spacing, and, for a distance from the source of 5 km to 10 km, use 1 km spacing. For calculating impacts in cavity regions of structures (that have public access), and or property fence-lines, CTDEP recommends a maximum receptor spacing of 50 meters. If maximum impacts are calculated, refinement of the receptor grid may be necessary to identify the point of maximum impact. Additional receptors may be required at locations designated as sensitive, such as schools and hospitals, or in environmental justice communities, which are provided enhanced public participation requirements and may require additional information about potential environmental and health impacts.

## **Meteorological Data**

Meteorological data for refined modeling must be representative of wind flow and dispersion characteristics that affect source emissions. Properly collected site-specific data can be preferable to off-site data for modeling dispersion near a source. EPA's meteorological monitoring guidance (EPA, 2000) should be followed in designing and operating a site-specific meteorological monitoring program. Generally, one year of hourly site-specific meteorological data is considered the minimum requirement for dispersion modeling. However, applicants may use a minimum of five years of NWS data to adequately characterize year-to-year meteorological variability, in lieu of one year of site-specific data. Meteorological data used as input to the model should be selected on the basis of spatial and climatological representativeness of the individual parameters selected to characterize the transport and dispersion conditions in the area of concern. For a more detailed discussion of data representativeness considerations, see Section 3.1.1 of the AERMOD Implementation Guide (EPA, 2009), and Section 8.3 of Appendix W of 40 CFR Part 51 (EPA, 2005).

## **Upper Air Data**

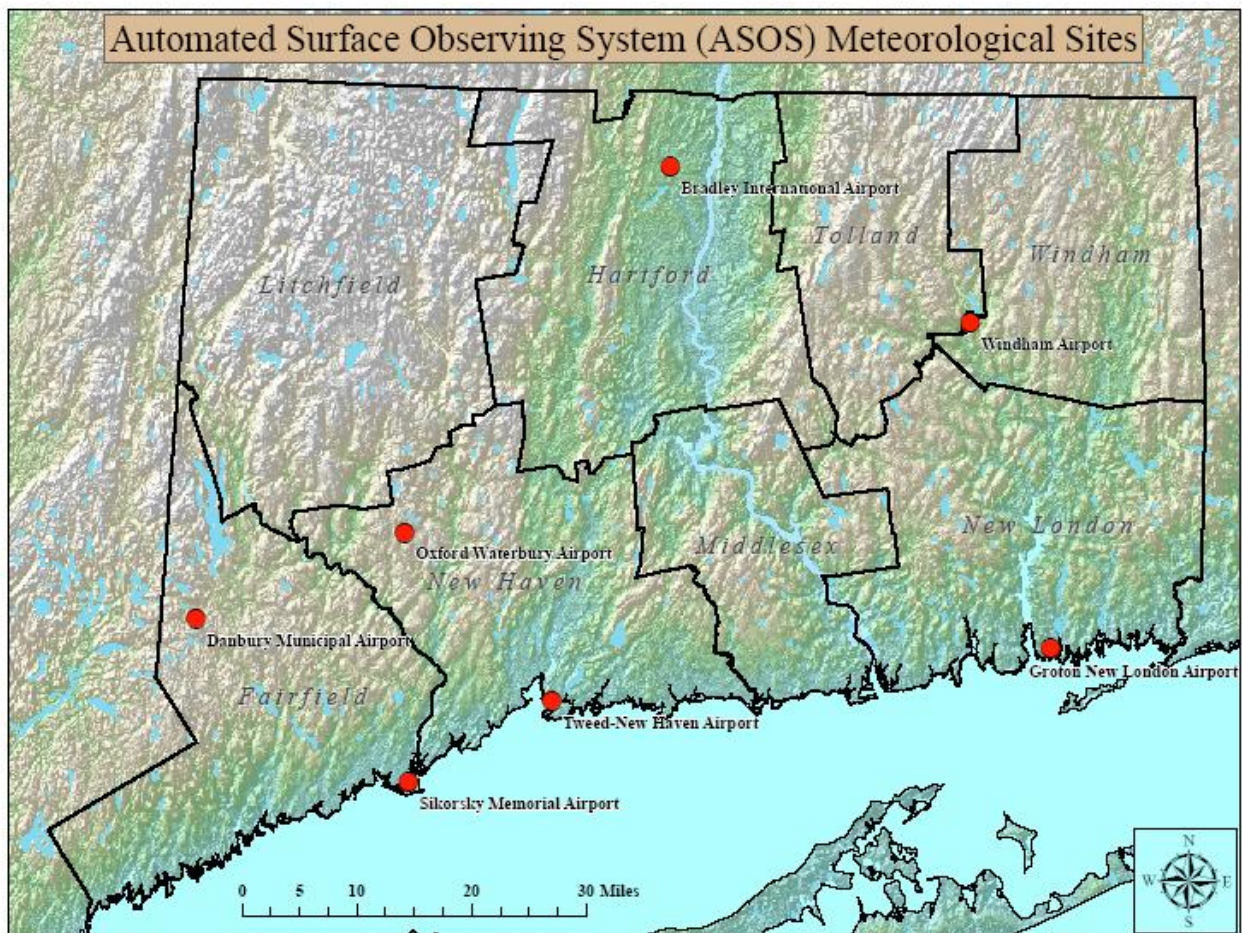
Depending on the source location, data from one of the following two (2) upper air sites are required for AERMOD meteorological data processing: 1) Albany upper air morning (12Z) sounding data for all inland proposed/existing source locations of at least several miles from Connecticut's shoreline; and Brookhaven, NY upper air morning (12Z) sounding data for all shoreline proposed/existing source locations within several miles of Connecticut's coast. Applicants are encouraged to consult with CTDEP

modeling staff if the applicant is unclear which upper air site is more appropriate.

### Surface Data

There are six (6) NWS ASOS/AWOS sites available for general use in Connecticut in lieu of on-site collected data. Figure 5-1 below displays the location of these sites. We strongly encourage applicants to consult with CTDEP modeling staff to discuss meteorological data requirements for a specific project. Currently, CTDEP does not recommend the use of the ASOS site at Windham Airport due to poor data quality. It is CTDEP's intent to have these data processed and available for download via its web page in the future.

**FIGURE 5-1**



### 5.2.3 SIGNIFICANT IMPACT AREA (SIA) DETERMINATION

When the maximum impacts exceed the SIL for any pollutant and averaging time shown in Table 4-3, then multi-source analysis is required. The SIA is defined as the area that extends from the source to farthest



receptor distance at which the source has a significant impact for a given pollutant. The cumulative analyses must be performed for that portion of the receptor grid where significant impacts were modeled.

#### **5.2.4 MULTI-SOURCE REFINED MODELING AND INVENTORY REQUIREMENTS**

When performing a multi-source modeling analysis for a subject source, all source parameters mentioned above should be available as part of the air permit application. In a NAAQS analysis, the subject source and all other stationary sources located on the subject premise are modeled with their allowable emission rates. For PSD increment tracking, the subject source and all increment consuming sources located on the applicant's premise are modeled with allowable emission rates. For nearby existing NAAQS sources and PSD increment consuming sources located within the significant impact area (SIA), the source parameters and emission rates will be provided by CTDEP from the point source inventory.

Once the pollutant-specific radius of significance for the subject source has been determined, a radius search program will be run by CTDEP to retrieve source parameters for the NAAQS and PSD multi-source modeling analyses. CTDEP's radius search program will retrieve the following sources for the pollutant requested:

- For NAAQS modeling:
  - All stacks with actual emissions of > 15 tons per year (TPY) of a given pollutant that fall within the radius of significance of the subject source for that pollutant;
  - All stacks with actual emissions of  $\geq 50$  TPY that fall within 20 km of the subject source; and
  - All stacks with actual emissions of  $\geq 500$  TPY that fall within 50 km of the subject source.

All sources retrieved above should be modeled at their allowable emission rate for all short term averaging times. Sources can be modeled at their actual emission rates for annual average modeling.

- For PSD increment tracking:
  - All sources affecting PSD increment (defined in RCSA sections 22a-174-3a(k)(5) and 22a-174-3a(k)(6)) that fall within the radius of significance of the subject source for the applicable pollutant;
  - All sources affecting PSD increment with actual stack emissions of  $\geq 50$  TPY that fall within 20 km of the subject source; and
  - All sources affecting PSD increment with actual stack emissions of  $\geq 500$  TPY that fall within 50 km of the subject source.

All PSD increment consuming sources retrieved above should be modeled with their maximum allowable emission rates for averaging periods of less than one year. For the annual average time period, actual emissions can be modeled and will be provided by CTDEP. All increment consuming sources on the applicant's premise should also be modeled with allowable emission rates for averaging periods of less than one year. For annual averages, actual emissions should be estimated from fuel use data provided by the applicant to CTDEP.

If the SIA of a source extends beyond the Connecticut state line, the applicant must obtain existing source information from the neighboring state, submit a copy of the source emissions data to the CTDEP, and include these sources in the modeling.

In addition to the inventory provided by CTDEP for PSD increment modeling, the applicant may be required to address the effects of area-wide emissions growth on increment consumption, particularly when modeled concentrations approach the available increments in areas where existing measured ambient air quality levels are increasing.

### **5.3 ADDITIONAL PSD IMPACT ANALYSES**

The Federal PSD program requires that the owner of any new major source or a source undergoing a major modification provide an analysis of additional impacts that would occur as a direct result of the general, residential, commercial, industrial and/or other growth associated with the construction and operation of the source.

In addition, an analysis of impairment of visibility, soils and vegetation that would occur as a result of the source is also required. Visible emissions from the source are typically minimized by controlling the emissions through the implementation of BACT (Best Available Control Technology) for new sources or modifications or Best Practical Treatment (BPT) for existing sources.

Further guidance relating to these analyses are provided in the EPA documents entitled: “A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils and Animals” (EPA, 1980), “PSD Workshop Manual” (EPA, August 1980), and the draft [NSR Workshop Manual](#) (EPA, 1990).

In the event that a proposed major source is located within 100 kilometers of the Class I area at Lye Brook Vermont, the applicant should consult with CTDEP staff for the purpose of determining if a Class I area Air Quality Related Values (AQRV) analysis is required. CTDEP will, in consultation with the appropriate federal land manager (FLM), determine if an AQRV modeling demonstration is necessary. The FLM and CTDEP will make this determination on a case-by-case basis, considering such factors as:

- current conditions of sensitive AQRVs;
- magnitude of emissions;
- distance from the Class I area;
- potential for source growth in an area/region;
- existing/prevaling meteorological conditions; and
- cumulative effects of several sources to AQRVs.

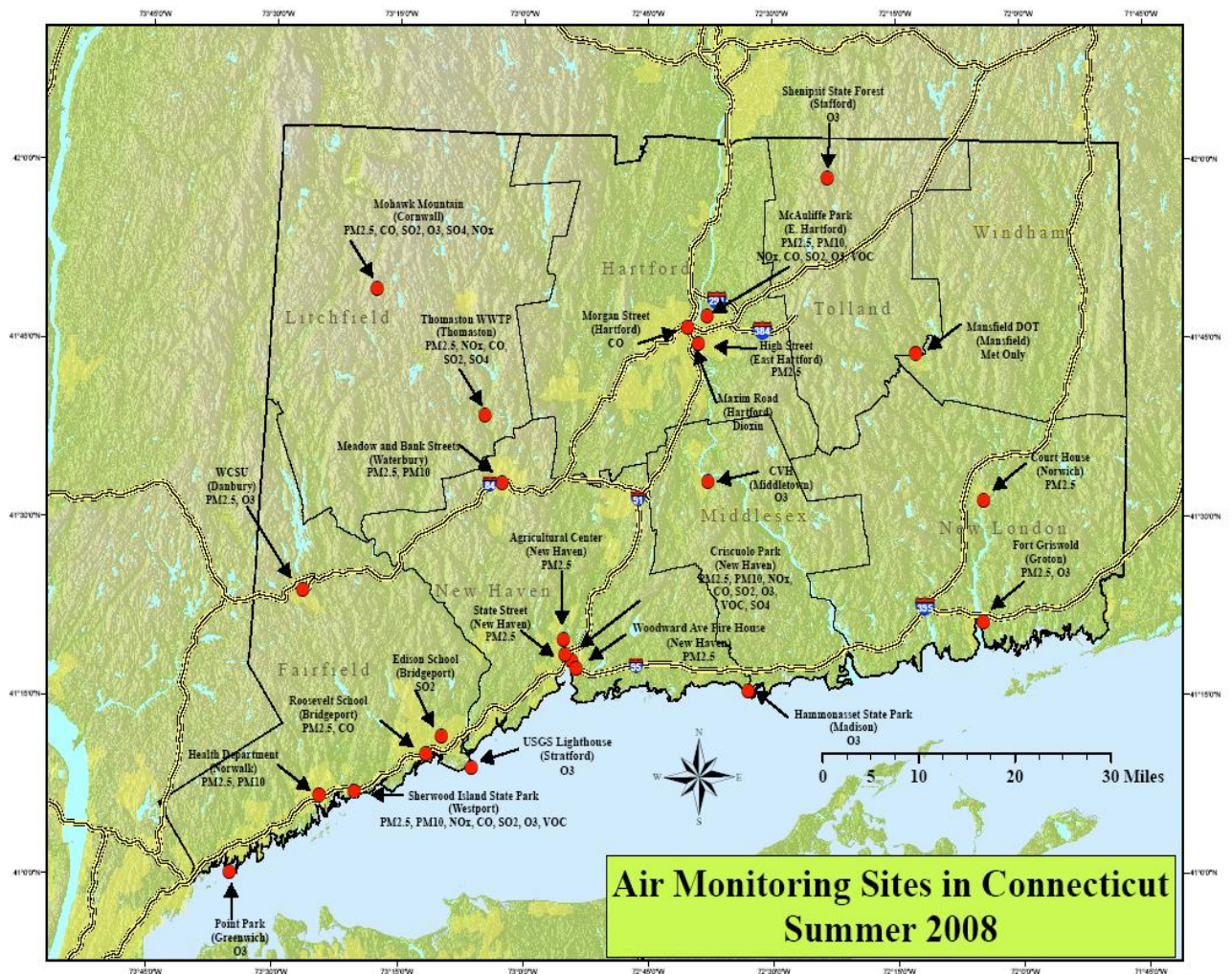
If an AQRV modeling analysis is required, the applicant, CTDEP, and the FLM will work together to formulate an appropriate modeling demonstration. Currently, the CALPUFF model has been approved by EPA for calculating a source’s effect on Class I area AQRVs beyond 50 km. For a general description of what is expected of an AQRV analysis see the document entitled *Federal Land Managers’ Air Quality Related Values Workgroup (FLAG) Phase I Report* (December 2000)” at <http://www.nature.nps.gov/air/Permits/flag/flagDoc/index.cfm>. Additional support can be found on the National Park Service web page at <http://www.nature.nps.gov/air/Permits/flag/index.cfm>.



## 6.0 BACKGROUND AIR QUALITY

Background air quality levels are added to modeled impacts to determine compliance with the NAAQS for the appropriate pollutant and averaging time. Recommendations for estimating background concentrations from CTDEP monitoring sites are summarized in this section. The most recent three years of available design concentrations from three representative federal reference method (FRM) CTDEP monitoring sites located within or nearest to the modeling domain, should be used to calculate background concentrations for NSR modeling reviews. Figure 6-1, below, depicts the current CTDEP air monitoring network with a listing of parameters measured at each site.

FIGURE 6-1



## 6.1 MONITORED DESIGN CONCENTRATIONS

The latest measured SO<sub>2</sub>, NO<sub>2</sub>, PM<sub>10</sub>, PM<sub>2.5</sub> and CO design concentrations calculated from CTDEP's FRM ambient monitors are available on the CTDEP web site at:

[http://www.ct.gov/dep/cwp/view.asp?a=2684&Q=421150&depNav\\_GID=1744](http://www.ct.gov/dep/cwp/view.asp?a=2684&Q=421150&depNav_GID=1744)

There may be occasions where a more refined short-term average background estimate is needed in a modeling review, particularly when design concentrations approach the NAAQS. This situation currently exists with the 24-hour average design concentrations for PM<sub>2.5</sub>. For modeling reviews that cannot demonstrate compliance with the PM<sub>2.5</sub> 24-hour average NAAQS of 35µg/m<sup>3</sup> using design concentrations for background, CTDEP recommends post-processing all model predicted 24-hour PM<sub>2.5</sub> concentrations at all receptors by adding these values to the 24-hour average measured daily background PM<sub>2.5</sub> concentration for each day modeled. The data used to calculate the daily background values will be provided to the applicant by the CTDEP. For days where no FRM measured data exist, FRM adjusted BAM, and or FRM adjusted FDMS data can be used to calculate background PM<sub>2.5</sub> for these days. It is important the date of the measured 24-hour concentrations match the date of the modeled 24-hour concentration when the two are added. The data can then be sorted from highest to lowest for each receptor to obtain the 8<sup>th</sup> highest concentration for each year. To calculate a 3-year block average (for five years it's the first three years, middle three years and last three years), take the highest of the 3 year block 8<sup>th</sup> highest concentrations for all receptors to obtain the highest 8<sup>th</sup> high predicted 24-hour PM<sub>2.5</sub> impact for a five year period. **Applicants are strongly encouraged to contact CTDEP air modeling staff to discuss the mechanics of this approach in more detail.** Note that this approach applies to the 24-hour average PM<sub>2.5</sub> portion of a modeling analysis only.

Background concentrations for a specific project are estimated by choosing three monitoring sites that are most representative of background levels expected at the source location. Proximity of the monitoring site to the source location is the main criteria used to choose the monitoring sites to include in your background estimate. A secondary consideration would involve a comparison of the land use surrounding the source and the monitoring site.

If the SIA of a proposed source extends across the Connecticut border to a neighboring state, the applicant may need to obtain monitored data from the neighboring state in order to establish a representative background value for the project impact area.

Sources subject to federal PSD requirements should contact CTDEP to determine whether pre-construction monitoring will be required for some pollutants if existing CTDEP-monitored data are deemed non-representative. This determination will be made on a case-by-case basis following EPA monitoring guidance (EPA, 1990).

## 6.2 LEAD

CTDEP is currently estimating ambient lead (Pb) levels from speciated PM<sub>2.5</sub> data only at the Criscolo Park site in New Haven, CT. This method of measuring ambient Pb levels will not be considered a federal reference method (FRM) for demonstrating attainment/nonattainment with the newly revised NAAQS of 0.15 µg/m<sup>3</sup> (rolling three-month average not to be exceeded over a three-year period), which was effective on January 12, 2009. A neighborhood scale ambient monitoring network is scheduled to be established in 2011 to fulfill the monitoring requirements of the new standard.

A value equal to one half of the NAAQS ( $0.075 \mu\text{g}/\text{m}^3$  3-month average) should be used as background for modeling purposes at all Connecticut locations until FRM measured data become available. An applicant may use an alternate value upon demonstration to CTDEP that the alternate value is more appropriate.

### **6.3 HAZARDOUS AIR POLLUTANTS**

Background levels for hazardous air pollutants regulated under Connecticut's hazardous air pollution program are expected to be quite low. For example, background levels for dioxin (currently the only hazardous air pollutant with a Connecticut Ambient Air Quality Standard (CAAQS)) have been barely detectable. Therefore, CTDEP recommends that background levels for hazardous air pollutants for which a CAAQS exists be defined as one half of the standard for these pollutants until more data become available.

## **7.0 ANALYSIS AND INTERPRETATION OF MODELED RESULTS**

### **7.1 SHORT-TERM AVERAGES**

Several of the NAAQS and PSD increments are defined for averaging times for 24-hours or less (i.e., short-term averages). The AERMOD model will produce results for short-term averaging times such as the 1-hour, 3-hour, 8-hour and 24-hour averages. These values are compared directly to the PSD increments or added to background levels for comparison with NAAQS.

### **7.2 LONG-TERM AVERAGES**

Long-term averages are generally considered to be for periods of one month or more. NAAQS and PSD increments currently exist for quarterly (3-month) and annual averages.

**Lead 3-Month Average.** The new Lead (Pb) NAAQS is a 3-month rolling average not to be exceeded.

Using five years of AERMOD model results three-month rolling averages can be calculated from the monthly averages. The largest of the three-month average concentrations is added to a lead background concentration for comparison with the NAAQS.

**Annual Averages.** Annual average concentrations can be produced directly by the AERMOD model for comparison with PSD increments or can be added to background levels for comparison with the NAAQS.

## **8.0 PRESENTATION OF COMPLIANCE DEMONSTRATION**

Air quality dispersion modeling analyses are performed to demonstrate compliance with all applicable NAAQS and Class II PSD increments in Connecticut. Once compliance with all of the applicable standards has been demonstrated, the applicant must submit a detailed report that clearly describes not only the results of the modeling but also the methodologies and data bases used in the process. Applicants have the option of submitting a separate modeling report after submittal of the original Air Permit Application (recommended), or submitting the modeling report as part of the permit application.

A modeling report submitted to CTDEP should have, at a minimum, the following contents:

- scope of the project;
- modeling approach;
- models used to demonstrate compliance;
- land use data;
- meteorological data;
- building related input data (GEP analysis);
- receptor grid/surrounding terrain;
- preparation of input parameters;
- selection of modeled load cases;
- background data used/processed;
- all other analyses/data needed to demonstrate compliance;
- tables of stack inputs (physical stack parameters, emission rates, flows) for all modeled sources;
- tables that list the maximum impact (H1H, H2H, H6H, and H8H depending on the pollutant/averaging period), the corresponding receptor location (Easting/Northing coordinates) and elevation, and the meteorological period associated with the maximum impact for each pollutant/averaging period; and
- comparison of modeling results to applicable NAAQS and Class II PSD increment standards.

Additionally, applicants must submit copies of the following electronic files: all dispersion model input/output files; input/output files from all preprocessors used such as AERMAP, AERSURFACE, AERMET and BPIP; any raw meteorological data used; any post-processor programs used to calculate ambient impacts or background data such as access data bases, excel spreadsheets, and or computer code such as FORTRAN. Please include a directory of file(s) submitted files, where all file naming conventions are clearly identified.

## **9.0 REFERENCES**

CTDEP, 1989: Ambient Impact Analyses Guideline, Connecticut Department of Environmental Protection, Bureau of Air Management, Hartford, CT.

CTDEP, 2005: The Regulations of the Connecticut State Agencies Concerning Abatement of Air Pollution (Revised); Section 22a-174 3a.

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EPA, March 2009 AERMOD IMPLEMENTATION GUIDE. AERMOD Implementation Workgroup. Office of Air Quality Planning and Standards, Air Quality Assessment Division, Research Triangle Park, NC.