Alberta Government

Air Monitoring Directive Chapter 3: Ambient Monitoring Site Selection, Siting Criteria and Sampling System Requirements

August 3, 2016

Title:	**Air Monitoring Directive Chapter 3: Ambient Monitoring Site Selection, Siting Criteria and Sampling System Requirements**
Number:	**AEP, Air, 2016, No. 1-3**
Program Name:	**Air Policy**
Effective Date:	**September 23, 2014**
This document was updated on:	**August 3, 2016**
ISBN No:	**978-1-4601-1764-4 (Printed Edition)** **978-1-4601-1765-1 (On-line Edition)**
Disclaimer:	

Table of Contents

List of Tables

List of Figures

1.0 Purpose

This Ambient Monitoring Site Selection, Siting Criteria and Sampling System Requirements document forms a part (Chapter 3) of Alberta's Air Monitoring Directive (Alberta Environment and Parks 2016, as amended from time to time) and will hereafter be referred to as the Site Selection Chapter. Refer to Chapter 1 (the AMD Introduction) for requirements and definitions that apply to all parts of the AMD, a list of what components constitute the AMD, and details on review of and revisions to the AMD.

The purpose of the Site Selection Chapter is to outline:

- criteria and guidelines for selecting a monitoring site; and
- sampling system requirements;

for continuous ambient air monitoring stations, precipitation monitoring, passive sampling, and intermittent sampling.

SS 1-A	*The person responsible must comply with the requirements set out in the Site Selection Chapter of the AMD on or before September 23, 2015.*

1.1 Amendments

August 3, 2016

1. Update to document design/branding.
2. Changed "precipitation sampler" to "precipitation sampling equipment" in each occurrence and in SS 2-A changed "precipitation sampler" to "precipitation sampling site" for consistency with Chapter 4.
3. Note added below Table 2 for siting in relation to roadways.
4. Changed angle from 30° to 26.5° in SS 2-D (d) to coincide with 2 times the height of the obstacle above the inlet in (c) and updated angle in Figure 1 to 26.5°.
5. For siting passives, changed elevation angle from the diffusion barrier surface to the top of any obstacle from 30° or less to 26.5° or less (Table 4 and Figure 3). Removed criteria B from Table 4 and Figure 3 (distance from obstacle of greater than 10 times the obstacle height).
6. Provided a reference in section 2.5 guidance to Chapter 4 for requirements for conducting precipitation sampling.
7. Removed requirement to bury power and communications cables in SS 2-K.
8. Removed requirement for the use of ground-fault circuit interrupters in clause SS 3-C for consistency with current Alberta Electrical Code.

9. Change to clause numbering in section 3.0 on account of removal of SS 3-C.

10. Changed SS 3-H to require the water and large particulate knock-out trap to be installed to prevent water and large particulate from entering the sample line, rather than requiring installation and the end of the manifold.

11. Changed SS 3-I (b) to require the particulate filter be installed according to the manufacturer's specifications, rather than requiring installation upstream of the analyzer.

12. In SS 4-B, added clarification that site documentation requirements apply to continuous ambient air monitoring stations.

13. In SS 4-C, clarified that site documentation requirements apply to a network of one or more continuous ambient air monitoring stations to reflect the error in transferring requirements from the 1989 AMD. Therefore a windrose is required for each continuous ambient air monitoring station.

14. In SS 4-C (b), removed requirement for topographic map since map is required in SS 4-C (a).

15. In SS 4-D, removed requirement for cross-sectional sketch through obstacles since non-conformances are to be documented separately as per SS 4-B (h) and SS 4-D (e).

16. In SS 4-F and SS 4-G, corrected error in cross reference (from SS 4-B to SS 4-A). Clause SS 4-A is the requirement to complete and submit site documentation.

17. Changed SS 4-F to require site number or site name for passives, rather than serial number.

18. Switched order of appendices to match order of reference in the body text.

2.0 Site Selection and Siting Criteria

2.1 Site Selection

SS 2-A	*The person responsible shall site each ambient air monitoring station, precipitation sampling site, passive sampler, and intermittent sampler in accordance with the requirements of the AMD.*

The location of ambient monitoring sites should be based on an objective procedure which will provide the best monitoring results to meet the needs of the monitoring program. In the case of industrial operations, dispersion modelling is to be used to determine the general location of a monitoring site. Once the general location is determined, the specific siting requirements outlined in the Site Selection Chapter need to be followed when establishing the final site.

SS 2-B	*The person responsible shall use dispersion modelling to locate all new continuous ambient air monitoring stations, precipitation samplers, passive samplers, and intermittent samplers for each industrial operation that requires an approval, unless otherwise specified in writing by the Director.*
SS 2-C	*The person responsible must obtain authorization in writing from the Director for the siting of each ambient air monitoring station, precipitation sampler, passive sampler, and intermittent sampler for industrial operations which submit ambient air monitoring data to the Regulator.*

The authorization for the siting of ambient air monitoring in SS 2-C may be addressed through the authorization of an ambient air monitoring program submitted by an industrial operation as part of approval requirements.

2.2 Standard Siting Criteria

In addition to the siting requirements in the Site Selection Chapter, a site should be accessible year round (in normal weather conditions), have available utilities and other support facilities, be secure against vandalism, and be secure from both wild and domestic animals.

Obstructions such as trees and fences can significantly alter the air flow. It is important that air flow around the sample inlet is representative of the general air flow in the area to prevent sampling bias. The area is defined by the spatial scale most appropriate to the monitoring objective (urban, regional, etc.). Therefore, the following factors should be considered when placing sample inlets so as to avoid introducing bias to the sample: inlet height above the ground; inlet length (for horizontal inlets); inlet distance from airflow restrictions; and distance from roadways and other physical influences.

Sampling locations that are unduly influenced by downwash or ground dust (e.g., a rooftop air inlet near a stack or a ground-level inlet near an unpaved road) should be avoided. In these cases, the sample inlet would need to be elevated above the level of the maximum ground turbulence effect or placed at a reasonable distance from the source of ground dust.

2.3 Continuous Ambient Air Monitoring Siting Criteria

SS 2-D	*The person responsible must site continuous ambient air monitoring sampling inlets in accordance with the following siting criteria, unless otherwise specified in writing by the Director:* *(a) meeting the criteria outlined in Table 1;* *(b) greater than 20 metres horizontally from trees;* *(c) the distance from the sample inlet to any air flow obstacle, e.g., buildings, is greater than 2 times the height of the obstacle above the inlet;* *(d) the elevation angle is 26.5° or less from the sample inlet to the top of any obstacle; and* *(e) air flow is unrestricted in 3 of the 4 wind quadrants.*

Figure 1 illustrates siting requirements that are outlined in clause SS 2-D and in Table 1.

Portable generators used as power for an ambient air monitoring station are not recommended, but if their use cannot be avoided, siting criteria are as follows.

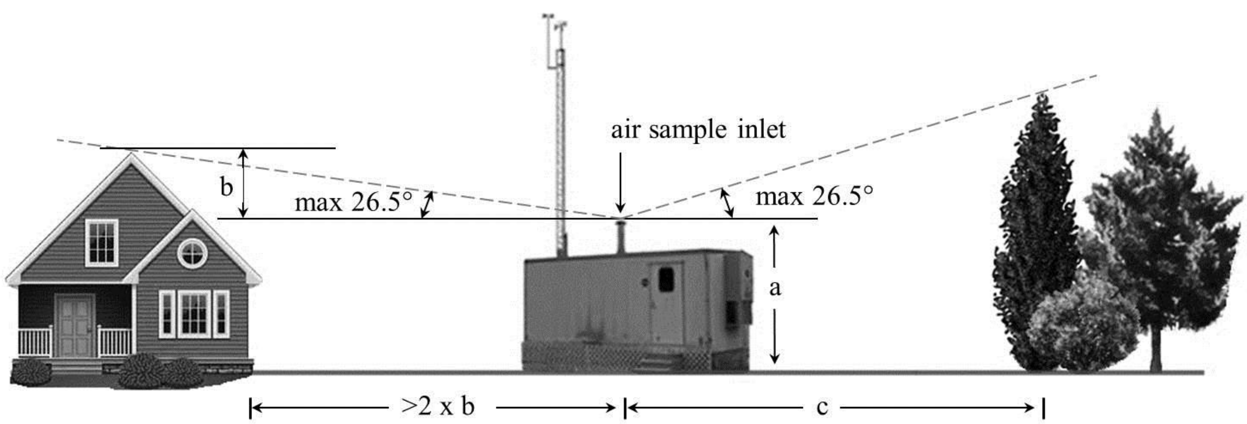
SS 2-E	*When using a portable generator, the person responsible must locate the portable generator exhaust at least 30 metres downwind of the air sample inlet of any ambient air monitoring station.*

Table 1 Criteria for locating standard continuous ambient air monitoring sampling inlets

Pollutant	Height above ground (m)	Distance from Supporting Structures: Vertical (m)	Distance from Supporting Structures: Horizontal[1] (m)	Other Criteria / Requirements
$PM_{2.5}$ and PM_{10}	2 to 15	>2	>2	No nearby[2] furnace or incinerator stacks
SO_2	3 to 15	>1	>1	No nearby[2] furnace or incinerator stacks
				Inlet height must be > 0.8 of the mean height of surrounding buildings
H_2S, TRS, HC, BTEX, NH_3	3 to 15	>1	>1	Inlet height must be > 0.8 of the mean height of surrounding buildings
CO	3 to 10	>1	>1	> 10 metres from street intersections or at mid-block location
O_3, NO_2	3 to 15	>1	>1	

[1] When an inlet is located on a rooftop, this separation distance is in reference to walls, parapets, or penthouses located on the roof.

[2] Distance depends on the height of furnace or incinerator stacks, type of waste or fuel burned, and quality of fuel (sulphur and ash content). This is to avoid undue influences from nearby sources.



Note: All angles of projection are measured from the sample inlet and all heights measured relative to the base of the instrumentation.

Where:

- a = height of sample inlet above ground (Table 1)
- b = distance from sample inlet to any air flow obstacle (e.g., buildings) must be greater than 2 times the height of the obstacle above the sample inlet (SS 2-D (c))
- c = sample inlet must be greater than 20 metres horizontally from trees (SS 2-D (b))

Figure 1 Illustration of distance and height requirements for sampling inlets for a standard continuous ambient air monitoring site

SS 2-F	*The person responsible shall site continuous ambient air monitoring stations a minimum distance away from roadways as indicated in Table 2, unless otherwise specified in writing by the Director.*

Table 2 Minimum distance from roadways for siting continuous ambient air monitoring stations

Average Traffic (vehicles per day)	≤ 10,000	15,000	20,000	40,000	70,000	≥ 110,000
Minimum distance to roadway (metres)	≥ 10	20	30	50	100	≥ 250

Note: If vehicle count falls between the values provided, the vehicle count should be rounded up to the nearest 10,000 to choose minimum siting distance from roadways.

2.3.1 Siting of Wind Instruments

SS 2-G	*The person responsible shall site wind instruments in accordance with the siting criteria outlined in Table 3.*

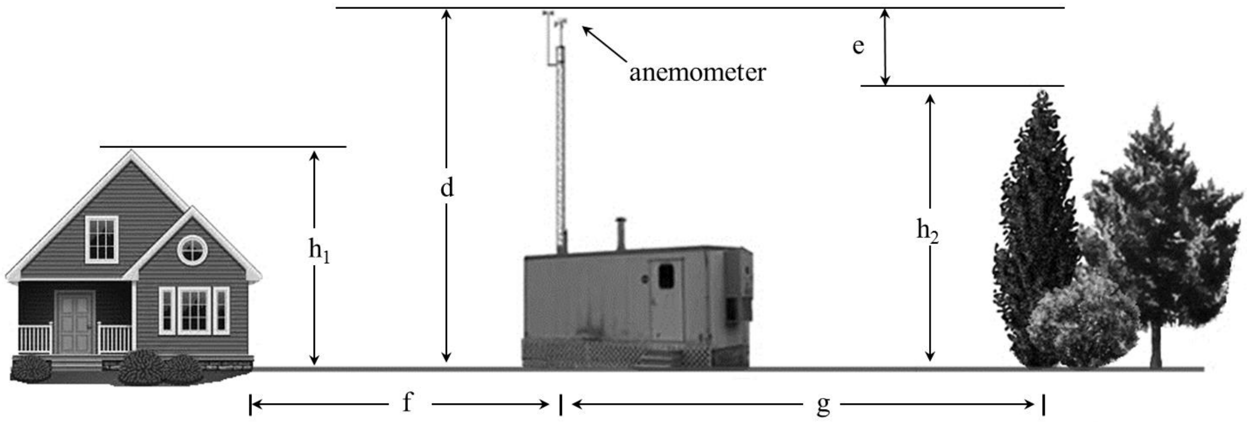
Figure 2 illustrates siting requirements that are outlined clause SS 2-G and in Table 3.

Table 3 Criteria for siting wind instruments

Site Characteristics		Wind Instruments
Height above ground	A.	Greater than 2.5 times shelter height (minimum of 10 metres)
Other requirements	B.	Height above any obstacle greater than 2 metres, and surroundings for 100 metre radius must be uniform
		or:
	C.	Distance from obstacles greater than 10 times the obstacle height

SS 2-H	*The person responsible shall orient wind direction instruments with respect to "True North".*

Magnetic compasses may be used, but survey benchmarks or the Local Apparent Noon procedure described in Appendix A is more accurate for orienting wind direction instruments to True North.



Where:

h_1 = height of obstacle 1
h_2 = height of obstacle 2
d = must be greater than 2.5 times the shelter height (minimum of 10 metres) (Table 3 A)
e = height above any obstacle greater than 2 metres (Table 3 B)
f = distance must be minimum 10 times h_1 (Table 3 C)
g = distance must be minimum 10 times h_2 (Table 3 C)

Figure 2 Illustration of distance and height requirements for siting wind instruments

2.4 Passive and Intermittent Sampler Siting Criteria

Passive and intermittent sampling provides concentrations of substances averaged over the sampling period, for example daily or monthly.

SS 2-I The person responsible shall site passive samplers:
(a) in accordance with the siting criteria in Table 4; and
(b) mounted to a supporting structure (fence post, trees, etc.) such that airflow will not be restricted.

Static monitors should be sited using the same criteria as passive samplers until such time that statics are no longer in use (refer to the Monitoring Chapter of the AMD, Chapter 4).

Table 4 Siting criteria for passive samplers

Site Characteristics	Passive Samplers
Diffusion barrier surface height above ground	1.5 to 4 metres
Other requirements	Elevation angle is 26.5° or less from the diffusion barrier surface to the top of any obstacle

Note: All angles of projection are measured from the instrument inlet and all heights measured relative to the base of the instrumentation.

The horizontal distance between co-located or replicate passive samplers should be no more than 4 metres. It is recommended that replicate passive samplers, and all passive samplers within a monitoring network, be positioned at the same sampling height. Figure 3 illustrates siting requirements for passive samplers that are outlined in Table 4.

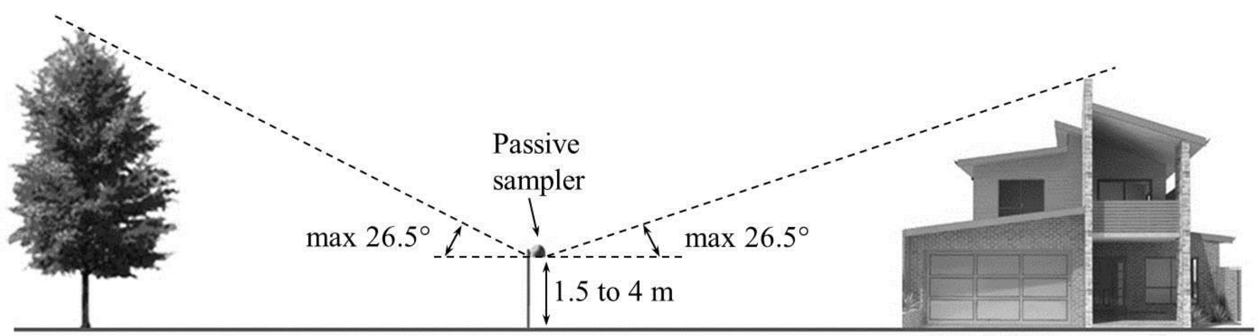


Figure 3 Illustration of siting requirements for passive samplers

SS 2-J	*The person responsible shall site intermittent samplers in accordance with the siting criteria in Table 5.*

Table 5 Siting criteria for intermittent samplers

Site Characteristics		Intermittent Samplers
Sampler inlet - height above ground		minimum 2 metres, maximum 15 metres
Other requirements	A.	Distance from an obstacle greater than 2.5 times the height of the obstacle above the sampler, and
	B.	at least 2 metres from any other samplers or inlets with flow rates greater than 200 litres per minute, or at least 1 metre apart from any other samplers or inlets with flow rates less than or equal to 200 litres per minute, and
	C.	unrestricted air flow in 3 to 4 wind quadrants.

2.5 Precipitation Sampling Equipment Siting Criteria

When co-locating precipitation sampling equipment with continuous analyzers (gases and particulate matter) it may be necessary to locate precipitation sampling equipment away from continuous analyzers as they have conflicting requirements. To meet the siting requirements of both, a three sided clearing is a suitable compromise, with continuous analyzers on the predominately downwind side. Refer to the Monitoring Chapter (Chapter 4) of the AMD for requirements for conducting precipitation sampling.

2.5.1 Siting of Precipitation Sampling Equipment

SS 2-K *The person responsible shall site precipitation sampling equipment:*

- *(a) with the inlet or opening height above ground 1.0 to 3.0 metres;*
- *(b) on a flat surface;*
- *(c) so that the distance away from any obstruction is 2.5 times the height of the obstruction;*
- *(d) greater than 5 metres, horizontally, from surfaces such as concrete or metal;*
- *(e) in a clearing for which the diameter does not exceed 10 times the height of the trees in the vicinity;*
- *(f) mounted so that the opening through which precipitation enters the sampler can be adjusted to 1 metre above accumulated snow;*
- *(g) with the chassis situated in an East-West orientation; and*
- *(h) with a 15 amp power supply shared with the rain gauge.*

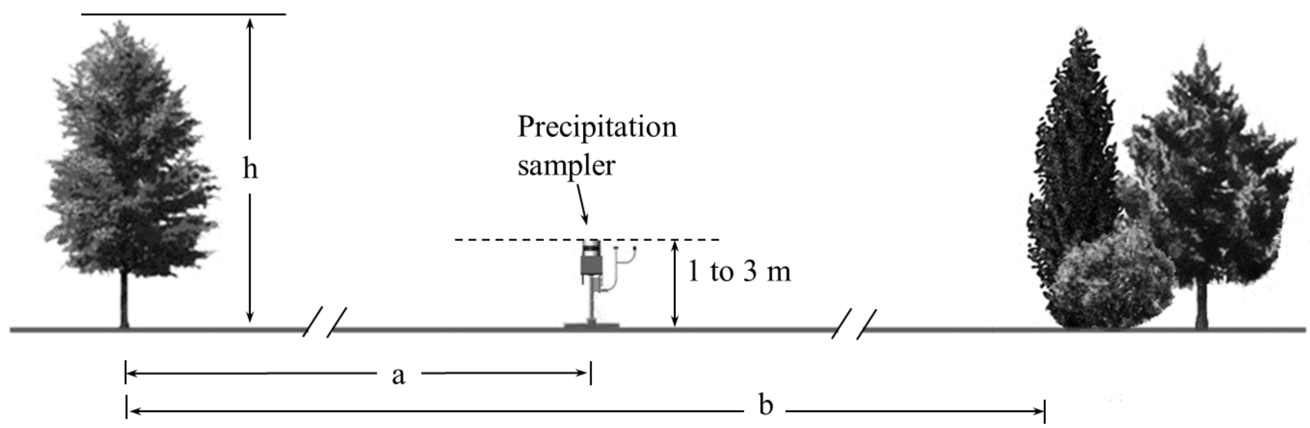
Figure 4 illustrates siting requirements outlined in SS 2-K.

2.5.2 Siting of Background Precipitation Sampling Equipment

Alberta adapted the Canadian Air and Precipitation Monitoring Network (CAPMoN) criteria for siting background, regional scale precipitation sampling. The CAPMoN program is designed to study regional trends of air pollutants in both air and precipitation.

The criteria outlined in Table 6 are set to avoid local source influences. These sites should represent the general topography, flow patterns and precipitation characteristics of the area. Additional 'on site' siting requirements for precipitation sampling equipment are outlined in Section 2.5.1 of the Site Selection Chapter.

SS 2-L *The person responsible shall site all new background precipitation sampling in accordance with the criteria outlined in Table 6.*



Where:

h = height of obstacle

a = distance must be minimum 2.5 times h (SS 2-K (c))

b = diameter of clearing must be less than 10 times the height of the trees (SS 2-K (e))

Figure 4 Illustration of precipitation sampling equipment siting

Table 6 Station and inlet siting criteria for precipitation sampling equipment

Influence	Spacing Distance
Industrial pollution sources	>50 km for individual point sources (exceeding 10,000 tonnes SO_2 or NO_x emissions per year) or the sum of collective point and area sources (exceeding 10,000 tonnes SO_2 or NO_x emissions per year)
Population centres	>5 km from small towns or villages (population <5,000)
	>10 km from larger towns (population 5,000-10,000)
	>40 km from cities
Water bodies	Located away from water bodies such that the water body does not influence the micro- or meso-scale meteorological conditions at the station
Transportation routes	>500 m from any roads, canals, railways (except seldom travelled access road)
	>3 km from small airports
	>10 km from large airports
Local pollution sources	>500 m from small-scale pollution sources
Agricultural activity	>500 m from any intensive agricultural activity
On-site obstructions	Distance of the sampler from any air flow obstructions must be >2.5 times height of obstacle above the sampler (e.g. trees, towers, poles, etc.)
On-site buildings	Distance of the sampler from any on-site buildings must be 10 times height of the building

Note: Siting requirements in this table adapted from CAPMoN.

3.0 Sampling System

Proper design of a sampling system is essential for ensuring data quality. The temperature stability of the shelter, location of the sampling inlet, manifold system design, length and composition of sample tubing, and the composition of filters and fittings all may affect the integrity of the air sample.

3.1 Shelter Requirements for Continuous Ambient Air Monitoring

A proper sampling environment requires control of physical parameters that might affect the instrumentation.

SS 3-A	*The person responsible shall a) provide and b) maintain a continuous ambient air monitoring station shelter to protect instrumentation from:* *(i) precipitation;* *(ii) excessive dust and dirt;* *(iii) environmental stress, including vibration;* *(iv) corrosive chemicals;* *(v) intense light; and* *(vi) radiation.*
SS 3-B	*The shelter in SS 3-A must comply with Alberta's Occupational Health and Safety Act.*

The electrical power system should meet all electrical codes.

Most acceptable analyzers have been tested and qualified over a temperature range which stipulates both the range of operating temperatures and the range of temperature change that the analyzer can accommodate without excessive drift.

SS 3-C	*For the shelter in SS 3-A, the person responsible shall maintain the shelter temperature between 20°C and 30°C or as required by the manufacturer of the analyzers or samplers located within the shelter.*

In some cases (e.g., some particulate analyzers), the temperature of the shelter should be kept below 25°C. Refer to the manufacturer's instruction manual for acceptable temperature ranges.

SS 3-D	*The person responsible must equip the shelter in SS 3-A with an ABC type fire extinguisher.*

The shelter should be accessible throughout the year and be secured from unauthorized access (in a fenced compound).

3.2 Manifold System

The alternative to having separate, long sampling tubing is a manifold system. It is recommended that a manifold system be used when two or more analyzers are used in the same location. Manifold systems are discussed in Appendix B.

SS 3-E	*The person responsible shall not use sampling tubing in excess of 10 metres in length.*
SS 3-F	*The person responsible shall use (a) inlet, (b) manifold, and (c) sampling tubing that are made of either Teflon, borosilicate glass, or a substance that is inert to the pollutant(s) being sampled.*
SS 3-G	*The person responsible shall insert sample inlets (a) into the sides of, and (b) extending into the center of the manifold.*

Heating tapes should be used on sampling tubing if condensation is a problem. If the manifold has multiple ports, it is suggested that instruments requiring lower flows be placed closest to the inlet of the manifold. If the output from a calibration system is connected into the manifold for the purposes of analyzer calibration, the output tubing should be located so that calibration gases flow past the instruments before the gas is evacuated out of the manifold.

SS 3-H	*The person responsible shall incorporate a water and large particulate knock-out trap into the manifold to prevent water and large particulate from entering the sample line.*
SS 3-I	*The person responsible shall:* *(a) use a particulate filter, as recommended in the manufacturer's operating manual, for any analyzer requiring sample filtration; and* *(b) install the filter according to the manufacturer's specifications for the analyzer.*
SS 3-J	*The person responsible shall meet the following requirements for manifolds:* *(a) no leak shall be present in the sampling system;*

All manifold components should be free of cracks or chips where the sealing of the components can be compromised. All fittings should be in good condition and have the proper seals in place to prevent leakage around connections.

	(b) the manifold design must be such that there is a minimum number of bends to avoid losses due to impaction with the walls;

Particulate analyzers should have separate inlets that are as short and straight as possible to avoid particulate losses due to impaction on the walls.

> (c) *the residence time of the air sample from the sampling inlet to the sampling device must be less than 20 seconds;*
> (d) *the residence time of the air sample in the manifold and sample tubing to the sampling device must be less than 10 seconds of the total allowable 20 seconds required in SS 3-J (c);*

If the total residence time is greater than 20 seconds, a larger blower or vacuum pump should be attached to increase the flow rate and decrease the residence time. The method for determination of residence time is included in Appendix B.

> (e) *flow rate in the manifold must be at least 3 times the sum of all sampling flow rates required by individual analyzers; and*

A flow rate greater than the requirement in SS 3-J (e) is acceptable, but it should not be raised to a point at which analyzer response and accuracy are affected by the Venturi effect.

> (f) *notwithstanding SS 3-J (e), the air flow through the manifold must not cause the pressure inside the manifold to be more than one inch of water below ambient.*

The two conditions above in SS 3-J (e) and (f) can be assessed as follows:

- construct the manifold;
- use a pitot tube to measure the flow of the sample inside the manifold;
- at the same time, attach a water manometer to a sampling port;
- turn on the blower and measure the flow rate and the vacuum (remember to allow for the air demand of the instrumentation);
- adjust the flow rate to fit between these two parameters; and
- if this is impossible, the diameter of the manifold is too small.

Further information on manifolds can be found in Appendix B.

3.3 Sampling System Cleaning

> *SS 3-K* *At least once a month, the person responsible must clean the manifold and sampling tubing of all ambient air monitoring samplers.*

It is suggested that cleaning of the manifold be coordinated with calibration of the continuous analyzers so that no down time of analyzers be incurred. Seasonal variations and local conditions may require more frequent inspections and cleaning.

SS 3-L	*For sample tubes, flow splitters and other associated intake assemblies from particulate intakes to the particulate analyzer or sampler, the person responsible must (a) inspect and (b) clean at least annually or as directed by the manufacturer's operating manual if more frequent cleaning is required.*

3.3.1 $PM_{2.5}$ Inlet Cyclone and PM_{10} Head Cleaning

SS 3-M	*At least once every 30 days or at every sample filter change, whichever occurs first, the person responsible must clean PM_{10} heads and $PM_{2.5}$ inlet cyclones.*
SS 3-N	*At least once every 30 days, the person responsible must clean Beta Attenuation Monitor (BAM) and Sharp Particulate Monitor PM_{10} heads and $PM_{2.5}$ inlet cyclones.*
SS 3-O	*At least every fifteen 24-hour samples, the person responsible must clean filter based intermittent particulate sampler PM_{10} heads and $PM_{2.5}$ inlet cyclones.*

Note that if conditions warrant, more frequent cleaning should be performed for any type of sampler.

3.3.2 Total Suspended Particulate Intakes

SS 3-P	*The person responsible must clean the total suspended particulate intakes, on any type of sampler, every six months at a minimum.*

Note that if conditions warrant, more frequent cleaning should be performed for any type of sampler.

4.0 Site Documentation

Written descriptions and a history of all changes are required for all ambient monitoring sites.

SS 4-A	*The person responsible shall (a) complete and (b) submit in writing to the Director, site documentation:* *(i) when all new ambient monitoring sites are established, and* *(ii) when changes are made to the location of a monitoring site.*
SS 4-B	*Site documentation in SS 4-A shall include the following information for each continuous ambient air monitoring station, at a minimum:* *(a) name of owner/approval holder;* *(b) name of operating agency;*

(c) contact information, including:
  - *(i) name;*
  - *(ii) telephone number; and*
  - *(iii) email address;*

(d) date site or station was established;

(e) date site information was last updated;

(f) location, including i) latitude, and ii) longitude;

(g) four colour prints showing the view looking from the manifold to the i) East, ii) South, iii) West, and iv) North with the appropriate direction marked clearly on the bottom of the print;

(h) if the station does not conform to the standard site criteria, additional photographs and sketches must be submitted illustrating all irregularities;

(i) list of instruments located at the site including:
  - *(i) instrument type;*
  - *(ii) owner of the instrument;*
  - *(iii) make;*
  - *(iv) serial number;*
  - *(v) sampling height; and*
  - *(vi) date installed;*

(j) site description including:
  - *(i) land use by sector (use 90° as a sector);*
  - *(ii) site elevation (metres);*
  - *(iii) greatest angle of elevation and direction to nearby buildings;*
  - *(iv) average building height in the area (metres); and*
  - *(v) distance to the nearest trees (metres).*

SS 4-C Site documentation in SS 4-A shall also include the following information, at a minimum, for a network of one or more continuous ambient air monitoring stations:

(a) a recent area map showing the following at a minimum:
  - *(i) station location(s);*
  - *(ii) roadways;*
  - *(iii) railway lines;*
  - *(iv) airports;*
  - *(v) lakes;*
  - *(vi) rivers;*
  - *(vii) human settlements;*
  - *(viii) location(s) of identified industrial and non-industrial pollutant sources; and*
  - *(ix) other significant landmarks;*

(b) a windrose for each existing and new continuous ambient air monitoring station.

For existing and new network stations, it is preferable that the windrose is generated using a minimum five year average of the data from the nearest representative station.

SS 4-D	*The person responsible shall include the following information, at a minimum, in the site documentation for each continuous ambient air monitoring station:* *(a) a recent area map covering an approximate area of one square kilometre (i) with the station at the centre of the map and (ii) indicating land use sectors (use 90° as a sector);* *(b) a plan view sketch of the immediate surroundings within a 500 metre radius showing:* *(i) all topographical features;* *(ii) significant vegetation;* *(iii) buildings;* *(iv) other local disturbances (clearings, pits, towers, etc.); and* *(v) relevant distances to approximate scale;* *(c) colour prints(s) showing the details of the sampling inlet(s) or manifold in relation to the station;* *(d) a colour print of the structure housing the instruments from the door side with the direction of the exposure marked on the bottom; and* *(e) if the station does not conform to the standard site criteria, additional photographs and sketches must be submitted illustrating all irregularities.*
SS 4-E	*The person responsible shall keep current copies of site documentation in SS 4-B and SS 4-D for all continuous ambient air monitoring stations at the station site.*

Site sketches should be scanned to electronic format to include with the site documentation.

SS 4-F	*For passive samplers, the person responsible shall include the following site documentation information in SS 4-A, at a minimum:* *(a) owner;* *(b) type (i.e., SO_2);* *(c) make;* *(d) site number or site name;* *(e) location (latitude, longitude);* *(f) sampling height in metres, and* *(g) date installed.*
SS 4-G	*For static stations, the person responsible shall include the following site documentation information in SS 4-A, at a minimum:* *(a) plant operator;* *(b) plant location;* *(c) type of static sampling (i.e., SO_2, NO_2);* *(d) static number;* *(e) height above ground in metres; and* *(f) topographical description of surroundings.*

Documentation for static monitors is to be submitted until such time that statics are no longer in use (refer to the Monitoring Chapter of the AMD, Chapter 4).

Templates for site documentation and passive sampler site documentation are available on the AMD website.

Any comments, questions, or suggestions regarding the content of this document may be directed to:

ESRD.AMDFeedback@gov.ab.ca
Air Policy
Alberta Environment and Parks
Main Floor, Oxbridge Place
9820 – 106 Street
Edmonton, Alberta T5K 2J6

Website: AEP.alberta.ca/

Original signed by: ________________ Date: August 3, 2016
Hamid Namsechi, Director
Air Policy
Environment and Parks

Appendix A Wind Instrument Orientation by the Local Apparent Noon Method

Solar orientation is the most accurate method of determining true north and is therefore recommended over other methods. It is necessary to choose a day when the sun casts a detectable shadow.

Determine longitude of the station and calculate the difference between it and the standard meridian for Mountain Standard Time, 105°W. Multiply this difference in degrees and minutes by 4 to find the time difference in minutes between standard time and local mean time.

Because the station will be west of the standard meridian, the sun will cross the station later than it will cross the standard meridian, and Local Mean Noon will occur later than twelve o'clock standard time.

From Table 7, determine the Local Mean Time at Local Apparent Noon on the standard meridian.

From the Local Mean Time on the standard meridian, calculate the standard time at the station by adding the time difference found above (the difference between the station longitude and the standard meridian multiplied by 4).

Example: Date: March 7, 2016

Station Longitude	113°30' West
Station Meridian	105°00' West
Difference	8°30'
Multiply by 4 (minutes per degree)	4
Time difference	34 minutes

From Table 7, Local Mean Time on the standard meridian is 12:11 on March 7 at Local Apparent Noon.

Standard Time of Local Apparent Noon at the station is 12:45 (12:11 plus 34 minutes).

At local apparent noon the operator should stand north of the anemometer tower so that the shadow of the tower is at the operator's feet. A stake or marker is planted on the shadow at the appropriate time. From then on the marker is True North for that location and may be used at any time for anemometer alignment.

Table 7 Local Mean Time at Local Apparent Noon on the Meridian

	January		February		March		April		May		June	
Date	**h**	**m**	**h**	**m**	**h**	**m**	**h**	**m**	**h**	**m**	**h**	**m**
1	12	03 ½	12	14	12	12 ½	12	04	11	57	11	57 ½
4	12	05	12	14	12	12	12	03	11	56 ½	11	58
7	12	06 ½	12	14 ½	12	11	12	02	11	56 ½	11	58 ½
10	12	07 ½	12	14 ½	12	10 ½	12	01	11	56	11	59
13	12	09	12	14 ½	12	09 ½	12	00 ½	11	56	12	00
16	12	10	12	14 ½	12	08 ½	11	59 ½	11	56	12	00 ½
19	12	11	12	14	12	08	11	59	11	56 ½	12	01
22	12	11 ½	12	14	12	07	11	58 ½	11	56 ½	12	02
25	12	12 ½	12	13 ½	12	06	11	58	11	56 ½	12	02 ½
28	12	13	12	13	12	05	11	57 ½	11	57	12	03
31	12	13 ½	…		12	04	…		11	57 ½	…	

	July		August		September		October		November		December	
Date	**h**	**m**	**h**	**m**	**h**	**m**	**h**	**m**	**h**	**m**	**h**	**m**
1	12	03 ½	12	06	11	59 ½	11	49 ½	11	43 ½	11	49 ½
4	12	04	12	06	11	58 ½	11	48 ½	11	43 ½	11	50 ½
7	12	04 ½	12	05 ½	11	57 ½	11	47 ½	11	44	11	52
10	12	05	12	05	11	56 ½	11	47	11	44	11	53
13	12	05 ½	12	04 ½	11	55 ½	11	46	11	44 ½	11	54 ½
16	12	06	12	04	11	54 ½	11	45 ½	11	45	11	56
19	12	06	12	03 ½	11	53 ½	11	45	11	45 ½	11	57 ½
22	12	06	12	02 ½	11	52 ½	11	44 ½	11	46 ½	11	59
25	12	06	12	02	11	51 ½	11	44	11	47 ½	12	00 ½
28	12	06	12	01	11	50 ½	11	44	11	48 ½	12	02
31	12	06	12	00	…		11	43 ½	…		12	03 ½

At__________, longitude _________, Local Mean Time is ____________minutes later than Standard Time. To find the Mountain Standard Time of Local apparent noon you may simply add _________minutes to the appropriate value in the table.
(Enter data from your station for future reference).

Appendix B Manifold Systems

Important variables affecting the manifold design are the diameter, length, flow rate, pressure drop, and materials of construction. Considerations for these parameters are discussed for both vertical laminar flow and a conventional manifold design.

Vertical Laminar Flow Design

Sample air is prevented from reacting with the walls of the inlet when a proper large diameter vertical inlet is selected, and by maintaining a laminar flow throughout. Removable sample tubing constructed of Teflon, borosilicate glass or a substance non-reactive to the pollutant being sampled can be used to provide each device with sample air. Inlet diameters of 15 centimetres with a flow rate of 150 litres/min are necessary if diffusion losses and pressure drops are to be minimized. The sampling rate should be maintained to ensure laminar flow conditions.

This configuration has the following advantages:

- A 15 centimetre pipe can be cleaned easily by pulling a cloth through it with a string.
- Sampling ports can be cut into the pipe at any location and, if unused, can be plugged with stoppers of similar composition.
- Metal inlets pose no breakage hazard.
- With a larger diameter inlet, there is less potential for sample contamination than there is with smaller tubes.

Conventional Manifold Design

It may be difficult to achieve vertical laminar flow in practice because of the elbows within the intake manifold system. Therefore, a conventional horizontal manifold system should be constructed of inert materials such as borosilicate glass and/or Teflon, and in modular sections to enable frequent cleaning. The system consists of a vertical "candy cane" protruding through the roof of the shelter with a horizontal sampling manifold connected by a tee to the vertical section. Connected to the other vertical outlet of the tee is a bottle for collecting heavy particles and moisture before they enter the horizontal section. A small blower, 1700 litres/min at 0 centimetres of water at static pressure, is at the exhaust end of the system to provide a flow through the system of approximately 85 to 140 litres/min. Particulate monitoring instruments each have separate intake inlets that are as short and as straight as possible to avoid particulate losses due to impaction on the walls of the inlet.

Determination of Residence Time

No matter how non-reactive the sampling inlet material may be, after a period of use, reactive particulate matter is deposited on the inlet walls. Therefore, the time it takes the gas to transfer from the sample inlet to the sampling device is also critical. Residence time is defined as the amount of time that it takes for a sample of air to travel from the sampling inlet to the inlet of the instrument.

The residence time for a manifold system is determined in the following way. First the volume of the sampling inlet, manifold and sample tubing must be determined using the following equation:

Total Volume = Iv +Mv + Lv

Where:

- Iv = Volume of the sample inlet and extensions, cm^3
- Mv = Volume of the sample manifold and trap, cm^3
- Lv = Volume of the instrument tubing, cm^3

Each of the components of the sampling system must be measured individually. To measure the volume of the components, use the following calculation:

$$V = \pi * \left(\frac{d}{2}\right)^2 * L$$

Where:

- V = volume of the component, cm3
- π = 3.14159
- L = Length of the component, cm
- d = inside diameter, cm

Once the total volume is determined, divide the volume by the flow rate of all instruments. This will give the residence time.