Q. With reference to the correspondence from Derrick Maddocks, Director of the Department of Environment and Conservation to Frank Ricketts of Hydro dated February 9, 2006 (referenced in response to CA - 5 NLH), please

a) provide a copy of the "guidance document" referenced in the third paragraph thereof, together with such other guidance documents that may be referred to within the aforesaid "guidance document";

b) indicate whether Hydro has considered achieving compliance "through the use of approved compliance monitoring in areas of exceedances" as referenced in the third paragraph of Derrick Maddock's aforesaid correspondence.

A. a) Please find attached the following policy documents and Guidance Documents:
Policy Directive PPD 98-01
Guidance Document Compliance Determination GD-PPD-009.2
Guidance Document Source Emission Testing GD-PPD-016.1
Guidance Document Plume Dispersion Modelling GD-PPD-019

b) Ascertaining whether Hydro is compliant or non-compliant with the *Air Pollution Control Regulations, 2004* is a process that utilizes both stack dispersion modeling and ambient monitoring.

Pursuant to sections 9 and 11 of Guidance Document GD-PPD-009.2 – *Determination of Compliance with the Ambient Air Quality Standards,* it may be possible to establish compliance by establishing (pursuant to

section 9) an ambient air monitoring network at specific locations of maximum predicted non-compliance, or at approved alternate locations. Emissions levels at approved alternate locations (section 11) are prorated in accordance with the computer dispersion models to determine whether the recorded emission levels indicate compliance.

In the past, the application of the stack testing and computer modeling identified instances where Hydro exceeded the prescribed emission limits. Hydro has a significant ambient air monitoring network with four sites operated over the last 12 years and a fifth added in late 2004, however, it is very problematic to try to set up monitoring at maximum ground level concentration locations identified by modeling in this situation because of land availability, siting restrictions and quality control requirements.

In the meantime, Hydro has been issued a Certificate of Approval governing its activities pertaining to emissions at the HTGS. Pursuant to that Certificate, Hydro has been found to be non-compliant with the *Air Pollution Control Regulations, 2004*, and has therefore determined that action is required to reduce its emissions to an acceptable level under those regulations.

GOVERNMENT OF
NEWFOUNDLAND AND LABRADOR

Department of Environment & Labour

Policy Directive

Division:	Pollution Prevention	P.D.:	PPD 98-01
Prepared by:	Geoff Dawe	Issue Date:	1998-10-09
Authorized by:	Director	Corrected:	
Authorized by:	ADM	Review:	
Approved by:	DM	Supersedes:	
Approved by:	Minister		

Subject:

The methods approved by the Minister for the Monitoring of Air Contaminants as per Section 4 and 12.2 of the Air Pollution Control Regulations(957/96) under the Environment Act (O.C. 96-246).

Objective:

To define the appropriate methods for the monitoring of Air Contaminants. These contaminants are defined as Particulate Matter (includes Total Suspended Particulate, PM_{10} and $PM_{2.5}$), Sulfur dioxide, Carbon monoxide, Nitrogen oxides (as Nitrogen dioxide), Ozone, Volatile Organic Compounds and Lead. Further contaminants may be added, and methods determined, by the Department as the need arises.

Background:

The Air Pollution Control Regulations under the Environment Act state that the Minister may require the installation of such monitoring devices as are necessary to measure the concentrations of various air contaminants. This policy directive sets out the manner in which the monitoring (and reporting) is to be carried out. The policy directive is intended to ensure that the monitoring and reporting activities of the Certificate of Approval, or other requirements set out by the Department, are carried out in a consistent and standardized fashion. This directive is effective immediately and the Department should be consulted in regard to any departure from its requirements. Because of the many approaches to Ambient Air monitoring by various levels of government, the Department should be consulted when in doubt, so that the proponent can adhere to this Department's standards and approach.

Legislative Authority:

Section 4 and 12.2 of the Air Pollution Control Regulations(957/96) under the Environment Act (O.C. 96-246)

Policy:

The Department's Standard Operating procedure for the monitoring of common air contaminants shall be those methods approved by the United States EPA in the "Quality Assurance Handbook for Air Pollution Measurement Systems" Volume II- Ambient Air Specific Methods. The noted exception is in regard to the Rupprecht & Patashnick TEOM(Tapered Element Oscillating Microbalance) because of the different setup configuration for the colder Canadian climate.

The Standard Operating Procedures shall be further defined, by contaminant, to be:

A: Particulate Matter

1: Total suspended Particulate shall be determined by "Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere (High Volume Method)". Section 2.2, 1983

2: High Volume PM_{10} shall be determined by "Reference Method for the Determination of Particulate Matter as PM_{10} in the Atmosphere (High Volume PM_{10} Method) Section 2.11, 1990

3: Dichotomous PM_{10} (includes $PM_{2.5}$) shall be determined by "Reference Method for the Determination of Particulate Matter as PM_{10} in the Atmosphere (Dichotomous Sampler Method) Section 2.10, 1990

4: TEOM PM_{10} and $PM_{2.5}$ are in accordance United States EPA Automated Equivalent Method EQPM-1090-079, and within the guidelines of the Atmospheric and Air Quality Division of Environment Canada for the deployment of Particulate Matter analysers into the National Air Pollution Surveillance Network. Standard Operating Procedures have been established by the Department and methods used should be in consultation with, and the approval of, the Department.

B: Sulfur Dioxide shall be determined by the "Reference Method for the Determination of Sulfur Dioxide in the Atmosphere (Fluorescence) Section 2.9, 1982

C: Carbon Monoxide shall be determined by the "Reference Method for the Determination of Carbon Monoxide in the Atmosphere (Non-Dispersive Infrared Spectrometry) Section 2.6, 1983

D: Nitrogen Oxides (as Nitrogen Dioxide) shall be determined by the "Reference Method for the Determination of Nitrogen Dioxide in the Atmosphere (Chemiluminescence) Section 2.3, 1979

E: Ozone shall be determined by the "Determination of Ozone by Ultraviolet Analysis", A new Method for Volume II, Ambient Air Specific Methods, Quality Assurance Handbook for Air Pollution Measurement Systems. May, 1997.

F: Lead shall be determined by the "Reference Method for the Determination of Lead in Suspended Particulate Matter collected from Ambient Air (Atomic Absorption Spectrometry) Section 2.8, 1981

G: Other contaminants shall be determined after consultation with the Department, and in a method agreeable to the Department.

H: Meteorological data shall be determined according to the procedures and requirements set out in the "Quality Assurance Handbook for Air Pollution Measurement Systems" Volume IV: Meteorological Measurements (revised March, 1995)

These Standard Operating Procedures have been determined to be acceptable by the Department, but in all cases any monitoring initiative, or change in existing procedure, should only proceed after consultation with the Department.

This policy will take effect as soon as it is signed and shall remain in effect until altered or cancelled by the signatories.

Definitions:

The Department refers to the Newfoundland Department of Environment and Labour

GOVERNMENT OF
NEWFOUNDLAND AND LABRADOR

Department of Environment & Conservation

Guidance Document

Title: **Determination of Compliance with the Ambient Air Quality Standards**

Prepared By: _____
Barrie Lawrence, Environmental Biologist

Issue Date: **February 08, 2001**

1st Revision: **July 22, 2004**

2nd Revision: **September 20, 2005**

Approved By: _____
Derrick Maddocks, Director

Compliance Determination
GD-PPD-009.2

SUBJECT

The departmental determination of a facility's compliance with the ambient air quality standards.

OBJECTIVE

To set out and define the procedures that the Department of Environment and Conservation will follow in determining whether a facility is in compliance with Section 3 of the *Air Pollution Control Regulations*. More specifically, this policy will outline the conditions under which a facility will have to perform dispersion modelling, compliance ambient air monitoring, and / or stack emission testing, as well as define how compliance will be determined.

BACKGROUND

Under the *Air Pollution Control Regulations*, the ambient air quality standards are defined for a series of contaminants. These standards define levels that the Minister deems to be acceptable for the protection of the environment, including human life, wildlife and vegetation.

By their very nature, the ambient air quality standards are based on the emissions from all potential sources within an airshed. For some pollutants, such as sulphur dioxide, the number of potential sources in an airshed contributing to the concentrations in ambient air would be limited due to the chemistry involved in the formation of sulphur dioxide. For other pollutants, such as particulate matter, the number of potential sources in an airshed can be quite large, and difficult to assign to any particular source.

To determine the ambient levels of a particular pollutant, typically a series of monitors are located within the airshed. If the level of a pollutant exceeds the corresponding ambient air quality standard, then by Section 3 of the *Air Pollution Control Regulations*, the Minister can specify conditions in an approval or develop an air quality management plan for the airshed. However, it is often the case in an airshed which includes major industrial operations that the series of monitors do not record an ambient concentration in excess of the associated standard, yet an exceedance of the ambient air standard was likely to have occurred in an area where a monitor was not located.

So the question becomes, how is compliance with the ambient air quality standards determined in those areas with the presence of an industrial facility?

In those airsheds without any major industrial influences which could skew the normal levels, a series of monitors is likely representative of the airshed air quality. However, in airsheds with major industrial influences which could skew the normal ambient levels of a pollutant, compliance must be determined factoring into account the emissions from the industrial areas.

This guidance document will address how the Department of Environment and Conservation will determine compliance with the ambient air quality standards when there is a major influence in an airshed.

LEGISLATIVE AUTHORITY

Air Pollution Control Regulations, Sections 3 and 21:

Ambient air quality standards

3. (1) The ambient air quality standards prescribed in Schedule A shall be used to maintain air quality in the province.

(2) The concentration of air contaminants due to all sources shall not exceed the standards prescribed in Schedule A.

(3) For the purpose of ensuring that the standards prescribed in Schedule A are met, the minister may:

(a) specify a condition in an approval issued under Part XI of the Act; or

(b) develop an air quality management plan specifying the provisions to reduce the level of air contaminants emitted by each facility identified in the plan, and the owner or operator of each facility shall

(i) provide the minister with any information he or she may require regarding the development of an air quality management plan, including a company specific air quality management plan, and

(ii) comply with the provisions of the plan within the time specified by the minister.

Manner of measurements, recording and analyses

21. All measurements, recordings and analyses conducted under these regulations shall be

(a) performed at locations and by devices and methods acceptable to the department; and

(b) made readily accessible to the department in a time and manner acceptable to the department.

DEFINITIONS

"ambient air" means the portion of the atmosphere which is external to buildings, structures or underground spaces;

“changed facility” means any existing facility that has been modified;

"department" means the department presided over by the minister;

“distillate fuel oil” means fuel oil grades 1 and 2, which includes light fuel oil and diesel;

“existing facility” means any facility that has been in operation for 2 years or more;

"facility" means any stationary property, real or personal, taken as a whole, which has an emission source;

"GD-PPD-016.1" means departmental guidance document GD-PPD-016.1 entitled *Procedural Guide for Source Emission Testing* or it’s successors;

"GD-PPD-019" means departmental guidance document GD-PPD-019 entitled *Departmental Requirements for Dispersion modelling* or it’s successors;

“modified” means any addition or alteration to emission sources which may cause:

(i) an increase in the release of an air contaminant, or

(ii) an emission of an air contaminant that was not previously emitted;

“new facility” means any facility that has been in operation less than 2 years;

“dispersion model” means a mathematical model used to predict point of impingement concentrations;

"PPD 98-01" means departmental policy document PPD 98-01 entitled *Ambient Air Monitoring Methods* or it’s successors;

“registered” means submitted to and approved by the department in accordance with departmental policy and guidelines;

“residual fuel oil” means fuel oil grades 5, 6 and heavier which includes Bunker C;

"stack" means a chimney, flue conduit or duct arranged to conduct an air contaminant into the environment.

“stack emission test” means the sampling of pollutant emissions from a stack in accordance with departmental guidance document GD-PPD-016.1.

GENERAL

1. These guidelines will apply to all facilities which have emission sources that:

Type I emission source

(a) require a minimum of 2,000,000 litres of residual fuel oil consumption annually; or

(b) require a minimum of 5,000,000 litres of distillate fuel oil consumption annually; or

(c) emit a minimum of 20 tonnes of total particulate matter from a stack or a series of stacks annually; or

(d) require a minimum of 25 MW of electrical power on a continuous basis for use in an industrial process where the process has a resulting emission of an air contaminant to the atmosphere.

Type II emission source

(a) require a minimum of 1,000,000 litres, but less than 2,000,000 litres of residual fuel oil consumption annually, or

(b) require a minimum of 3,000,000 litres, but less than 5,000,000 litres of distillate fuel oil consumption annually, or

(c) generate a minimum 100 KW of electrical power for at least 500 hours annually.

Type III emission source

(a) have a minimum total particulate matter emission of 20 tonnes annually, and is not a Type I emission source.

Type IV emission source

(a) have an emission from a source that is not categorized as either a Type I, Type II or Type III emission source, but which may have an emission that may pose an environmental concern.

2. For all facilities covered by this guideline, compliance with the ambient air quality standards will be determined through a dispersion model, registered with the department and conducted in accordance with GD-PPD-019.

3. Compliance for a facility will be determined based on the predicted levels for all locations at or beyond the administrative boundary as defined in the associated Certificate of Approval.

4. All facilities covered under this guidance are required to show compliance with the ambient air quality standards on a continuous basis as follows, subject to the terms and conditions of the associated Certificate of Approval:

Type I emission source

New Facility

(a) A new facility will be required to register a stack emission test and a dispersion model within the first 6 months of operation, and to have a second stack emission test and dispersion model registered, within the last 6 months of the first 2 years of operation. After the first 2 years of operation, a new facility becomes an existing facility.

Changed Facility

(a) A changed facility will be required to register a stack emission test for the modified emission source and register a dispersion model for the facility, within the first 6 months of operation after the modifications have been completed.

(b) Upon registration, a changed facility will again be considered an existing facility.

Existing Facility

(a) An existing facility will be required to register a stack emission test and dispersion model once every 4 years if it has been shown, through a registered dispersion model, that the facility is compliant with the ambient air quality standards for all pollutants.

(b) If an existing facility has been shown through a registered dispersion model, not to be compliant with the ambient air quality standards for any pollutant, then the facility will normally complete and register a stack emission test and dispersion model, once every 2 years.

(c) Under special circumstances, the department reserves the right to require an existing facility to register a stack emission test, and a dispersion model at more frequent intervals.

Type II emission source

New Facility

(a) A new facility will be required to register a stack emission test and a dispersion model within the first 6 months of operation. After the first 2 years of operation, a new facility becomes an existing facility.

Changed Facility

(a) A changed facility will be required to register a stack emission test for the modified emission source and register a dispersion model for the facility, within the first 6 months of operation after the modifications have been completed.

(b) Upon registration, a changed facility will again be considered an existing facility.

Existing Facility

(a) An existing facility will be required to register a stack emission test and a dispersion model once every 5 years.

(b) Under special circumstances, the department reserves the right to require an existing facility to register a stack emission test, and a dispersion model at more frequent intervals.

Type III emission source

New Facility

(a) A new facility will be required to register a dispersion model within the first 6 months of operation. After the first 2 years of operation, a new facility becomes an existing facility.

Changed Facility

(a) A changed facility will be required to register a register a dispersion model for the

facility, within the first 6 months of operation after the modifications have been completed.

(b) Upon registration, a changed facility will again be considered an existing facility.

Existing Facility

(a) An existing facility will be required to register a dispersion model once every 5 years.

(b) Under special circumstances, the department reserves the right to require an existing facility to complete and register a dispersion model at more frequent intervals.

Type IV emission source

(a) All new, changed and existing facilities will conduct a stack emission tests and register a dispersion model per the provisions outlined in the associated Certificate of Approval.

5. When determining compliance, all sources which account for at least 1% of the facility's total emission, shall be included in the dispersion modelling analysis. Potential sources include, but are not limited to, stacks, vents, stockpiles, open pits, blasting, tailings, tanks, loadouts, lagoons and on-site vehicular movement. Emission determination from stacks and vents will be in accordance with GD-PPD-016.1 or through in-stack continuous emission monitoring. Emissions from tanks will be determined through the U.S. EPA Tanks program, adjusted for the meteorological conditions at the industrial facility. Emissions from all other potential sources may be determined through on-site measurements or through approved emissions factors.

6. For the purposes of this guidance document:

(a) New facilities include facilities which began operation on or after October 1, 2005,

(b) Existing facilities include facilities which were in operation on or before September 30, 2005,

(c) Changed facilities include facilities which completed modifications on or after October 1, 2005.

(d) Modifications do not include:

(i) routine maintenance, repair and parts replacement;
(ii) normal increases in production rates unless otherwise prohibited;
(iii) increases in hours of operation unless otherwise prohibited; or
(iv) use of an alternative cleaner fuel or raw material.

7. Where a facility can demonstrate to the department that an emission source, which would have otherwise been subject to the provisions of this guidance document, is not a major contributor to the local ambient airshed, then upon application, the frequency of stack emission testing, as outlined in this guidance document, may be reduced.

8. For each pollutant modelled, where the maximum predicted ground-level concentration under all operating scenarios is below the associated ambient air quality standard for the given timeframe, the facility will be deemed to be compliant for that particular pollutant. The facility will be deemed compliant when the modelling for all pollutants of concern indicates each pollutant is below the associated ambient air quality standard. Compliance will be valid until registration of the next scheduled dispersion model.

9. If non-compliance is determined, a facility may elect to enter into a compliance agreement with the department for the purposes of:

(a) attaining compliance within a reasonable timeframe; or

(b) establishing a compliance ambient monitoring network at locations of maximum predicted non-compliance. If the network indicates compliance at all locations for all timeframes after 2 years of monitoring, then the facility will be deemed compliant. If the network indicates non-compliance at any locations for any timeframe within 2 years of monitoring, then the facility will enter into an additional compliance agreement for the purposes of attaining compliance within a reasonable timeframe.

10. Where a facility elects to establish and operate a compliance ambient monitoring network, it will be established subject to the provisions of the facility's Certificate of Approval and in accordance with PPD 98-01.

11. Where it is not practical to establish a compliance ambient monitoring network at locations of maximum predicted non-compliance, upon application to the department, the facility may establish a compliance ambient monitoring network at alternate locations in close proximity to the location of maximum predicted non-compliance. In such situations, compliance will be based on prorating the monitored levels to the locations of maximum predicted non-compliance based on the registered dispersion model.

12. The establishment of a compliance ambient monitoring network in no way supersedes any requirements placed on a facility to operate a community ambient monitoring network as defined in the associated Certificate of Approval.

13. All records from both a community ambient monitoring network and a compliance ambient monitoring network will be public record and used for public awareness.

GOVERNMENT OF
NEWFOUNDLAND AND LABRADOR

Department of Environment and Conservation
Pollution Prevention Division

Guidance Document

Title: **Procedural Guide for Source Emission Testing**

Prepared By: _____
Barrie Lawrence, Environmental Biologist

Issue Date: **December 6, 2001**

Revision Date: **May 28, 2004**

Approved By: _____
Derrick Maddocks, Director

Subject

The procedures accepted by the department for source emission testing as per Section 21 of the *Air Pollution Control Regulations NLR 39/04.*

Objective

To define the required analytical procedures for compliance source emission testing. In so doing, the department ensures that the quality of all results obtained and submitted to the department are complete and consistent across all industrial facilities.

Background

In the past, when the department required an industrial facility to perform a source emission test, the procedures which the facility followed were often left to the discretion of the facility. As there are several similar but uniquely different procedures available, this discretion often led to inconsistencies in the information that was both collected and reported when facilities employed different contractors.

Having recognized the inconsistencies and the problems associated therein, as an initial step, in 1998 the department developed an interim policy directive which adopted a standard set of analytical procedures which all industrial facilities would follow. Subsequent to this interim policy directive, the department developed a standard set of guidelines which clearly defined the circumstances and conditions under which source emission testing would occur. These guidelines, coupled with the adoption of the standard set of analytical procedures, have cumulated in this guidance document, and replaces the rescinded interim policy directive PPD: 98-02.

Definitions

In this guidance document:

(a) “air contaminant” means any discharge, release, or other propagation into the air and includes, but is not limited to, dust, fumes, mist, smoke, particulate matter, vapours, gases, odours, odorous substances, acids, soot, grime or any combination thereof;

(b) “criteria air contaminants” mean the following specific air contaminants: carbon monoxide, nitrous oxides, particulate matter (including fractions), and sulphur oxides;

(c) “department” means the Department of Environment and it’s successors;

(d) “regulations” mean the *Air Pollution Control Regulations NLR 39/04*, as amended from time to time;

(e) “stack” means a stationary chimney, flue, conduit or duct arranged to conduct an air contaminant to the natural environment;

(f) ”source emission test” means the sampling of air contaminant emissions from a stack in accordance with this guidance document.

1. SAMPLE AND VELOCITY TRAVERSES

This procedure is used to determine representative measurement sites for air contaminant emissions and/or total volumetric flow rate from a stack, where the effluent gas stream is flowing in a known direction. This procedure cannot be used when:

(1) flow is cyclonic or swirling (see Section 1.4),
(2) a stack is smaller than 0.15 metre (6 in.) in diameter,
(3) the stack has a non-circular or non-rectangular cross-section, or
(4) the measurement site is less than 2 stack diameters downstream or less than 0.5 diameters upstream from a flow disturbance.

The requirements of this procedure must be considered before construction of a new facility from which emissions will be measured; failure to do so may require subsequent alterations to the stack or deviation from the standard procedure.

1.1 SPECIFICATIONS AND LOCATION OF SAMPLING PORTS

Sampling and velocity measurement should ideally be performed at a port located at least eight stack diameters downstream and two diameters upstream from any flow disturbance such as a bend, expansion, or contraction in the stack, or from a visible flame. For conical stacks, i.e. circular stacks which uniformly decrease in diameter with height, an equivalent diameter (D_e) is the diameter at the upstream flow disturbance. For a rectangular cross section, the equivalent diameter (D_e) for determining the upstream and downstream distances, shall be determined by Equation 1.1:

Equation 1.1

$$D_e = \frac{2DW}{D+W}$$

where: D=depth
W=width

.

Example. For a rectangular stack measuring 0.9 metres by 1.1 metres on the cross-sections, D_e would equal 0.99 metres.

(Reference hereafter to “diameter” includes both diameter of a circular cross-section and an equivalent diameter of a conical and rectangular cross-section.)

For a stack with a circular or conical cross-section, at least 2 sampling ports separated by 90° are required for stacks $\leq$ 2.50 metres in diameter, and at least 4 sampling ports, each separated by 90° are required for stacks > 2.50 metres in diameter. The ports are to be installed at an equal height such that centreline of each port intersects the others and the centrelines are perpendicular to the upstream flow disturbance as outlined in Figure 1.1-1. For rectangular cross-sections, ports are located on the most convenient side of the stack. The sampling ports will be constructed from 6 inch Schedule 40 pipe, threaded on one end and fitted with a cap as detailed in Figure 1.1-2. Assembly of sampling equipment with relation to the sampling ports is shown in Figure 1.1-3.

Figure 1.1-1

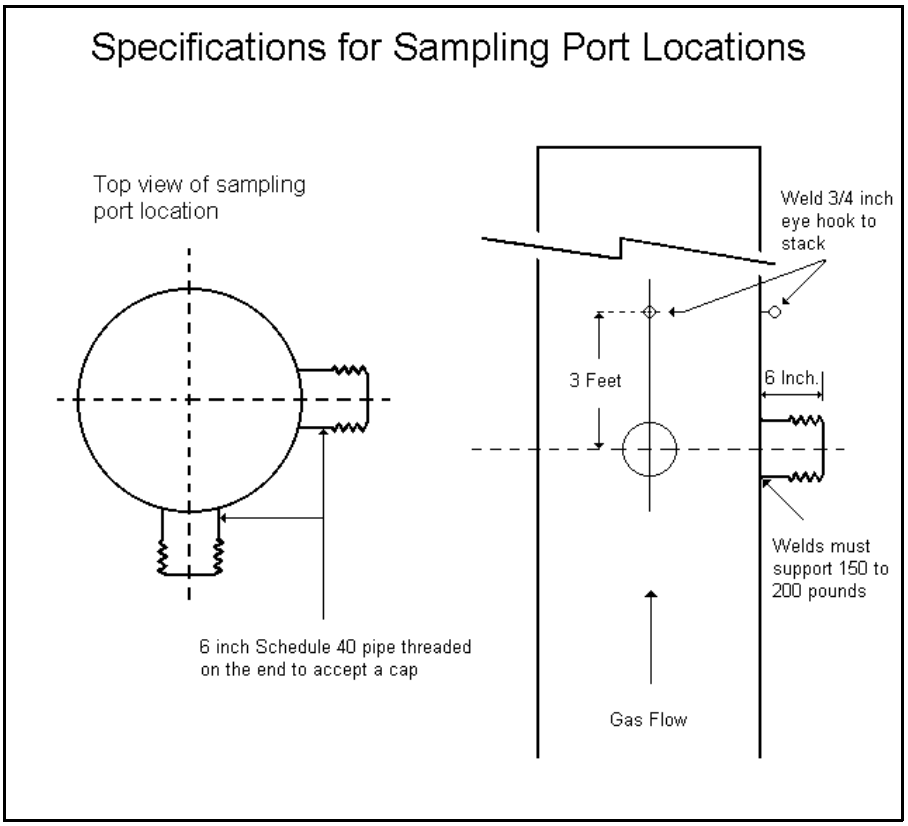


Figure 1.1-2

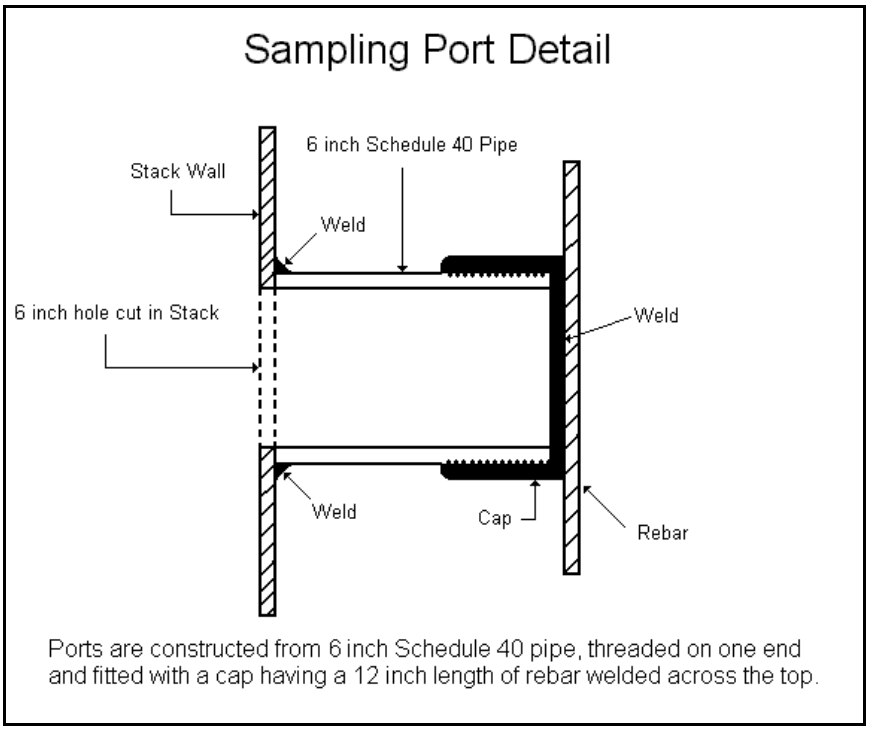
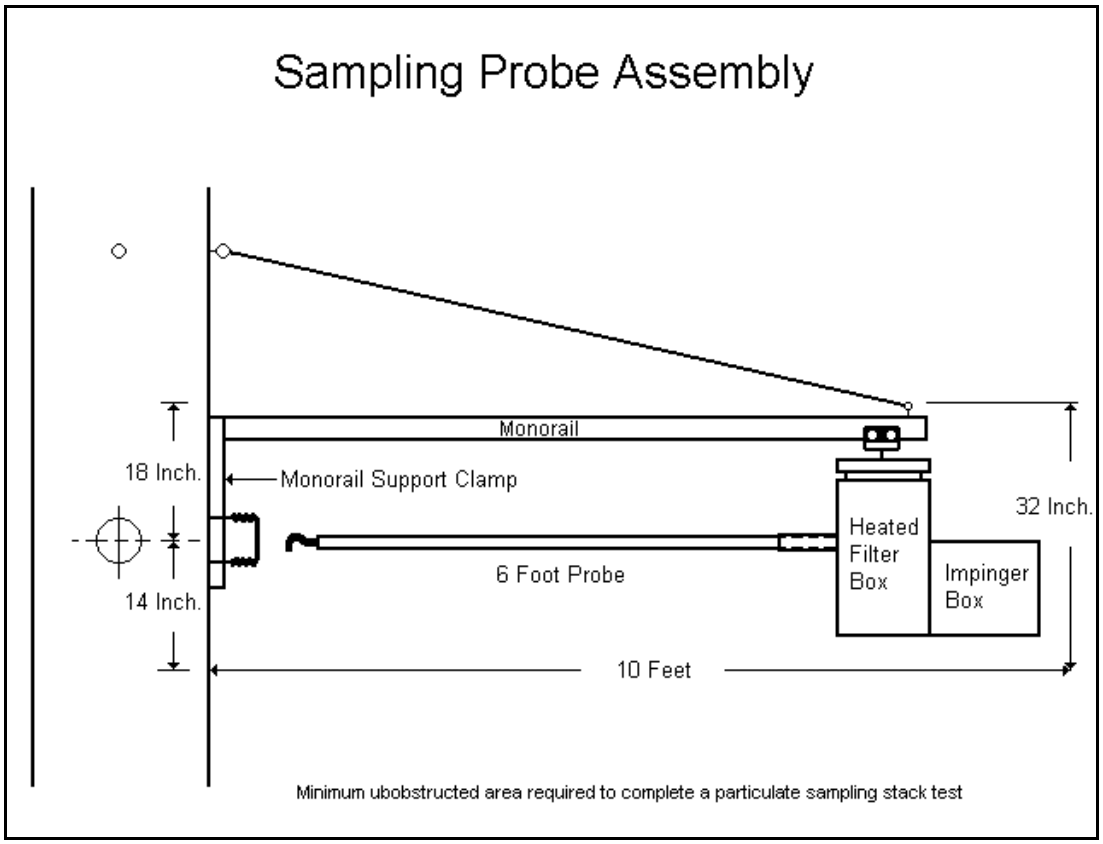


Figure 1.1-3



1.2 DETERMINATION OF THE NUMBER OF SAMPLING POINTS

The minimum number of total traverse points shall be as per Table 1.2-1.

Before referring to the table, determine the distances from the chosen measurement site to the nearest upstream and downstream disturbances, (A and B as shown in Figure 1.2-1 respectively), and divide each distance by the stack diameter, to determine the distance in terms of the number of stack diameters. Then, determine from Table 1.2-1 the minimum number of traverse points that corresponds to: (X) the number of duct diameters upstream; and (Y) the number of diameters downstream. For circular and conical stacks the number of sampling points will be the larger of the two minimums determined from Table 1.2-1. For rectangular stacks, the number of sampling points will be greater than or equal the larger of the two minimums determined from Table 1.2-1 such that for stacks with a depth to width ratio less than or equal to 1.5, the value is contained in Table 1.2-2, and for stacks with a depth to width ratio greater than 1.5, the matrix is chosen to closely approximate the stack dimensional ratio.

Figure 1.2-1

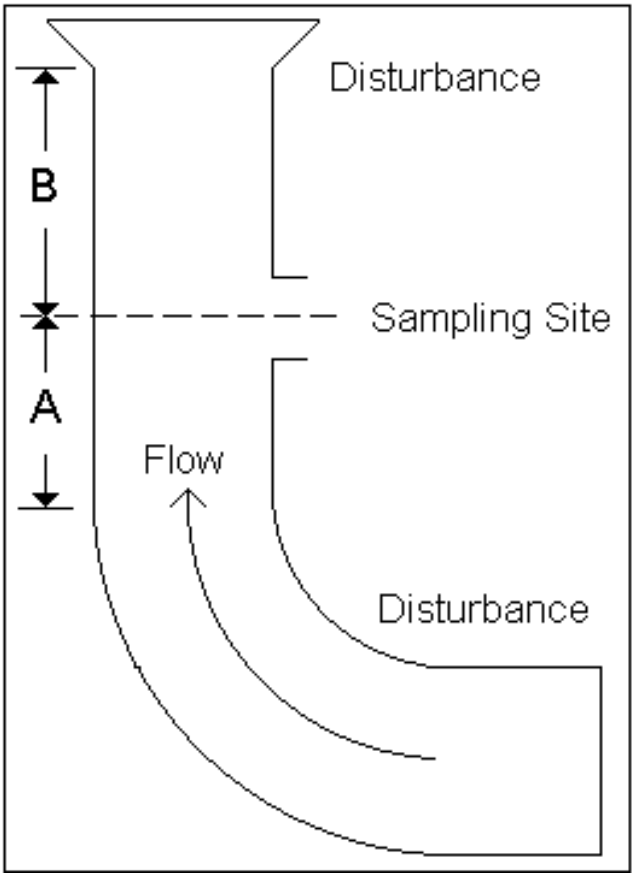


Table 1.2-1

MINIMUM REQUIRED SAMPLING POINTS						
Stack Diameter (m)	1.75 ≤ **Y** < 2.00	1.50 ≤ **Y** < 1.75	1.25 ≤ **Y** < 1.50	1.00≤ **Y** < 1.25	0.75 ≤ **Y** < 1.00	0.50 ≤ **Y** < 0.75
	7 ≤ **X** < 8	6 ≤ **X** < 7	5 ≤ **X** < 6	4 ≤ **X** < 5	3 ≤ **X** < 4	2 ≤ **X** < 3
$0.15 < D_e \leq 0.30$	4	4	4	4	8	8
$0.30 < D_e \leq 0.60$	8	8	8	12	12	12
$0.60 < D_e \leq 1.30$	12	16	20	24	24	24
$1.30 < D_e \leq 2.50$	16	20	24	28	28	28
$2.50 < D_e \leq 5.00$	20	24	28	32	32	32
$5.00 < D_e$	24	28	32	36	36	36

Table 1.2-2

CROSS-SECTIONAL LAYOUT FOR RECTANGULAR STACKS WITH DEPTH TO WIDTH RATIO ≤ 1.5	
Sampling Points	Rectangular Matrix Layout
4	2 x 2
9	3 x 3
12	3 x 4
16	4 x 4
20	4 x 5
25	5 x 5
30	5 x 6
36	6 x 6

1.3 LOCATION OF SAMPLING POINTS

For circular and conical stacks, locate the traverse points on two perpendicular diameters according to the example shown in Figure 1.3-1 and Table 1.3-1.

Figure 1.3-1: Example showing circular stack cross sections divided into 12 equal areas with location of traverse points

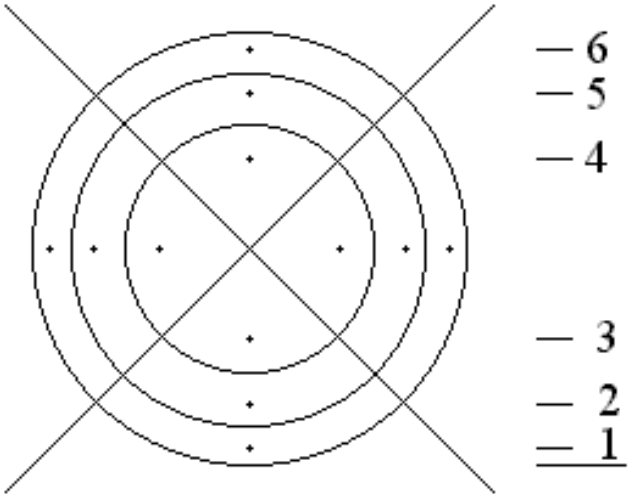


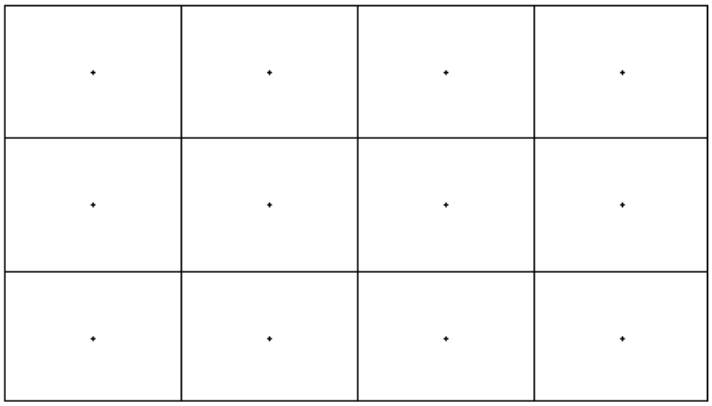
Table 1.3-1

LOCATION OF TRAVERSE POINT IN CIRCULAR STACKS (% of stack diameter from inside wall to traverse point)									
Traverse point number	Number of traverse points on a diameter								
	2	4	6	8	10	12	14	16	18
1	14.6	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8
7				89.5	77.4	64.4	36.6	28.3	23.6
8				96.8	85.4	75.0	63.4	37.5	29.6
9					91.8	82.3	73.1	62.5	38.2
10					97.4	88.2	79.9	71.7	61.8
11						93.3	85.4	78.0	70.4
12						97.9	90.1	83.1	76.4
13							94.3	87.5	81.2
14							98.2	91.5	85.4
15								95.1	89.1
16								98.4	92.5
17									95.6
18									98.6

For stacks having diameters greater than 0.61 m (24 in.) no traverse points shall be located within 2.5 centimetres (1.00 in.) of the stack wall. When any of the traverse points fall within 2.5 cm (1.00 in.) of the stack wall, relocate them away from the stack wall to either a distance of 2.5 cm (1.00 in.) or a distance equal to the sampling nozzle inside diameter, whichever is larger. For stacks having diameters equal to or less than 0.61 m (24 in.), no traverse points shall be located within 1.3 cm (0.50 in.) of the stack wall. When any of the traverse points fall within 1.3 cm (0.50 in) of the stack wall, relocate them away from the stack walls to either a distance of 1.3 cm (0.50 in.) or a distance equal to the sampling nozzle inside diameter, whichever is larger. These relocated traverse points shall be the ‘‘adjusted’’ traverse points. Whenever two successive traverse points are combined to form a single adjusted traverse point, treat the adjusted point as two separate traverse points, both in the sampling (or velocity measurement) procedure, and in recording the data.

For rectangular stacks, determine the number of traverse points as explained in Section 1.2 of this procedure. From Table 1.2-3 determine the grid configuration. Divide the stack cross-section into as many equal rectangular elemental areas as traverse points, and then locate a traverse point at the centroid of each equal area according to the example in Figure 1.3-2. The situation of traverse points being too close to the stack walls is not expected to arise with rectangular stacks.

Figure 1.3-2: Example showing rectangular stack cross section divided into 12 equal areas with a traverse point at centroid of each area



1.4 VERIFICATION OF ABSENCE OF CYCLONIC FLOW

In most stacks, the direction of gas flow is essentially parallel to the stack wall. However, cyclonic flow may exist after such devices as cyclones and inertial demisters, following venturi scrubbers, or in stacks having tangential inlets or other duct configurations which tend to induce swirling. In these instances, the presence or absence of cyclonic flow at the sampling location must be determined.

The following technique is acceptable for this determination.

Level and zero the manometer. Connect a Type S pitot tube to the manometer. Position the Type S pitot tube at each traverse point, in succession, so that the planes of the face openings of the pitot tube are perpendicular to the stack cross-sectional plane; when the Type S pitot tube is in this position, it is at ‘‘0˚ reference.’’ Note the differential pressure (Δp) reading at each traverse point. If a null (zero) pitot reading is obtained at 0˚ reference at a given traverse point, an acceptable flow condition exists at that point. If the pitot reading is not zero at 0˚ reference, rotate the pitot tube (up to ± 90˚), until a null reading is obtained. Carefully determine and record the value of the rotation angle (α) to the nearest degree. After the null technique has been applied at each traverse point, calculate the average of the absolute values of α; assign α values of 0˚ to those points for which no rotation was required, and include these in the overall average. If the average value of α is greater than 20˚, the overall flow condition in the stack is unacceptable and alternative methodology must be used to perform accurate sampling.

1.5 NON-STANDARD SAMPLING REGIMES

For sampling or velocity measurement regimes that do not conform to the procedures stated herein, the department must be consulted prior to the implementation of the sampling or velocity measurement program.

2. SAMPLING TRAIN CONDITIONS AND STANDARDS

2.1 NUMBER OF TESTS

Each stack is required to be tested a minimum of 3 times for every operating scenario. Results from all tests and an average are to be reported to the department.

2.2 SAMPLE TIMES

At each sample point as located in Section 1.3, a minimum of two readings will be taken before the sampling equipment is repositioned to the next point. One set of readings will be taken immediately after the assembly is positioned, and the subsequent reading(s) at the time defined in Table 2.2-1. The minimum total sampling time for each test shall be 60 minutes.

Table 2.2-1

Minimum Sampling Times and Number of Readings				
Sampling Points	Number of Readings per Sampling Point	Total Number of Readings	Time per Reading	Total Sample Time
4	6	24	2.5 minutes	60 minutes
8	4	32	2 minutes	64 minutes
12	3	36	2 minutes	72 minutes
16	2	32	2.5 minutes	80 minutes
20	2	40	2 minutes	80 minutes
24	2	48	2 minutes	96 minutes
28	2	56	2 minutes	112 minutes
32	2	64	2 minutes	128 minutes
36	2	72	2 minutes	144 minutes

2.3 SAMPLE VOLUMES

The sampling nozzle shall be sized to obtain a minimum sample volume of 1 m^3 (35.3 ft^3) If the minimum sample volume cannot be obtained in the minimum time in Section 2.2, then the sampling time will be adjusted accordingly to collect the required volume.

2.4 ISOKINETIC SAMPLING

The sampling nozzle shall be sized to ensure particulate sampling is isokinetic. The acceptable isokinetic deviation per reading is 100% +/- 10%. For size fractionation, the acceptable isokinetic deviation per reading is 100% +/- 20%.

2.5 LEAK CHECKS

Leak checks are mandatory to ensure that the sample has not been diluted by excess air. Sampling will not proceed until either a maximum leakage rate of 0.00057 m^3 / minute (0.02 ft^3 / minute) or 4% of the estimated sampling rate is achieved. Leak checks will be performed immediately prior to sampling, immediately after completion of sampling and immediately before and after a component change during sampling.

2.6 CALIBRATIONS

Equipment used in the sampling train shall be calibrated within the 6 months prior to the start of sampling. The sampling team must carry current copies of the calibration certificates for all calibrated equipment used in the sampling train. Such certificates must include all pertinent data, date of calibration and the name of the person who performed the calibration. All calibrated equipment shall be permanently and uniquely identified for easy reference. Calibration certificates are required for:

Dry Gas Meter
Magnehelic Pressure Gauges
Nozzles
Orifice Meter
Pitot Tubes
Thermocouples
Rotameter.

2.7 INTERRUPTIONS

If during any sampling test, a facility fails to maintain the source operating conditions as defined under Section 3.5, then an interruption has occurred and the following shall apply:

(1) The sampling is immediately discontinued upon such interruption
(2) The sampling probe is removed and sealed
(3) The sampling train temperature is maintained
(4) If such interruption is less than 10 minutes, then sampling can resume at the point where the interrupt occurred once the sampling process conditions are reestablished and leak checks are performed
(5) If such interruption exceeds 10 minutes then the test results will be considered invalid and sampling shall restart once the sampling process conditions are reestablished
(6) Any such interruption must be noted and reported to the department

3. SAMPLE COLLECTION CONDITIONS AND STANDARDS

3.1 PRETEST PLAN

All facilities shall submit a pretest plan to the department, a minimum of 30 days prior to stack emission testing and such plan shall include:

Process Parameters

i) mode of operation (cyclic, batch or continuous)
ii) product / raw material feed rates and composition
iii) fuel feed rates and composition
iv) normal operating temperatures
v) specific process parameters affecting emissions
vi) data verifying source operating conditions as defined in Section 3.5
vii) process flow diagrams identifying all points of emission related to the emission testing program

Stack Parameters

i) physical dimensions and layout of each stack
ii) sample port locations relative to upstream and downstream disturbances
iii) number of sampling points per stack
iv) physical and chemical nature of the pollutants

Test Area Parameters

i) shelter and safety provisions for sampling team
ii) accessibility to sampling site
iii) sampling platform and scaffolding requirements
iv) availability of power sources

General Parameters

i) description of the facility
ii) proposed dates of the sampling program
iii) statement of qualifications and experience of the sampling team
iv) source testing methods, subject to Section 3.3

If the pretest plan is deemed inadequate by department officials, the department shall request the necessary information from the industrial facility a minimum of 20 days prior to the first day of the proposed sampling schedule. The industrial facility shall submit the requested information to the department a minimum of 10 days prior to the first day of the proposed sampling date. All testing will be conducted only after acceptance of the pretest plan by department officials.

The facility shall notify the department of the final source testing schedule, 7 days prior to the actual commencement of source testing.

3.2 CONTAMINANTS TO BE TESTED

All source emission tests will require testing for the criteria air contaminants, carbon dioxide and oxygen as a minimum. The department reserves the right to require testing for other air contaminants in addition to the criteria air contaminants. Stacks that have not previously been tested, will normally require testing for other air contaminants as part of the initial source emission test.

3.3 SOURCE TESTING METHODS

The approved sampling methods are the United States Environmental Protection Agency (US EPA) methods under Codes of Regulations (CFR) Part 60 Appendix A and US EPA Test Methods for Evaluating Solid Wastes Physical / Chemical Methods (SW-846) and specifically are:

CFR Part 60 Methods:

Method 2	Determination of stack gas velocity and volumetric flow (Type S pitot tube)
Method 3A	Determination of Oxygen and Carbon Dioxide concentrations in emissions from stationary sources (instrumental analyzer procedure)
Method 4	Determination of Moisture content in stack gases
Method 5	Determination of Particulate emissions from stationary sources
Method 6C	Determination of Sulphur Dioxide emissions from stationary sources (instrumental analyzer procedure)
Method 7E	Determination of Nitrogen Oxide emissions from stationary sources (instrumental analyzer procedure)
Method 10	Determination of Carbon Monoxide emissions from stationary sources
Method 25A*	Determination of Total Gaseous Organic concentration using a flame ionization analyzer
Method 29*	Determination of Metals emissions from stationary sources
Method 201A	Determination of PM_{10} Emissions (Constant Sampling Rate Procedure)

SW-846 Methods:

Method 0010*	Modified Method 5 Sampling Train (Semi-Volatiles)
Method 0023A*	Sampling Method for Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofuran Emissions from Stationary Sources
Method 0030*	Volatile Organic Sampling Train

* when required

The department reserves the right to require sample retesting if the above noted Methods are not adhered to.

Upon request, the department may allow source testing to occur via other methods. Such request will be made in the pretest plan and will include the rationale and justification of using the alternate method.

If required by the department under section 3.2, other air contaminants will be sampled by a method approved by the department.

3.4 PARTICULATE SIZE FRACTIONATION

Particulate emission testing will incorporate size fractionation with the determination of PM_{10} and $PM_{2.5}$ as a minimum. If required, additional fractions will be determined via a cascade impactor yielding a minimum of 6 fractions, using a method approved by the department. Alternate methods of fractionation may also be used upon approval by the department.

3.5 SOURCE OPERATING CONDITIONS

The facility, will operate all sources which feed into the stack being tested, at the rate between the 85th percentile and the 95th percentile of the daily rates from the previous 3 years. Such rate shall be confirmed by departmental officials prior to the start of the source emission testing. Failure to maintain such a rate during sampling shall constitute an interruption under Section 2.7.

3.6 SOURCE TESTING AUDIT

Notwithstanding Section 3.1, the source testing program shall be subject to an onsite audit by a department official for consistency with the provisions of this document. If the audit shows that the provisions of this document are not met, then the onsite department official shall immediately suspend the source testing program for the affected pollutants. Source testing for such pollutants shall resume when the deficiencies identified during audit are within acceptable tolerances and addressed to the satisfaction of the onsite department official.

4. REPORTING REQUIREMENTS

4.1 FUEL CONSUMPTION

During source emission testing, the facility shall record and report total fuel consumption of all sources which feed into the stack.

4.2 FUEL COMPOSITION

During source emission testing, the facility shall sample and report the feed fuel of the stack being sampled, and have such sample independently analyzed for:

i)	% sulphur by weight	ASTM D129-95, ASTM D4294-98
ii)	% ash by weight	ASTM D482-95
iii)	API gravity	ASTM D4052-96
iv)	nickel ppm	AA or ICP
v)	vanadium ppm	AA or ICP
vi)	other parameters as determined by the department	

4.3 REPORTING RESULTS

The source emission testing results, irrespective of any other requirements placed on the facility such as a dispersion model report, shall be submitted to the department within 75 days of completion of the sampling and shall include:

i) all field data recorded during testing
ii) instrument calibration information
iii) sampling site characteristics
iv) detailed statistics for each sample run
v) fuel consumption and composition data for each sample run
vi) data confirming the required facility operating conditions
vii) all other information required under this document

4.4 REFERENCE CONDITIONS

All source emission testing results, irrespective of the method specification, shall be reported based on a dry gas temperature of 25° Celsius and a gas pressure of 101.325 kilopascals.

GOVERNMENT OF
NEWFOUNDLAND AND LABRADOR

Department of Environment

Guidance Document

Title: Departmental Requirements for Plume Dispersion Modelling

Prepared By: **Barrie Lawrence, Environmental Biologist**

Issue Date: **June 10, 2002**

Approved By: **Derrick Maddocks, Director**

Subject

The regulatory methods approved by the department for the purpose of calculating point of impingement concentrations as per Section 5 of the *Air Pollution Control Regulations.*

Objective

To define the terms and conditions of the regulatory models approved by the department for calculating the concentration of air contaminants at point of impingement released from stationary sources. **In so doing, the department ensures that the quality of all results obtained and submitted to the department are complete and consistent across all industrial facilities and employ the latest advances in modelling technology.**

Background

Under Subsection 7(3) of the former *Air Pollution Control Regulations, 26/81*, the method for determining the concentration of an air contaminant at point of impingement was in accordance with the formulae contained in Appendix 1 therein or in accordance with another method acceptable to the Minister. As the method of calculation in Appendix 1 was based on simplified plume dispersion modelling techniques, it was deemed inappropriate for inclusion in the updated *Air Pollution Control Regulations, 957/96*, thereby leaving the only available option for point of impingement calculations as a method acceptable to the Minister. In 1997, departmental policy directive PD: IEED 97-3 was developed to address the methods acceptable to the Minister, however, since that time, several new and advanced dispersion models have been developed. As these new models will be the principal models used worldwide in the foreseeable future, it has become necessary to update the requirements of PD: IEED 97-3 to reflect these models. **This guidance document therefore, defines the terms and conditions of the models approved by the department for calculating the concentration of air contaminants at point of impingement released by stationary sources. It replaces the rescinded policy directive PD: IEED 97-3.**

Definitions

In this guidance document:

(a) "AERMOD modelling system" means the modelling system developed by United States Environmental Protection Agency (US EPA) in conjunction with the American Meteorological Society (AMS) and includes the AERMET meteorological preprocessor, the AERMAP terrain preprocessor, and the AERMOD dispersion model;

(b) "air contaminant" means any discharge, release, or other propagation into the air and includes, but is not limited to, dust, fumes, mist, smoke, particulate matter, vapours, gases, odours, odorous substances, acids, soot, grime or any combination thereof;

(c) "CALPUFF modelling system" means the modelling system developed by Earth Tech Inc. and includes the CALMET meteorological preprocessor, the CALPUFF dispersion model, the CALPOST postprocessor, and the associated

preprocessing programs;

(d) "department" means the Department of Environment and it's successors;

(e) "point of impingement" means an animate or inanimate object, at or above ground level, upon which an air contaminant may impinge.

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1. APPROVED MODELS

For all regulatory applications, the CALPUFF modelling system is approved, subject to the terms and conditions outlined in Section 10. Under special circumstances outlined in Sections 5 and 6, and with the prior approval of the department, the US EPA model SCREEN3 and the AERMOD modelling system, respectively, may be approved for regulatory applications. If a circumstance exists where the CALPUFF modelling system, or alternatively the AERMOD modelling system or the SCREEN3 model is not appropriate, the department will review, on a case by case basis, the appropriateness of alternate models and define the terms and conditions under which an alternate model will be employed.

2. CALPUFF MODELLING SYSTEM - OVERVIEW

The CALPUFF modelling system includes three main components: CALMET, CALPUFF and CALPOST and a large set of preprocessing programs designed to interface the model to standard, routinely-available meteorological and geophysical datasets. CALMET is a meteorological model that develops hourly wind and temperature fields on a three-dimensional gridded modelling domain. Associated two-dimensional fields such as mixing heights, surface characteristics and dispersion properties are also included in the file produced by CALMET. CALPUFF is a transport and dispersion model that advects "puffs" of material emitted from modelled sources, simulating dispersion and transformation processes along the way. It typically uses the fields generated by CALMET, or as an option, uses simpler non-gridded meteorological data much like the existing plume models. Temporal and spatial variations in the meteorological fields selected are explicitly incorporated in the resulting distribution of puffs throughout a simulation period. The primary output files from CALPUFF contain either hourly concentrations or hourly deposition fluxes evaluated at selected receptor locations. CALPOST is used to process these files, producing tabulations that summarize the results of the simulation, identifying, for example, the highest and second highest 1-hour average concentrations at each receptor. When performing visibility-related modelling, CALPOST uses concentrations from CALPUFF to compute extinction coefficients and related measures of visibility, reporting these for selected averaging times and location. [1]

3. AERMOD MODELLING SYSTEM - OVERVIEW

The AERMOD modelling system includes three main components: AERMET, AERMAP and AERMOD. AERMET is a general purpose meteorological preprocessor for organizing available meteorological data, and requires the input of surface roughness, Bowen ratio and albedo together with morning upper air soundings and hourly observations of wind speed, wind direction, cloud cover and temperature. AERMAP is a terrain preprocessor whose primary purpose is to determine the height scale for each receptor in the modelling domain. AERMOD is a steady-state plume dispersion model for assessment of pollutant concentrations from a variety of sources. AERMOD simulates transport and dispersion from multiple point, area, or volume sources based on an up-to-date characterization of the atmospheric boundary layer. [2,3]

4. US EPA SCREEN3 MODEL - OVERVIEW

SCREEN3 is a Gaussian plume model that incorporates source-related factors and meteorological factors to estimate pollutant concentration from continuous sources. It assumes that the pollutant does not undergo any chemical reactions, and that no other removal processes, such as wet or dry deposition, act on the plume during its transport from the source. SCREEN3 performs all of the single source, short-term calculations including estimating maximum ground-level concentrations and the distance to the maximum, incorporating the effects of building downwash on the maximum concentrations for both the near wake and far wake regions, estimating concentrations in the cavity recirculation zone, estimating concentrations due to inversion break-up and shoreline fumigation, and determining plume rise for flare releases. SCREEN3 can not explicitly determine maximum impacts from multiple sources. [4]

5. SCREEN3 MODEL - SPECIAL CIRCUMSTANCES

The SCREEN3 model may be approved for regulatory applications provided the application does not involve situations denoted in Table 5.1 and either;

1) does not have annual emissions in excess of those denoted in Table 5.2; or

2) does have annual emissions in excess of those denoted in Table 5.2, but the department has deemed the use of the model as adequate for the application.

For pollutants not listed in Table 5.2, but where the use of SCREEN3 may otherwise be approved, the department shall determine, on a case by case basis, if SCREEN3 may be applied. If SCREEN3 indicates a potential violation of the ***Air Pollution Control Regulations*** or a condition of a Certificate of Approval, then the department may require the use of either the AERMOD modelling system or the CALPUFF modelling system. In such circumstances, the application shall adhere to the provisions of Sections 9 or 10 respectively.

Examples of regulatory applications for which SCREEN3 may be approved include:

- single source diesel powered electrical generators
- space heating of small rectangular buildings
- VOC emissions from small autobody shops
- single flare oil production wells

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Table 5.1

Applications where SCREEN3 is not acceptable	
- Multiple sources	- Complex fumigation calculations [a]
- On-site meteorological data required	- More than 1 downwash structure exists
- Terrain elevations vary about the sources	- Total suspended particulate modelling with particulate size fractionation required

a. Situations where fumigation occurs and terrain is above the final plume rise height, land use is urban, or stack height is less than 10 metres.

Table 5.2

Pollutant	Annual Emission (kilograms)
sulphur dioxide (SO_2)	5000
total suspended particulate (TSP)	1000
particulate matter less than 10 microns (PM10)	500
particulate matter less than 2.5 microns (PM2.5)	250
nitrogen oxides (as nitrogen dioxide) (NO_x)	5000

6. AERMOD MODELLING SYSTEM - SPECIAL CIRCUMSTANCES

The AERMOD modelling system, as detailed in Section 9, may be approved for regulatory application if the application does not involve situations denoted in Table 6.1. If an application involves a circumstance denoted in Table 6.1, the application shall adhere to the provisions of the CALPUFF modelling system detailed in Section 10.

Should this guidance document require the use of CALPUFF for regulatory application, but the use of the AERMOD modelling system was previously approved by an existing Certificate of Approval, the AERMOD modelling system may be used until the expiration of the Certificate of Approval or is otherwise replaced by another Certificate of Approval. The requirements of this guidance document shall be reflected in any future Certificate of Approval.

Table 6.1

Applications where the AERMOD modelling system is not acceptable	
- Long range transport (> 50km)	- Visibility-related postprocessing
- Overwater and coastal interaction effects	- Chemical transformations present
- Temporal analysis required	- Modelling of odour
- Subgrid scaling of complex terrain	- Wet or dry deposition calculations [b]

b. Deposition calculations not currently available with the AERMOD modelling system. At such time when the AERMOD modelling system incorporates deposition calculations, this stipulation will be considered for removal.

7. POLLUTANTS TO BE MODELLED

Unless otherwise specified under an approval issued by the department, the minimum number of pollutants to be modelled include:

(1) For combustion sources:

(1) sulphur dioxide (SO_2);
(2) total suspended particulate (TSP);
(3) particulate matter less than 10 microns (PM10);
(4) particulate matter less than 2.5 microns (PM2.5);
(5) nitrogen oxides (as nitrogen dioxide) (NO_x); and
(6) carbon monoxide (CO).

(2) For non-combustion sources:

(1) total suspended particulate (TSP);
(2) particulate matter less than 10 microns (PM10); and
(3) particulate matter less than 2.5 microns (PM2.5).

Where other pollutants are deemed by the department to have the potential to exceed the limits established in the *Air Pollution Control Regulations* or otherwise have an adverse affect on the environment, the department reserves the right to require the modelling of these other pollutants.

8. AVERAGING PERIODS TO BE MODELLED

For regulatory applications in which the SCREEN3 model is approved by the department, the averaging period to be modelled for all pollutants denoted in Section 7 is 1 hour. For all other regulatory applications, the averaging periods to be modelled for all pollutants denoted in Section 7 are contained in Table 8.1. Where concentrations are modelled, the results shall be reported in micrograms per cubic metre ($\mu g/m^3$). Where deposition is modelled, the results shall be reported in micrograms per square metre ($\mu g/m^2$). The minimum output requirement is the maximum concentration at each receptor for the time frames denoted in Table 8.1 over the meteorological period defined in Sections 9 and 10.

Table 8.1

Pollutant	**Averaging Period**
sulphur dioxide (SO_2)	1 hour, 3 hour, 24 hour, annual
total suspended particulate (TSP)	1 hour, 24 hour, annual
particulate matter less than 10 microns (PM10)	1 hour, 24 hour
particulate matter less than 2.5 microns (PM2.5)	1 hour, 24 hour
nitrogen oxides (as nitrogen dioxide) (NO_x)	1 hour, 24 hour, annual
carbon monoxide (CO)	1 hour, 8 hour

Where modelling of other pollutants is required under Section 7, such modelling shall be conducted for the averaging

periods specified by the department.

9. AERMOD MODELLING SYSTEM - MODELLING PROVISIONS

When modelling with the AERMOD modelling system, the following minimum specifications shall be required as model inputs:

AERMET

(a) Meteorological data inputs shall consist of observations extracted from twice daily upper air soundings together with hourly surface data from an on-site meteorological station and/or nearest Environment Canada meteorological station. Where sufficient meteorological data from an on-site station is available, a minimal data record of 1 year is required for regulatory applications. Where sufficient meteorological data from an on-site station is not available, then a minimal data record of 3 years is required consisting of on-site data supplemented with data from the nearest Environment Canada meteorological station. Where no on-site data is available, then a minimal data record of 5 years is required from the nearest Environment Canada meteorological station. Data from an Environment Canada meteorological station can be obtained from the Atlantic Climate Centre in Fredericton NB. Upper air sounding data can be obtain from the Atlantic Climate Centre in Fredericton NB, or the National Climatic Data Center (NCDC) in the United States.

(b) Data extracted from the twice daily upper air soundings shall extend to the 500 mb level and shall incorporate all sounding levels (mandatory, significant, etc.), including the surface level and 500 mb level. Data to be extracted at each level includes, pressure, altitude, temperature, dew point temperature, wind direction and wind speed. The upper air soundings are to be taken from the nearest upper air station. Where a facility is approximately equidistant from 2 upper air stations, the station to the west is to be used.

(c) Sufficient on-site meteorological data includes: wind speed, wind direction, ambient temperature, barometric pressure and opaque cloud cover (or alternatively total cloud cover). Meteorological data from an Environment Canada station shall include: wind speed, wind direction, ambient temperature, barometric pressure, opaque cloud, total cover, ceiling height and relative humidity.

(d) Albedo, Bowen ratio and surface roughness may be taken as seasonal values, though monthly is preferred, for a minimum of 4 direction sectors. Each sector shall be representative of the prevalent site characteristics, and need not be equal in dimension. In situations where the site characteristics are not explicitly defined within the generally available literature and tables, pre-approval of the albedo, bowen ratio and surface roughness values is required.

(e) All wind directions are to be randomized to 1º, either prior to using AERMET or through the METHOD command in AERMET.

(f) Only results from the latest version of AERMET shall be acceptable. As of the date of this guidance document, the version was 02081. The department shall be contacted prior to undertaking compliance modelling to confirm the latest acceptable version.

AERMAP

(a) All applications are required to employ terrain effects, and calculate effects at ground-level.

(b) Terrain elevation data shall be extracted from digital elevation mapping available from the Department of Government Services and Lands or National Resources Canada. When available, terrain elevations shall be extracted from maps scaled 1:2500 in MTM (Modified Traverse Mercator) - NAD83 coordinates. When 1:2500 scaled digital elevation maps are not available, data shall be extracted from 1:50000 scaled maps in UTM (Universal Traverse Mercator) - NAD83 coordinates.

(c) Terrain / receptor grids shall be rectangular Cartesian using either MTM or UTM coordinates as noted above, with a maximum spacing as follows:

1) 100 metre spacing from the centre of the source out to 1.0 km,
2) 200 metre spacing from 1.0 km out to 5.0 km,
3) 500 metre spacing beyond 5.0 km,
4) 100 metre spacing within all residential areas of communities less than 5.0 km of property fenceline,
5) 200 metre spacing within all residential areas of communities beyond 5.0 km of property fenceline.

The physical extent of the spacing requirement shall be determined after consultation with the department.

(d) Only results from the latest version of AERMAP shall be acceptable. As of the date of this guidance document, the version was 99211. The department shall be contacted prior to undertaking compliance modelling to confirm the latest acceptable version.

AERMOD

(a) Building downwash must be accounted for when it exists. As a general rule of thumb, if a building height is greater than 40% of the source emission height, then there is building downwash.

(b) Building downwash shall be calculated via the Plume Rise Model Enhancements (PRIME) algorithm with the appropriate output variables from the PRIME algorithm serving as inputs into AERMOD. These variables are (variable name):

1) direction specific projected building width (buildwid),
2) direction specific projected building height (buildhgt),
3) along flow distance from the stack to centre of upwind face of the projected building (xbadj),
4) across flow distance from the stack to centre of upwind face of the projected building (ybadj).

(c) The application is to be employed in regulatory default mode.

(d) The application is to be employed without flagpole heights.

(e) Source emission parameters shall be taken from the most recent stack test conducted in accordance with departmental guidance document GD-PPD-016. If no stack parameters exist, then source inputs to the model shall be made only in consultation with the department.

(f) Only results from the latest version of AERMOD shall be acceptable. As of the date of this guidance document, the version was 01247. The department shall be contacted prior to undertaking compliance modelling to confirm the latest acceptable version.

10. CALPUFF MODELLING SYSTEM - MODELLING PROVISIONS

When modelling with the CALPUFF modelling system, the following minimum specifications shall be required as model inputs:

CALMET

(a) Meteorological data inputs shall consist of observations extracted from twice daily upper air soundings together with hourly surface data from an on-site meteorological station and/or nearest Environment Canada meteorological station. Where sufficient meteorological data from an on-site station is available, a minimal data record of 1 year is required for regulatory applications. Where sufficient meteorological data from an on-site station is not available, then a minimal data record of 3 years is required consisting of on-site data supplemented with data from the nearest Environment Canada meteorological station. Where no on-site data is available, then a minimal data record of 5 years is required from the nearest Environment Canada meteorological station. Data from an Environment Canada meteorological station can be obtained from the Atlantic Climate Centre in Fredericton NB. Upper air sounding data can be obtain from the Atlantic Climate Centre in Fredericton NB, or the National Climatic Data Center (NCDC) in the United States.

(b) Data extracted from the twice daily upper air soundings shall extend to the 500 mb level and shall incorporate all sounding levels (mandatory, significant, etc.), including the surface level and 500 mb level. Data to be extracted at each level includes, pressure, altitude, temperature, dew point temperature, wind direction and wind speed. The upper air soundings are to be taken from the nearest upper air station. Where a facility is approximately equidistant from 2 upper air stations, the station to the west is to be used.

(c) Sufficient on-site meteorological data includes: wind speed, wind direction, ambient temperature, barometric pressure and opaque cloud cover (or alternatively total cloud cover). Meteorological data from an Environment Canada station shall include: wind speed, wind direction, ambient temperature, barometric pressure, opaque cloud, total cover, ceiling height and relative humidity.

(d) The meteorological grid shall be rectangular Cartesian, and shall be sufficiently large to encompass the entire modelling domain. Nodal spacing within the grid shall be a maximum of 1000 metres, but where terrain varies significantly about the facility, a meteorological grid of smaller spacing may be required. In the vertical, a minimum of 7 cell face heights are required, the heights of which are dependent of the nature of the facility being modelled and the surrounding terrain. The bias at each cell face height shall

be determined only after consultation with the department.

(e) Where sea breezes are likely to affect the dispersion of a pollutant from a facility located in close proximity to the ocean, the lake breeze module must be employed. In this case, sea surface meteorological parameters must be extracted from a representative station. Though hourly is preferred, parameters recorded weekly or monthly may be acceptable.

(f) Albedo, bowen ratio, surface roughness, soil heat flux, anthropogenic heat flux, leaf area index and land use parameters are to be determined for each node of the meteorological grid. In situations where these characteristics are not readily available from the Lands branch of the Department of Government Services and Lands or from other sources, the Department of Environment shall be contacted for appropriate guidance.

(g) All applications are required to employ terrain effects. Terrain elevation data shall be extracted from digital elevation mapping available from the Department of Government Services and Lands or National Resources Canada. When available, terrain elevations shall be extracted from maps scaled 1:2500 in MTM (Modified Transverse Mercator) - NAD83 coordinates. When 1:2500 scaled digital elevation maps are not available, data shall be extracted from 1:50000 scaled maps in UTM (Universal Traverse Mercator) - NAD83 coordinates.

(h) All parameters of the input file are to be set at default unless justification exists to the contrary. For the following parameters, however, the required values are noted:

Parameter	Name	Value
ICALM	Calm wind extrapolation	1

(i) Wind directions are to be randomized to 1º or better.

(j) Where only one surface meteorological station exists in the meteorological grid, the LVARY variable, specifying the radius of influence of the meteorological data, shall be set to true. If more than one surface meteorological station exists, then appropriate values of RMAX1, RMAX2 and RMAX3 need to be defined based on the topography of the meteorological grid.

(k) Only results from the latest version of CALMET shall be acceptable. As of the date of this guidance document, the version was 5.2, level 000602d. The department shall be contacted prior to undertaking compliance modelling to confirm the latest acceptable version.

CALPUFF

(a) The receptor grid shall be rectangular Cartesian using either MTM or UTM coordinates as noted above, with a maximum spacing as follows:

1) 100 metre spacing from the centre of the source out to 1.0 km,
2) 200 metre spacing from 1.0 km out to 5.0 km,
3) 500 metre spacing beyond 5.0 km,
4) 100 metre spacing within all residential areas of communities less than 5.0 km of property fenceline,
5) 200 metre spacing within all residential areas of communities beyond 5.0 km of

property fenceline.

The physical extent of the spacing requirement shall be determined after consultation with the department.

(b) The computational grid shall be sized such that it extends a minimum of 1 km beyond the outer extent of the receptor grid in all directions to allow for puffs to reintegrate onto the receptor grid in the event of wind directional changes.

(c) Building downwash must be accounted for when it exists. As a general rule of thumb, if a building height is greater than 40% of the source emission height, then there is building downwash.

(d) All parameters of the input file are to be set at default unless justification exists to the contrary. In situations where the default parameters are not justified for modelling, such as modelling for wet removal and dry deposition, the department shall be contacted for guidance. Irrespective of these situations, for the following parameters, the required values shall be:

Parameter	Name	Value
MCTADJ	Terrain adjustment method	2
MSHEAR	Wind shear above stack top	1
MSPLIT	Puff splitting allowed	1
MDISP	Dispersion coefficient method	2
MPDF	PDF formulation under convective	1

(e) In situations where the prediction of near source concentrations are desired, or in situations where building downwash is significant, CALPUFF shall be run in slug mode, i.e. parameter MSLUG= 1, versus puff mode.

(f) Source emission parameters shall be taken from the most recent stack test conducted in accordance with departmental guidance document GD-PPD-016. If no stack parameters exist, then source inputs to the model shall be made only in consultation with the department.

(g) Only results from the latest version of CALPUFF shall be acceptable. As of the date of this guidance document, the version was 5.5, level 010730_1. The department shall be contacted prior to undertaking compliance modelling to confirm the latest acceptable version.

CALPOST

(a) All parameters of the input file, subject to the provisions of Section 8, are to be set at default unless justification exists to the contrary.

(b) Only results from the latest version of CALPOST shall be acceptable. As of the date of this guidance document, the version was 5.2, level 991104d. The department shall be contacted prior to undertaking compliance modelling to confirm the latest acceptable version.

11. REPORTING

The modelling report shall be submitted to the department within 120 days of completion of a source emission test as defined in an approval issued to the industry, or in accordance with departmental guidance document GD-PPD-009. The modelling report shall include:

(a) isopleths for the pollutants listed in Section 7 over the time frames specified in Table 8.1, superimposed on a map defining major roads, buildings, structures, landmarks.

(b) a listing of model input parameters including a copy of the input and output files.

(c) accompanying discussion of the results.

12. REFERENCES

1. Scire, J.S, D.G. Strimaitis and R.J. Yamartino, 2000: A User's Guide for the CALPUFF Dispersion Model. Earth Tech Inc., Concord MA.

2. U.S. Environmental Protection Agency, 1998: User's Guide for the AERMOD Meteorological Preprocessor (AERMET). U.S. Environmental Protection Agency, Research Triangle Park, NC.

3. U.S. Environmental Protection Agency, 2000: 40 CFR Part 51, Guideline on Air Quality Models, Proposed Rule. U.S. Environmental Protection Agency.

4. U.S. Environmental Protection Agency, 1995: Screen3 Model User's Guide. U.S. Environmental Protection Agency, Research Triangle Park, NC.