Minor New Source Review Air Dispersion Modeling Guideline

MARICOPA COUNTY AIR QUALITY DEPARTMENT

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MARICOPA COUNTY AIR QUALITY DEPARTMENT: AIR DISPERSION GUIDANCE DOCUMENT

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1. Introduction

To meet the requirements of the federal Clean Air Act and Environmental Protection Agency (EPA) regulations, state and local agencies are required to develop a minor New Source Review (NSR) program [42 USC 7410(a)(2) and 40 CFR 51.160]. Under the minor NSR regulations, the program must contain "legally enforceable procedures" to prevent the construction or modification of a source if it will "interfere with the attainment or maintenance of" the National Ambient Air Quality Standards (NAAQS). NAAQS are standards established by EPA under the Clean Air Act that apply to outdoor air throughout the country. Primary standards are designed to protect human health with an adequate margin of safety for sensitive populations such as children, the elderly, and individuals suffering from respiratory diseases [42 USC 7409].

In February 2016, the Maricopa County Air Quality Department (MCAQD) adopted minor NSR requirements in its revision of Maricopa County Air Pollution Control Rule 241. Section 303 of this rule requires new sources and existing sources that increase emissions above prescribed thresholds to perform an ambient air quality impact assessment to demonstrate that emissions from the new or modified source do not interfere with attainment or maintenance of the NAAQS. Section 308 of this rule outlines the requirements of the NAAQS Compliance Assessment. The rule may be found at:

http://www.maricopa.gov/aq/divisions/planning_analysis/rules/docs/241-1602.pdf

The primary means by which an air quality impact assessment is performed is through the use of an air dispersion model. Air dispersion modeling is the tool used to predict possible ambient impacts of criteria pollutants emitted from a source. The model uses a series of equations that mathematically describe the behavior of pollutants in the air. It provides a cause-effect link between the emissions into the air and the resulting air pollution concentrations. The equations and algorithms represent atmospheric processes, which are then used to determine if a new or existing source of air pollutants will cause or contribute to an exceedance of a NAAQS. The results of these analyses are then used in helping sources properly design and configure their facility to minimize the impacts of their emissions.

The purpose of this document is to provide guidance to sources that are required to conduct an ambient air quality impact assessment. This guidance document will not address modeling conducted under Rule 240 or the federal prevention of significant deterioration (PSD) program. Major sources subject to these programs will find additional information in the Air Dispersion Modeling Guidelines for Arizona Air Quality Permits at:

http://www.azdeq.gov/environ/air/permits/download/modeling_guidance.pdf

2. Air Dispersion Modeling Overview

Two different types of air dispersion models have been developed for these purposes: screen modeling and refined modeling. Modeling analyses can vary widely in complexity based on the type of source being modeled. A simple modeling analysis might include a single stack that could be assessed with a screen model as discussed below. A more complex source could be one with multiple stacks, roads, and fugitive sources. This type of complex scenario could require refined modeling to simulate the facility's ambient impact.

Screen models such as AERSCREEN and SCREEN3 are used to provide a conservative estimate of pollution concentrations at specified ground-level locations (called receptors) surrounding an emission source. This type of analysis is normally used to evaluate a single source. Multiple emission points can sometimes be approximated as a single source using techniques discussed later in this document.

Refined modeling using more complex models such as AERMOD and CALPUFF requires detailed and precise input data in order to produce more accurate concentration estimates. This type of analysis is capable of estimating multiple emission sources and receptors. AERMOD is the recommended model for most regulatory modeling applications per Appendix W of 40 CFR Part 51. CALPUFF is mainly used to assess distant impacts of emissions, particularly at National Parks and Wilderness Areas, and will not be addressed in this document.

This guidance document addresses only screen and refined modeling for the purposes of regulating sources under MCAQD Rule 241.

3. Regulatory Triggers

An applicant for a permit subject to Rule 241 shall conduct an ambient air quality impact assessment upon the Control Officer's request per Rule 241 §303. However, as a practical first approximation, MCAQD will require the assessment to be performed by new sources with a potential to emit (PTE) greater than, or equal to, a minor NSR modification threshold detailed in Table 1 below, or an existing source that makes a minor NSR modification.

A minor NSR modification is defined in Rule 100 §200.71 as any of the following changes that do not qualify as a major source or major modification:

a. *Any physical change in or change in the method of operation of an emission unit or a stationary source that either:*

   i. *Increases the potential to emit of a regulated minor NSR pollutant by an amount greater than the minor NSR modification threshold, or*

   ii. *Results in the potential to emit of a regulated minor NSR pollutant not previously emitted by such emission unit or stationary source in an amount greater than the minor NSR modification threshold.*

b. *Construction of one or more new emissions units that have the potential to emit regulated minor NSR pollutants at an amount greater than the minor NSR modification threshold.*

c. *A change covered by Sections [3.a or 3.b] constitutes a minor NSR modification regardless of whether there will be a net decrease in total source emissions or a net increase in total source emissions that is less than the minor NSR modification threshold as a result of decreases in the potential to emit of other emission units at the same stationary source.*

d. *For the purposes of this definition, the following do not constitute a physical change or change in the method of operation:*

   i. *A change consisting solely of the construction of, or changes to, a combination of emissions units qualifying as an insignificant activity.*

   ii. *For a stationary source that is required to obtain a Non-Title V permit under MCAQD Rule 200 and that is subject to source-wide emissions caps under MCAQD Rule 201, a change that will not result in the violation of the existing emissions cap for that regulated minor NSR pollutant.*

   iii. *Replacement of an emission unit by a unit with a potential to emit regulated minor NSR pollutants that is less than or equal to the potential to emit of the existing unit, provided the replacement does not cause an increase in emissions at other emission units at the stationary source. A unit installed under this provision is subject to any limits applicable to the unit it replaced.*

   iv. *Routine maintenance, repair, and replacement.*

   v. *Use of an alternative fuel or raw material by reason of an order under Sections 2(a) and (b) of the Energy Supply and Environmental Coordination Act of 1974, 15 U.S.C. 792, or by reason of a natural gas curtailment plan under the Federal Power Act, 16 U.S.C. 792 to 825r.*

   vi. *Use of an alternative fuel by reason of an order or rule under Section 125 of the Act.*

   vii. *Use of an alternative fuel at a steam generating unit to the extent that the fuel is generated from municipal solid waste.*

   viii. *Use of an alternative fuel or raw material by a stationary source that either:*

      1) *The source was capable of accommodating before December 12, 1976, unless the change would be prohibited under any federally enforceable permit condition established after December 12, 1976, under 40 CFR 52.21, or under MCAQD Rules 210, 220, 240, or 241; or*

2) *The source is approved to use under any permit issued under 40 CFR 52.21, or under MCAQD Rules 210, 220, or 240.*

ix. *An increase in the hours of operation or in the production rate, unless the change would be prohibited under any federally enforceable permit condition established after December 12, 1976, under 40 CFR 52.21, or under MCAQD Rules 210, 220, 240, or 241.*

x. *Any change in ownership at a stationary source.*

e. *For purposes of this definition:*

i. *"Potential to emit" means the lower of a source's or emission unit's potential to emit or its allowable emissions.*

ii. *In determining potential to emit, the fugitive emissions of a stationary source shall not be considered unless the source belongs to a Section 302(j) category as defined in MCAQD Rule 100 §200.133.*

iii. *All of the roadways located at a stationary source constitute a single emissions unit.*

Table 1: Minor NSR Modification Thresholds

Pollutant	Minor NSR Modification Threshold (tons/year)
Fine Particulate Matter ($PM_{2.5}$)	5.0
Respirable Particulate Matter (PM_{10})	7.5
Sulfur Dioxide (SO_2)	20
Nitrogen Oxides (NO_x)	20
Volatile Organic Compounds (VOC)	20
Carbon Monoxide (CO)	50
Lead (Pb)	0.3

The Control Officer has discretion to require other sources subject to Rule 241 to conduct an ambient air quality impact assessment if there is reason to believe that the source could interfere with the attainment or maintenance of the NAAQS. Sources that agreed to an emissions limit to avoid triggering Rule 241 and are now seeking to relax that limit above the thresholds may also be subject to modeling at the Control Officer's discretion. It is suggested that these sources contact MCAQD to discuss applicability before any modification applications are submitted.

Note that fugitive emissions are not included in the determination as to whether a facility triggers minor NSR. However, once triggered, fugitive emissions must be included in the NAAQS Compliance Assessment.

Also note that the minor NSR threshold for VOCs does not currently trigger the need for an ambient air quality impact assessment due to the fact that no NAAQS exists for this pollutant (see the discussion regarding ozone in Section 5 of this guideline).

Some examples are provided below for clarity:

Example 1: New Source

A source plans to construct a new automotive assembly plant in Maricopa County. The plant has a potential to emit 50 tons per year (tpy) NOx, 60 tpy SO_2 and 5 tpy PM_{10}. In this example, the 50 tpy of NO_x and 60 tpy of SO_2 subject the plant to Rule 241 which requires the facility to conduct modeling for these pollutants. The PM-10 emissions do not exceed the modification thresholds in Table 1 and therefore do not require modeling.

Example 2: Modified Source

An existing source is proposing a modification that involves the installation of a new boiler. The source is currently permitted to emit 55 tpy of NO_x, 55 tpy of CO, and 10 tpy of SO_2. The new boiler has a PTE of 25 tpy NO_x, 25 tpy of CO, and 21 tpy of SO_2. The new site wide PTE of the facility is now 80 tpy NO_x, 80 tpy CO, and 31 tpy SO_2. Since the modification increased emissions of NOx and SO_2 above the minor NSR modification thresholds in table 1, these pollutants would be subject to Rule 241 and would require modeling. Important to note, although the post project facility site wide CO emissions are above the minor NSR modification threshold, modeling may not be required since the modification itself is not above the 50 tpy threshold value for CO. It is assumed in this example that the source did not accept a limit to avoid Rule 241 in the past which would require a case-by-case determination before modeling is ruled out.

[Rule 241 §303]

4. Significant Impact Levels (SILs)

It is EPA's policy under the Prevention of Significant Deterioration (PSD) program to allow the use of Significant Impact Levels (SILs) to determine whether a proposed new or modified stationary source will have a significant impact to the ambient air.

For a new or modified source, the PTE increase associated with the proposed project may be modeled to compare with the SILs. If the modeling results are below the SILs, the modeling demonstration is satisfied. Otherwise, the PTE increase should be modeled and the maximum off-site concentration added to representative ambient background concentrations to compare with the NAAQS.

The current SILs are listed in Table 2. Units of measure for the standards are micrograms per cubic meter of air ($\mu g/m^3$).

Table 2: Significant Impact Levels (SILs)

Pollutant	Averaging Period	SIL ($\mu g/m^3$)
NO_2	1-hour	7.5 [a]
	Annual	1
SO_2	1-hour	7.8 [b]
	3-hour	25
$PM_{2.5}$	24-hour	1.2
	Annual	0.2
PM_{10}	24-hour	5
CO	1-hour	2,000
	8-hour	500
Ozone	8-hour	NA
Pb	Rolling 3-month avg.	NA

[a] Interim 1-hour NO_2 SIL, 4 parts per billion
[b] Interim 1-hour SO_2 SIL, 3 parts per billion

5. NAAQS and Pollutants to be Modeled

The purpose of the minor NSR program is to ensure that criteria pollutants emitted from a source will not cause or significantly contribute to a violation of any NAAQS.

The current standards are listed in Table 3. Units of measure for the standards are parts per million (ppm) by volume, parts per billion (ppb) by volume, and micrograms per cubic meter of air ($\mu g/m^3$).

Table 3: National Ambient Air Quality Standards (NAAQS)

Pollutant		Averaging Time	Level	Form
Carbon Monoxide (CO)		8 hours	9 ppm	Not to be exceeded more than once per year
		1 hour	35 ppm	
Nitrogen Dioxide (NO_2)		1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		1 year	53 ppb	Annual Mean
Ozone (O_3)		8 hours	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particulate Matter	$PM_{2.5}$	1 year	12.0 μg/m^3	Annual mean, averaged over 3 years
		24 hours	35 μg/m^3	98th percentile, averaged over 3 years
	PM_{10}	24 hours	150 μg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)		1 hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
Lead (Pb)		Rolling 3 month average	0.15 μg/m^3	Not to be exceeded

Current NAAQS values may be found at EPA's NAAQS web site at:
https://www.epa.gov/criteria-air-pollutants/naaqs-table

Ozone

Ozone is a secondary pollutant formed in the atmosphere from a series of photochemical reactions involving VOC and NO_x. Due to the lack of screening tools and techniques for ozone modeling MCAQD does not currently require sources to conduct dispersion modeling for VOCs. MCAQD may adopt a modeling methodology to address the impact of ozone should these techniques become available in the future.

6. Acceptable Models

Unless prior written approval has been secured from MCAQD to use a different model, the latest version of AERSCREEN shall be used for screen modeling and AERMOD shall be used for refined modeling.

For more information regarding dispersion modeling, including models available for download, visit the EPA's Support Center for Regulator Air Models (SCRAM):
https://www3.epa.gov/ttn/scram/dispersion_prefrec.htm

The department will consider alternative models on a case-by-case basis.

7. Process for Conducting an Ambient Air Quality Impact Assessment

The modeling process consists of the following five steps (also see the Applicability / Process Flow Chart in Appendix A).

a. **Step One:**

i. Determine if the new or modified source is subject to the ambient air quality impact assessment requirements of Rule 241. An ambient air quality impact assessment is required for new sources with allowable emissions greater than or equal to the minor NSR modification thresholds (see Table 1), or existing sources that makes a minor NSR Modification. Other sources subject to Rule 241 may be required to perform an assessment upon the Control Officer's request. It is encouraged that applicants contact MCAQD to set up a pre-application meeting to discuss the determination of this rule if there are any uncertainties.

ii. If the source is subject to air quality impact assessment requirements for its new or modified source, proceed to Step Two.

b. **Step Two:**
The applicant shall conduct a preliminary impact determination to predict whether the proposed source(s) could cause a significant impact on existing air quality.

i. New Source: For a new source, screen modeling shall be performed for each criteria pollutant above the minor NSR modification threshold. The maximum potential short-term and long-term emission rates based on PTE should be modeled and compared with the significant impact levels (SILs) shown in Table 2. If the screen model results are below the SILs, the modeling demonstration is satisfied.

ii. Modified Source: For an existing source making a minor NSR modification, the PTE increase associated with the proposed project shall be modeled using a screening tool and compared with the SILs. If the modeling results are below the SILs, the modeling demonstration is satisfied.

iii. If the results show output concentrations above the SILs, the applicant shall either consider the options in Section 7.f – Next Steps or proceed to Step Three or Step Four.

c. **Step Three:**
The applicant may elect to perform a preliminary ambient air quality impact assessment to predict whether the proposed source(s) could cause an exceedance of the NAAQS.

i. New Source: For a new source, screen modeling shall be performed for each criteria pollutant above the minor NSR modification threshold. The maximum potential short-term and long-term emission rates based on PTE should be modeled and added to a representative background concentration for that pollutant. The result should then be compared with the NAAQS shown in Table 3. If the screen model results are below the NAAQS, the modeling demonstration is satisfied. Screen modeling is described in more detail in Section 8 – Screen Modeling Principles and Procedures.

ii. Modified Source: For an existing source making a minor NSR modification, the PTE increase associated with the proposed project shall be modeled using a screening tool and added to a representative background concentration for that pollutant. The result should then be compared with the NAAQS. If the modeling results are below the NAAQS, the modeling demonstration is satisfied.

iii. If the results show output concentrations above the NAAQS, the applicant shall either consider the options in Section 7.f – Next Steps or proceed to Step Four.

The procedure for determining a representative background concentration is discussed in Section 9 – Background Concentrations.

d. **Step Four:**
The applicant shall perform an ambient air quality impact assessment using a refined air dispersion model to determine whether the proposed source(s) could make a significant impact on existing air quality. It is the applicant's responsibility to perform refined modeling. Refined modeling is described in more detail in Section 10 – Refined Modeling.

i. New Source: For a new source, refined modeling shall be performed for each criteria pollutant above the minor NSR modification threshold. The maximum potential short-term and long-term emission rates based on PTE should be modeled and compared with the SILs. If the refined model results are below the SILs, the modeling demonstration is satisfied.

ii. Modified Source: For an existing source making a minor NSR modification, the PTE increase associated with the proposed project shall be modeled with a refined air dispersion model and compared with the SILs. If the modeling results are below the SILs, the modeling demonstration is satisfied.

iii. If the results show output concentrations above the SILs, the applicant shall either consider the options in Section 7.f – Next Steps or proceed to Step Five.

e. **Step Five:**

The applicant shall perform a NAAQS assessment using a refined air dispersion model to determine whether the proposed source(s) could cause an exceedance of the NAAQs. It is the Permittee's responsibility to perform refined modeling.

i. New Source: For a new source, refined modeling shall be performed for each criteria pollutant above the minor NSR modification threshold. The maximum potential short-term and long-term emission rates based on PTE should be modeled and added to a representative background concentration for that pollutant. The result should then be compared with the NAAQS shown in Table 3. If the refined model results are below the NAAQS, the modeling demonstration is satisfied.

ii. Modified Source: For an existing source making a minor NSR modification, the PTE increase associated with the proposed project shall be modeled using a refined dispersion model and added to a representative background concentration for that pollutant. The result should then be compared with the NAAQS. If the modeling results are below the NAAQS, the modeling demonstration is satisfied.

iii. If the results show output concentrations above the NAAQS, the applicant shall either consider the options in Section 7.f – Next Steps or the permit application shall be denied.

The procedure for determining a representative background concentration is discussed in Section 9 – Background Concentrations.

f. **Next Steps:**

If the model indicates that a SIL or NAAQS is initially exceeded, the Permittee has the opportunity to consider several options to prevent the exceedance. Preliminary NAAQS exceedances might be avoided through the use of some or all of the following:

i. Refining emissions estimates by using other defensible emission factors than those used in the preliminary modeling analysis (for example: performance testing data rather than AP-42);

ii. Limiting operational hours or process throughputs;

iii. Optimizing stack parameters for better pollutant dispersion (i.e. raise stack heights, increase exhaust airflows (subject to restrictions on prohibited dispersion techniques), or crown stack diameters to obtain higher exhaust velocities);

iv. Relocating emission sources to other portions of a facility which would lead to lower modeled offsite impacts;

v. Installing pollution controls to limit emissions.

Note that the EPA's "prohibited dispersion techniques" as defined in 40 CFR §§ 51.100 (hh)(1)(i)-(iii) shall not be used. Examples of these prohibited techniques include improper stack heights and varying the emissions rate or shutting down based on atmospheric conditions or ambient pollution concentrations.

g. **Model Report:**

Once completed, the Permittee shall submit a modeling report to MCAQD. The modeling report should include the following at a minimum:

- Company and facility name;
- Permit number and type of permit;
- Overview of the project, project location, and general brief description of facility operations;
- Description of the federal and Arizona regulations and guidelines that pertain to the proposed project. Focus should be on modeling requirements;
- Detailed Facility layout (locations of emission points and process equipment);
- Emission Profiles with all Short and Long term emission rates identified and the method used to determine these values;
- Stack parameters used; and
- Modeling approach, including parameters used and results.

8. Screen Modeling Principles and Procedures

Screen modeling provides conservative estimates of source impacts with a minimum of input. Screening models are usually designed to evaluate a single emission source; however, in some cases they may be used for facilities with multiple emission points (see "special considerations" below).

a. **Screen Overview:**

The recommended model for screening sources is the most recent version of EPA's AERSCREEN model. AERSCREEN is a simple screening-level air quality model based on AERMOD. The AERSCREEN model can be downloaded from EPA's website at http://www.epa.gov/ttn/scram. The AERSCREEN model has replaced the previous SCREEN3 model as the recommended model; therefore, SCREEN3 will not be accepted by MCAQD for this type of modeling. The screening analysis performed with AERSCREEN should be consistent with the guidance contained in EPA's *Guideline on Air Quality Models* and appropriate screening modeling documents such as the *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources*.

Additional guidance for AERSCREEN may be obtained in the *EPA AERSCREEN User Guide* at: https://www3.epa.gov/scram001/models/screen/aerscreen_userguide.pdf

b. **Options for Modeling:**

The Permittee may perform screen modeling or may elect to have the MCAQD permit engineer perform a screening model of its emissions. In the latter case MCAQD will charge for this service as a billable permit action at the current hourly permit processing rate. In either case MCAQD will require the applicant to complete the AERSCREEN Data Input Form located in Appendix B.

c. **Emission Rates:**

Modeling shall be performed for each criteria pollutant that triggers minor NSR review and shall include both process and fugitive emissions.

i. Maximum emission rates:

The maximum short-term emission rates for each source should be used to demonstrate compliance with all short-term averaging standards and guidelines. For example; if equipment is to be operated under different conditions, such as operating hours, load factor, or fuel type, each emission scenario should be evaluated and the maximum short-term emission rate should be used. In addition, modeling must include emissions from all source types that could be operated simultaneously.

ii. Controls:

The Permittee may take credit for any emissions reductions provided by controls that are made enforceable through the air permit.

d. **Types of sources:**

Regulatory modeling should reflect the actual characteristics of the proposed emission sources. The source types found in AERSCREEN are described in this section.

i. **Point:**

Point source characterization is used to simulate emissions that are emitted from a stack, chimneys or vents. AERSCREEN can be used for a single point, vertical stack, capped stack or horizontal stack. Each of the following parameters are required to model point source emissions:

- Emission rate in grams per second (g/s),
- Stack inside diameter in meters,
- Stack height above grade in meters,
- Stack gas exit velocity in meters per second (m/s),
- Stack gas exit temperature in degrees Kelvin (K).

When modeling horizontal stacks or vertical stacks with rain caps, the exit velocity should be set to 0.001 m/s to eliminate plume rise from momentum and the flow rate should be held constant. In order to maintain a constant flow rate for vertical rain-capped stacks, the modeled stack diameter must be different from the actual stack diameter. The modeled stack diameter for vertical rain-capped stacks should be calculated using the following equation:

$$d_m = d_a (V_a/V_m)^{1/2}$$

where:

d_m = modeled stack diameter
d_a = actual stack diameter
V_m = modeled stack exit velocity, i.e., 0.001 m/s
V_a = actual stack exit velocity

ii. **Rectangular and Circular Area Sources:**
The Rectangular Area source characterization is used to simulate emissions that initially disperse in two dimensions with little or no plume rise, such as ground level or low level emissions from storage piles, slag dumping, landfills or holding ponds. For a simple area source each of the following parameters are needed:

- Area emission rate in $g/(s\text{-}m)^2$
- Source release high above ground in meters
- Length of the long side of the area in meters
- Length of the short side of the area in meters
- Optional inputs include the orientation angle in degrees and initial vertical dimension of the area source plume rise, in meters.

AERSCREEN also has the option to model circular area sources and requires the radius of the circle in meters.

The release height should be set to zero, except in the case of tank farms and storage areas, where the release height should be set to the average height of the pollutant release.

The downwind distance used in the model is measured from the center of the area source, not its edge. The modeler should be careful to measure the correct distance from the center of the area source to the nearest ambient air boundary in setting the first receptor distance. Generally the receptor distance should not be less than the length of one side of the area source.

iii. **Volume:**
Volume source characterization is used to simulate emissions that initially disperse in three dimensions with little or no plume rise, such as emissions from vents on a building roof; multiple vents from a building; and fugitive emissions from pipes, stockpiles and conveyor belts. Each of the following parameters are needed to model volume source emissions:

- Emission rate in g/s,
- Centerpoint height above ground in meters,
- Initial lateral dimension of the volume in meters,
- Initial vertical dimension of the volume in meters.

Volume sources must have a square base, but need not be a cube. For a square, or nearly square, source the actual building dimensions (height and width) should be used for the screening analysis. For non-square sources, the width of the source should be set equal to the minimum building length.

The downwind distance used in the model is measured from the center of volume source, not its edge. The modeler should be careful to measure the correct distance from the center of the source to the nearest ambient air boundary in setting the first receptor distance.

A volume source is defined by its centerpoint height and initial lateral and vertical dimensions. The centerpoint height is the center of the volume source and so it should be set equal to one-half the average building height. The initial lateral dimension for a volume source should be set equal to its width divided by 4.3. The initial vertical dimension for a volume source should be set equal to the average building height divided by 2.15.

iv. **Flares:**
Flares, such as those used to burn landfill gas, are modeled as flare sources in AERSCREEN. Each

of the following parameters should be used when modeling flares:

- Emission rate in g/s,
- Stack height in meters,
- Heat release rate in cal/s,
- Radiative heat loss fraction.

Flares are typically modeled similar to point sources. However, the heat release from the flare is utilized to calculate plume rise. The heat loss fraction can be user selected or the AERSCREEN default value of 0.55 can be used.

e. **Building Downwash:**

Building downwash is a term used to represent the potential effects of a building on the dispersion of emissions from a source. Point sources with stack heights less than good engineering practice (GEP) stack height should consider dispersion impacts associated with building wake effects (downwash).

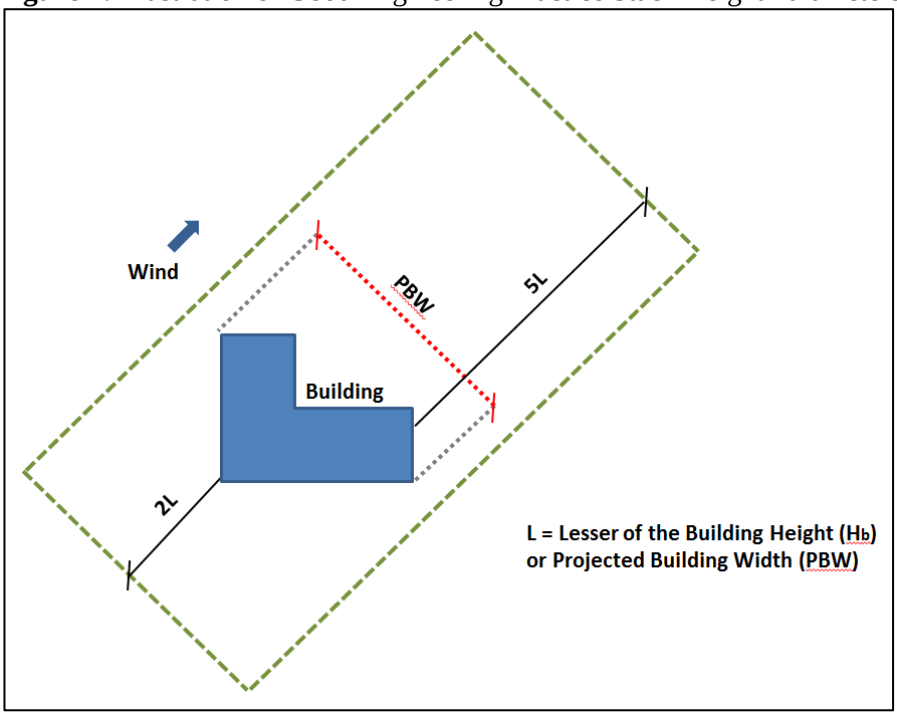
$H_{GEP} = H_b + 1.5L$

Where:

H_{GEP} = the GEP stack height;
H_b = the building height; and
L = the lesser of the building height or maximum projected width (the width as seen from the source looking towards either the wind direction or the direction of interest) of the building

The GEP height is the highest height calculated for any nearby building (a building is 'nearby' if it is within five times the lesser of its height or width from the stack). This distance is commonly referred to as the building's region of influence. The most conservative building dimensions are usually associated with the height and diagonal width of the tallest nearby building.

Figure 1: Illustration of Good Engineering Practice Stack Height Parameters



Once downwash applicability is determined, the following parameters are needed by AERSCREEN for input:

- Options to use an existing Building Profile Input Program for Plume Rise Model Enhancements (BPIPPRM), if available.
- Building height
- Maximum building horizontal dimension

- Minimum building horizontal dimension
- Degrees from North of maximum building horizontal dimension (0-179 degrees)
- Degrees from North of stack location relative to building center (0-360 degrees)
- Distance between stack and building center

f. **Land Use – Urban/Rural:**
It is important to determine whether a source is located in an urban or rural dispersion environment. In general, urban areas cause greater rates of dispersion because of increased turbulent mixing and buoyancy-induced mixing.

EPA guidance identifies two recommended methods to determine whether a source resides in an urban area:

i. Land Use – Draw a 3 km radius around the source and analyze the land use. If more than 50% of the land use can be categorized as industrial (Heavy or medium), commercial, or residential, the source exists in an urban area.

ii. Population – If the population surrounding the source exceeds 750 people per square kilometer (1,943 people/square mile), the source exists in an urban area.

The land-use procedure is preferred. If the area qualifies as Urban, AERSCREEN requires a population figure to be entered. The value must be at least 100 for AERSCREEN to accept the urban selection.

g. **Meteorology and Surface Characteristics:**
AERSCREEN model consists of the MAKEMET program which generates application specific worst-case meteorology using representative ambient air temperatures, minimum wind speed, and surface characteristics type (albedo, Bowen ratio, and surface roughness). When entering surface characteristics, the applicant can enter user defined values or they can utilize the AERMET seasonal tables, which will require the land use type (water, forest, etc) and the surface moisture (average, wet or dry).

h. **Terrain:**
Much of Maricopa County can be characterized as having relatively flat terrain; however, there may be instances where sources have simple to complex terrain. Typically, MCAQD defines flat terrain as terrain equal to the elevation of the stack base; simple terrain as terrain lower than the height of the stack top; and, complex terrain as terrain above the height of the plume center line (for screening modeling, complex terrain is terrain above the height of the stack top). Terrain above the height of the stack top but below the height of the plume center line is known as intermediate terrain.

Most sources will use flat terrain in their modeling analysis, but if complex terrain is more representative, please refer to the AERSCREEN user guide for more information on inputs, located at:
https://www3.epa.gov/scram001/models/screen/aerscreen_userguide.pdf

i. **Receptors and Ambient Area Boundary:**
The ambient air boundary must be determined before an air impact assessment can be completed. 40 CRF Part 50.1(e) defines ambient air as, "…that portion of the atmosphere, external to buildings, to which the general public has access." This may be a fence line or other physical barrier or a facility's Process Area Boundary defined as the process areas within the facility occupied by emission generating activities, the area in the immediate vicinity of those activities and the area between adjacent activities.

Receptors should be adequately placed throughout a modeling domain to determine areas of maximum predicted concentrations. It is suggested that the minimum distance to ambient air be set at the ambient air boundary and a maximum distance to probe be set at 1000 meters.

j. **Special Considerations:**

i. **Multiple Stacks:**
The impacts from two or more point sources can be conservatively estimated by modeling each point source independently and then adding the maximum concentrations together, regardless of the associated downwind distances. This is a useful approach when individual impacts are small and compliance with regulatory standards can be easily demonstrated without using a refined

model.

The emissions from multiple stacks which are located within 100 meters of each other and which have volumetric flow rates that differ by no more than 20% can also be merged using the following procedure (EPA, Screening Procedures for Estimating the Air Quality Impact of Stationary Sources-Revised, EPA-450/R-92-019):

Step 1: Compute the parameter M for each stack to be merged where:

$$M = \frac{(h_s \times V \times T_s)}{Q}$$

Where:

M = merged stack parameter
h_s = stack height above ground (m)
V = volumetric flow rate = $(\pi/4)\, d_s^2\, v_s$, (m^3/s)
d_s = effective stack exit inside diameter, (m)
v_s = stack gas exit velocity, (m/s)
T_s = stack gas exit temperature, ($^{\circ}K$)
Q = air contaminant emission rate, (g/s)

Step 2: Determine which of the stacks has the lowest value of M. This is the representative stack.

Step 3: Sum the emissions rates (Q) for the stacks that are being merged. This summed emission rate, along with the stack parameters for the representative stack should be used in modeling the merged stacks.

ii. **NO to NO_2 Conversion:**

Most emission calculation methodologies are done using NOx emission factors, which includes NO and NO_2. For the most conservative approach, applicants may assume all NO is converted into NO_2 without any additional justification; however, given the stringency of the 1-hour NO_2 standard relative to the annual standard, applicants may find it necessary to use less conservative approaches to NO_x conversion than simply full conversion. As a result, the applicant may use any of the following methods for NO conversion:

1) **Option 1** – assume all NO is converted to NO_2.

2) **Option 2** – Ambient Ratio Method (ARM) - multiply Option 1 by 0.8 as a default ambient ratio for the 1-hour NO_2 standard without additional justification. The national default ratio of 0.75 recommended in Appendix W for the annual standard may not be used without some justification of the appropriateness for that assumption.

3) **Option 3** – AERSCREEN has modeling options for NO conversion. Both of the methods are outlined below:

   a) The Ozone Limiting Method (OLM); and,

   b) The Plume Volume Molar Ratio Method (PVMRM)

   The key input variables for these model options are in-stack NO_2/NO_x ratios and background ozone concentrations. The in-stack NO_2/NO_x ratio is simply how much of the total NO_x in the outlet stream is already converted to NO_2. The background ozone concentration is needed for both methods as it is used in the calculations to determine the remaining NO conversion to NO_2. The ozone concentration can be specified in parts per million (ppm), parts per billion (ppb) or micrograms per cubic meter ($\mu g/m^3$).

   c) In-stack NO_2/NO_x ratios:
   The EPA established a general acceptance of 0.50 as a default in-stack ratio of NO_2/NO_x for input to the OLM and PVMRM model options within AERSCREEN.

   If proposing an in-stack NO_2/NO_x ratio other than the default, sufficient justification and documentation must be provided to support the source-specific data on the in-stack

NO_2/NO_x ratio.

d) Background ozone concentrations:
Ozone concentration should be entered as a single most conservative value of the representative background concentration of ozone. The highest hourly ozone concentration over the model period should be used. The default value of 40 ppb in AERSCREEN should not be used. The highest hourly ozone concentrations are available from the EPA AirData website at: http://www.epa.gov/airdata/

The methodology above was taken from the EPA memorandum issued on March 1, 2011 entitled, "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard". This memorandum is meant to supplement the memorandum issued by the EPA on June 29, 2010 entitled, "Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard". The 2011 memorandum provides further clarification and guidance on the application of Appendix W guidance for the 1-hour NO_2 standard. The memorandum does not apply to the other averaging periods of NO_2, nor does it apply to other pollutants with a standard based on a multi-year average.

iii. **Modeling for 1-Hour and 24-Hour standards:**
Some sources may have higher-than-normal emissions triggered by certain events. For example, high short-term emissions may result from startup/shutdown operations or bypasses of control equipment. For compliance demonstrations with the 1-hour NO_2 or SO_2 NAAQS, special consideration should be given to determine whether such emissions should be included in the modeling analysis or not. Because of the probabilistic nature of the two standards, EPA recommends that the most appropriate data to use for compliance demonstrations for the 1-hour NO_2 and SO_2 standards are those based on emissions scenarios that are continuous enough or frequent enough to contribute significantly to the annual distribution of maximum daily 1-hour concentrations. Therefore, MCAQD may allow an exemption from 1-hour NO_2 and SO_2 modeling if these events are infrequent enough so that the emissions caused by these events will not contribute significantly to the annual distribution of maximum daily 1-hour concentrations. As this exemption determination is on a case-by-case basis, the Permittee should provide MCAQD detailed information about these events such as frequency and duration.

For compliance demonstrations with the 24-hour or annual NAAQS, emission rates modeled should incorporate a suitable number of these high-emission periods combined with normal equipment operations. For example, power generation facilities are typically permitted for a certain number of startup/shutdown events. Therefore, calculations for 24-hour average emissions or annual emissions for a power generation facility must consider the emissions from startup/shutdown events combined with emissions from steady-state operations.

The Permittee shall also explain in detail which option is being used for NO conversion (if any) outlined in Section 8.k.ii above.

Some examples are provided below for clarity:

Example 1:
A source operating a non-emergency engine triggers the requirement to demonstrate compliance with the 1-hour and 1-year NO_2 NAAQS and the 24-hour PM_{10} NAAQS. The engine is permitted to operate 1,000 hours in any 12 month period. The Permittee should assume the highest maximum hourly emission rate at any given engine load for both the 1-hour and 24-hour timeframes. Alternatively, the Permittee may accept an enforceable daily run time limit and assume potential 24-hour emissions at that reduced maximum daily limit. To demonstrate compliance with the 1-year NO_2 standard, the Permittee shall assume the maximum emission rate at 1,000 hours of operation.

Example 2:
Consider a power generation facility with a simple cycle unit that needs to model the 24-hour PM_{10} NAAQS and the 1-hour SO_2 NAAQS. The simple cycle unit will have a certain number

of start-up and shut-down events throughout the year. A typical Start-up event is 20 min, and a typical shutdown event is 12 min. This gives a worst-case scenario for an hour:

28 min normal operation
20 min start-up
12 min shutdown

Each of these operating scenarios has its own hourly emission rate which would be multiplied by the total time in which their events occur in an hour.

X (lbs/hr in normal operation) x 28/60
Y (lbs/hr in start-up) x 20/60
Z (lbs/hr in shutdown) 12/60

The sum of these parameters would be the worst-case emission profile for the 1-hour NAAQS comparison.

For the 24-hour PM_{10} NAAQS, the Permittee should consider the possibility of how many events are likely to occur over a 24-hour period. The Permittee should include as many events in the 24-hour window that are likely and frequent enough to occur in order to accurately characterize impacts.

iv. **Secondary Formation of $PM_{2.5}$:**

In addition to being emitted directly, $PM_{2.5}$ is created by secondary formation from precursor emissions such as SO_2 and NO_x due to chemical reactions that occur in the atmosphere gradually over time (hours or days depending on atmospheric conditions and other variables). The applicant shall consider precursors in their model for $PM_{2.5}$ as outlined below.

Step 1: Determine the Primary $PM_{2.5}$, NO_x and SO_2 PTE from a new source or the Primary $PM_{2.5}$, NO_x and SO_2 PTE increase for a modified source.

If Primary $PM_{2.5}$ is above 5.0 tpy and NO_x and SO_2 are both below 20 tpy, secondary formation of $PM_{2.5}$ does not need to be evaluated and no further action for this section is required.

If Primary $PM_{2.5}$ is above 5.0 tpy and NO_x and/or SO_2 emissions are above 20 tpy, proceed to Step 2.

If Primary $PM_{2.5}$ is below 5.0 tpy modeling is not required.

Step 2: The applicant shall calculate the "total equivalent primary $PM_{2.5}$" emissions with the following formula which uses the interpollutant offset ratios for SO_2 and NO_x as defined in EPA's NSR implementation rule for $PM_{2.5}$ (73 FR 28321, 2008). The offset ratios used here for SO_2 and NO_x are used for simplifying the quantitative assessment. Ideally, if the applicant has site specific offset ratio data for NO_x or SO_2 that data should be used.

$$Total\ Equivalent\ Primary\ PM_{2.5}\ [tpy] = Primary\ PM_{2.5}\ [tpy] + \frac{SO_2[tpy]}{40} + \frac{NO_x[tpy]}{100}$$

Where,

Primary $PM_{2.5}$, *SO_2* and *NO_x* are all determined from Step 1.

For a new source: Calculate the total equivalent primary $PM_{2.5}$ based on the facility-wide PTEs for Primary $PM_{2.5}$, SO_2 and NO_x.

For modifications: calculate the PTE increase in total equivalent primary $PM_{2.5}$ based on the PTE increases for primary $PM_{2.5}$, SO_2 and NO_x due to the proposed projects.

Proceed to step 3.

Step 3: The applicant shall model only the Primary $PM_{2.5}$ emissions from the source to identify the highest $PM_{2.5}$ concentration outside of the process area boundary. This concentration is defined as the Modeled Primary $PM_{2.5}$ ($\mu g/m^3$). Proceed to Step 4.

Step 4: Using the following formula, the applicant shall estimate the total impacts from primary

$PM_{2.5}$ and secondarily formed $PM_{2.5}$:

$$Total\ PM_{2.5}\ Concentration\left(\frac{\mu g}{m^3}\right) = Modeled\ Primary\ PM_{2.5}\ \left(\frac{\mu g}{m^3}\right) x\ \frac{Total\ Equivalent\ Primary\ \mathrm{PM_{2.5}}\ [tpy]}{Primary\ \mathrm{PM_{2.5}}\ [tpy]}$$

Where,

Modeled Primary $PM_{2.5}$ ($\mu g/m^3$) is determined from Step 3
Total equivalent primary $PM_{2.5}$ is determined from Step 2
Primary $PM_{2.5}$ is determined from Step 1

The result is the [Total $PM_{2.5}$ Concentration] that includes the contribution of secondary formation for $PM_{2.5}$. Please note that MCAQD may request additional qualitative and quantitative assessments on a case-by-case basis beyond what is outlined in this section.

9. Background Concentrations:

When performing modeling, the applicant will need to add representative background concentrations to each pollutant source modeled. These background concentrations are intended to account for other pollution sources not explicitly included in the modeling, such as natural sources and other non-modeled or unidentified sources of air pollution. The combined background and modeled values from this analysis are then compared to the NAAQS, at the appropriate averaging times, to determine if the facility could interfere with attainment or maintenance status of the standards.

The background values chosen for modeling should be representative of the area in the vicinity of the facility and are usually obtained from the ambient air monitoring network. In almost all cases, these data can be obtained from the air monitor closest to the facility, depending on the monitor's scale and purpose; however, on rare occasions a more distant monitoring site might better represent the area surrounding the facility. The applicant should describe in their modeling protocol why the selected monitor is the most representative of background concentrations surrounding their facility. This modeling protocol, and the selection of the source of background data, is subject to the approval of MCAQD.

The Permittee shall select the background concentrations as described in Table 4 using the most recent 3 years of ambient monitoring data. Background concentrations should be representative of regional air quality in the vicinity of a facility. Additional guidance for determining refined estimates of background values from local monitoring data can be found in 40 CFR Part 51, Appendix W, section 8.2.

In and around Maricopa County, ambient pollutant monitoring is conducted by the following agencies:

- MCAQD
- ADEQ
- Fort McDowell Yavapai Nation
- Gila River Indian Community
- Salt River Pima-Maricopa Indian Community

These agencies publicly report the data from the various monitoring sites to the EPA. Values can be downloaded from the EPA's Air Quality System (AQS) database (https://www.epa.gov/aqs, account required) or the AirData website (https://www3.epa.gov/airdata/).

After choosing the suitable monitoring site, consult Table 4 to find the appropriate background form for the applicable pollutant. Background forms are unique to each NAAQS pollutant and averaging time and usually mirror the NAAQS form. An exception to this is the PM_{10} form; the PM_{10} 24-hour average NAAQS form is based on the number of days exceeding the 150 $\mu g/m^3$ standard, which cannot be more than once per year on average. Due to fugitive dust events resulting from atypical weather events, a PM_{10} background form that is based on the 1st or 2nd highest 24-hour average would be unduly high and contrary to EPA modeling protocol, which allows for the consideration of uncharacteristic meteorological conditions. MCAQD also recognizes that it would be unlikely that two independent events, one source-driven and one background-driven, would occur simultaneously at the same location; therefore the background form for PM_{10} is the 98th percentile of annual daily values, averaged over a three-year period. This form makes allowances for atypical weather conditions that better represents characteristic background conditions.

Concentrations flagged as exceptional events do not need to be considered in background concentrations. It is not acceptable to exclude high concentrations caused by non-exceptional events however.

Table 4: Determination of Background Concentrations

Pollutant		Averaging Time	NAAQS Level	Form	MCAQD Background Form
Carbon Monoxide (CO)		8 hours	9 ppm	Not to be exceeded more than once per year	Highest concentration during most recent 3 years
		1 hour	35 ppm		
Nitrogen Dioxide (NO_2)		1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years	98th percentile of the annual distribution of daily maximum 1-hours values averaged across the most recent three years
		1 year	53 ppb	Annual Mean	Highest annual concentration for most recent three years
Ozone (O_3)		8 hours	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years	Not Applicable
Particulate Matter	$PM_{2.5}$	1 year	12.0 μg/m^3	Annual mean, averaged over 3 years	Average of the annual values over most recent three years [a]
		24 hours	35 μg/m^3	98th percentile, averaged over 3 years	Average of the 98th percentile 24-hour values over most recent three years
	PM_{10}	24 hours	150 μg/m^3	Not to be exceeded more than once per year on average over 3 years	98th percentile of the annual distribution of daily maximum daily values averaged across the most recent three years
Sulfur Dioxide (SO_2)		1 hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years	99th percentile of the annual distribution of daily maximum 1-hours values averaged across the most recent three years
Lead (Pb)		Rolling 3 month average	0.15 μg/m^3	Not to be exceeded	Highest concentration during most recent three years

[a] See Appendix N to Part 50 – Interpretation of the National Ambient Air Quality Standards for PM2.5 https://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol2/pdf/CFR-2014-title40-vol2-part50-appN.pdf

10. Refined Modeling

Refined modeling requires more detailed and precise input data and utilizes more complex models in order to provide better estimates of ground level concentrations. Refined modeling is required if the screening analysis results indicate that the predicted concentrations from the evaluated sources could exceed the NAAQS. Refined modeling may also be necessary if it is determined that a screening analysis will not adequately address the modeling scenario. The primary model used for the refined modeling of industrial sources is the most recent regulatory version of EPA's AERMOD model. It is the applicant's responsibility to perform refined modeling.

a. **Process Overview:** Refined modeling will be conducted in accordance with the ADEQ Air Dispersion Modeling Guidelines for Arizona Air Quality Permits (with certain exceptions as described in Section 10.d.i.1).

b. **Modeling Protocol:** It is strongly recommended that the Permittee submit a written modeling protocol prior to performing any refined modeling analysis and obtain written MCAQD approval before proceeding. Such protocols allow MCAQD to review the methodologies to be utilized in the modeling analysis and to comment on modeling techniques in advance of significant modeling resource expenditure on the part of the applicant. A modeling report that is submitted without a pre-approved modeling protocol will be treated and reviewed as a protocol. If the report is found to be deficient it will be rejected, creating additional delays and effort on the part of the Permittee. To prevent this situation, it is recommended that written MCAQD approval of the protocol be obtained. Modeling protocols should include the information found in Appendix C of this guideline.

c. **Modeling Reports:** Subsequent to modeling the Permittee shall submit a modeling report. Modeling reports should include a discussion of each relevant modeling protocol element listed in Appendix C as well as graphic figures which appropriately indicate facility impacts and ambient air boundaries. MCAQD will also require copies of all electronic modeling files including model input files, model output files, model plot files, building downwash files, meteorological data files, etc.

The results section of the report should include the following information:

- Model input and output files, including the meteorological data, receptor height and other supporting modeling files.
- A listing of maximum impacts and associated receptor locations, meteorological data, and the modeling scenario for each applicable averaging time and pollutant.
- A comparison with the applicable SILs or NAAQS for the source under review.

d. **Incorporated Documents:**

i. ADEQ Air Dispersion Modeling Guidelines for Arizona Air Quality Permits
http://www.azdeq.gov/environ/air/permits/download/modeling_guidance.pdf

1) Exceptions to ADEQ Guidance:

a) Section 3.8 – Given the dis-similarity of the other site locations, MCAQD approves upper-air data from Tucson only.

b) Section 3.10 – Given the availability of background data in Maricopa County, the use of background data from other states is prohibited. Background concentrations will be established using the methodology found in Table 4.

c) Section 7.1.4 – Given the availability of background data in Maricopa County, the 1-hour NO_2 background concentration will be established using the methodology found in Table 4.

d) Section 7.1.6 – MCAQD will evaluate intermittent NO_2 sources on a case-by-case basis.

e) Section 7.2.4 – MCAQD will evaluate intermittent SO_2 sources on a case-by-case basis.

ii. EPA Modeling Guidance Documents

1) EPA Guideline on Air Quality Models (GAQM) as codified in 40 CFR 51, Appendix W
https://www3.epa.gov/ttn/scram/guidance/guide/appw_05.pdf

2) Applicability of Appendix W Modeling Guidance for the 1-hour NO2 National Ambient Air Quality Standard (U.S. EPA, 2010)
https://www3.epa.gov/scram001/guidance/clarification/ClarificationMemo_AppendixW_Hourly-NO2-NAAQS_FINAL_06-28-2010.pdf

3) Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO2 National Ambient Air Quality Standard (U.S. EPA, 2011)
https://www.epa.gov/sites/production/files/2015-07/documents/appwno2_2.pdf

4) Applicability of Appendix W Modeling Guidance for the 1-hour SO2 National Ambient Air Quality Standard (U.S. EPA, 2010)

https://www3.epa.gov/scram001/guidance/clarification/ClarificationMemo_AppendixW_Hourly-SO2-NAAQS_FINAL_08-23-2010.pdf

5) Modeling Procedures for Demonstrating Compliance with PM2.5 NAAQS (U.S. EPA, 2010) https://www3.epa.gov/scram001/guidance/clarification/Official%20Signed%20Modeling%20Proc%20for%20Demo%20Compli%20w%20PM2.5.pdf

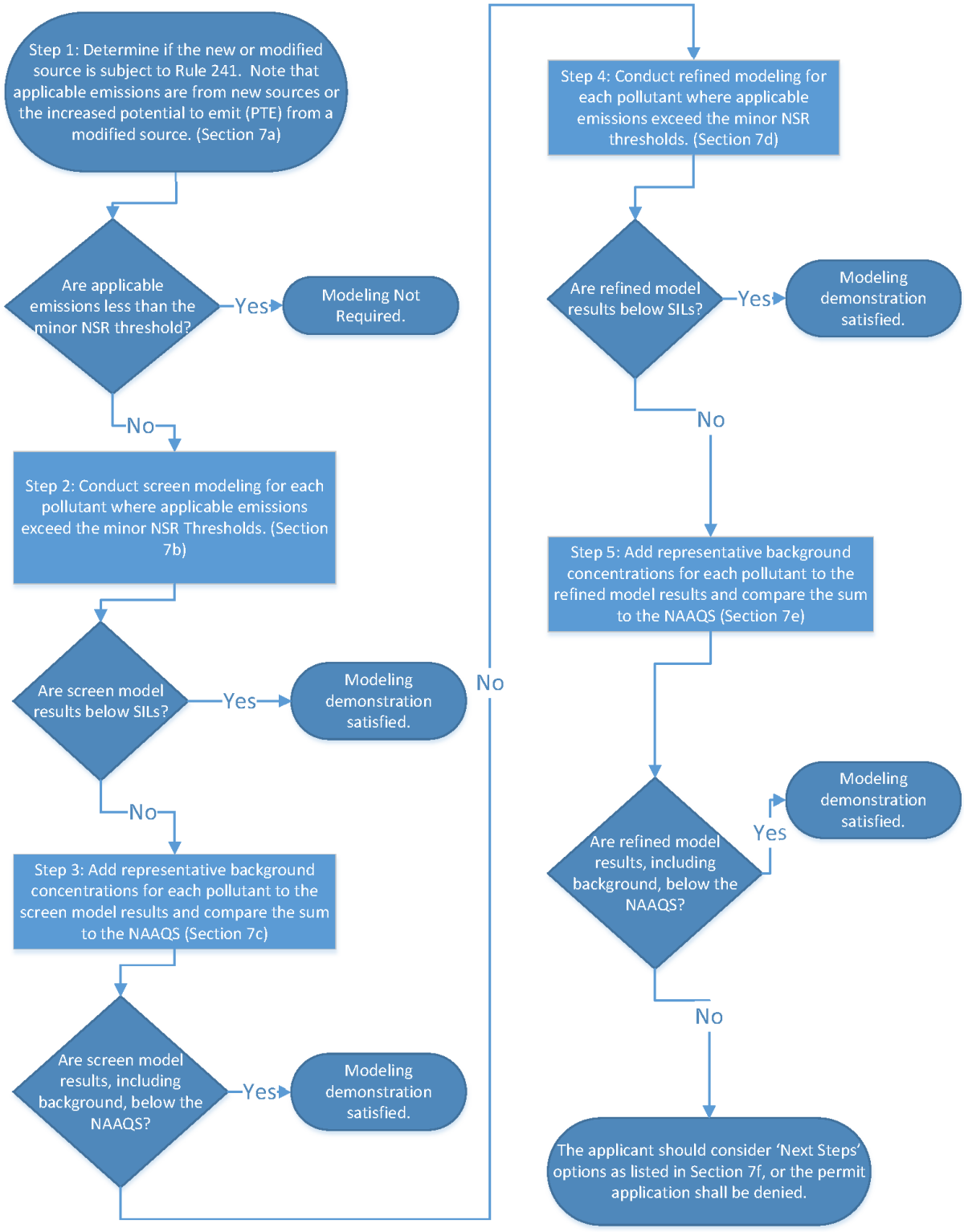
6) Guidance for $PM_{2.5}$ Permit Modeling (U.S. EPA, 2014) https://www3.epa.gov/scram001/guidance/guide/Guidance_for_PM25_Permit_Modeling.pdf

7) US EPA Haul Road Workgroup Final Report https://www3.epa.gov/ttn/scram/reports/Haul_Road_Workgroup-Final_Report_Package-20120302.pdf

e. **Meteorological Data:** AERMET files for the Phoenix area may be downloaded at: http://azdeq.gov/node/2127

Appendix A – Applicability / Process Flow Chart

Process for Conducting an Air Quality Impact Assessment (Section 7)



Appendix B – AERSCREEN Data Input Form

Maricopa County
Air Quality Department

Return completed form to:
Maricopa County Air Quality Department
1001 N Central Ave, Suite 125, Phoenix, AZ 85004
Phone (602) 506-6010 Fax (602) 372-0587
AQPermits@mail.maricopa.gov

Introduction

The Maricopa County Air Quality Department (MCAQD) regulates all facilities and sources that release air pollutants into the ambient atmosphere. The primary purpose of this form is to provide technical information for a new or modified source to MCAQD in order to conduct screening air dispersion modeling to evaluate ground-level concentrations of criteria air pollutants for comparison against the National Ambient Air Quality Standards (NAAQS). Complete the form by typing or printing legibly. Enter information in the fields, as applicable to the emission point type. Note that not all data pertains to all emission point types. Complete one form per emission point. If you need help completing this form, please see our website or contact the Permitting Division at 602-618-9337.

Instructions for the AERSCREEN Input Form

These instructions are provided to assist owners and operators of affected facilities and sources located in Maricopa County to provide accurate information related to emissions and exhaust parameters to MCAQD.

Please provide data in specified units. If providing data in units other than specified, clearly indicate by underlining entry and noting alternate units. Unit abbreviations are noted below.

lb/hr - pounds per hour

tons/yr - tons per year

ft - feet

°F - Fahrenheit

fps - feet per second

ACFM - actual cubic feet per minute

BTU/hr - British Thermal Units per hour

Section 1 – Facility Information:

Business name: Enter the business name, as filed with the Arizona Corporation Commission.

Facility/Registered Entity Name: Enter the Facility/Registered Entity Name, if different than Business name.

Current Permit Number: If applicable, enter the current air permit number.

Address of site: Enter the address of the site, including city, and zip code.

Contact Person Details: Enter the name, title, email, and phone number for the contact person for the permit.

Section 2 – Emission Point Characteristics:

Section 2a – Stack or Release Type: Check the appropriate box for stack or release types. Select only one type per emission source. See the following table for source type descriptions.

Source Type	Source Options	Source Description	Examples
Point	Vertical Stack, Capped Stack, Horizontal Stack	An emission source where emissions are being released through a stack into the atmosphere. Point sources can have weather caps (select capped stack) and can discharge vertically (select vertical stack), horizontally (select horizontal stack), and downward (select capped stack).	Combustion exhaust from a heater, boiler, engine or a thermal oxidizer, emissions from a baghouse or dust collection system is vented through a stack

	Flare	A flare is an elevated source that may be modeled using point source characterization or 'flare' source characterization. Flare source characterization requires certain input parameters that are specific to the flare and may not be readily available. Section 2e should be completed if the design heat input rating for the flare is known.	Flare (industrial wastewater or landfill)
Fugitive	Volume	Fugitive emission sources that have an initial vertical dimension.	Open buildings, open storage tanks, building roof vents, multiple vents, conveyor belts, transfer points
	Area	A low-level or ground-level release with no plume rise. Area sources can be rectangular, circular, or polygonal in shape.	Storage piles, open pits, ponds

Description of the Source: Enter a brief description of the source. Examples include: 20.0 MMBtu/hr natural gas-fired boiler, 600 hp diesel engine, emergency generator, stock pile, or process vent.

Source ID: Enter the assigned Source ID from the air permit, or assign a source ID.

Source Coordinates: Enter the source coordinates in latitude and longitude using decimal degrees, to the 4th decimal place (e.g., 33.2827 degrees). Coordinates can be obtained from GoogleMaps, GoogleEarth, the County Assessor's website (http://maps.mcassessor.maricopa.gov/), or by using a cell phone compass application.

Distance from Source to the Nearest Property Line: Enter the distance between the emission source and the nearest property boundary in feet. See Figure 1 for illustration.

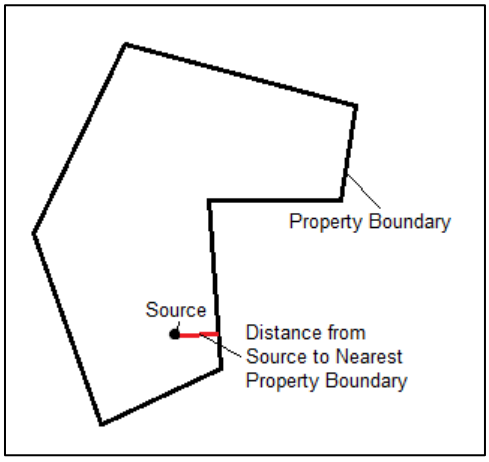


Figure 1. Distance from Source to Nearest Property Boundary Illustration

Section 2b – For Stacks/Point Sources Only (see Figure 2):
Stack Height (Above Ground): Enter the stack height, above ground level in feet.

Stack Diameter: Enter the inside diameter of the exit point of the stack in feet.

Stack Exhaust Temperature: Enter the stack exhaust temperature at the exit of the stack in degrees F. If exhaust temperature is ambient, please indicate by writing "Ambient".

Stack Exit Flow Rate OR Exit Velocity: Enter the stack exit flow rate (in acfm) OR exit velocity (in ft/s). You do not need to enter both.

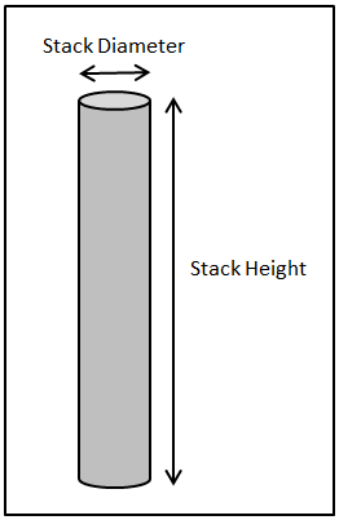


Figure 2. Stack height and stack diameter illustration.

Section 2c - For Volume Sources Only (see Figure 3*):*

Initial Lateral Dimension of the Volume: Enter the width of the volume source divided by 4.3. For non-square sources, the width of the source should be reported as the minimum building length side.

Initial Vertical Dimension of the Volume: Enter the height of the volume source divided by 2.15.

Center Point of the Volume: Enter the center point height above ground of the volume source in feet.

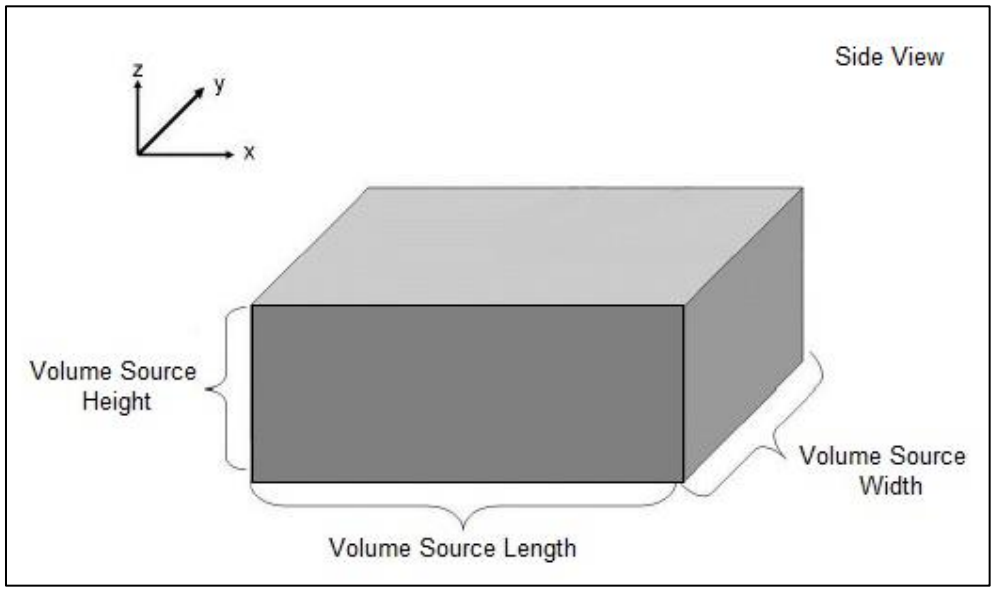


Figure 3. Volume source parameter illustration.

Section 2d - For Area Source Only (see Figure 4*):*
Release Height (Above Ground): Enter the release height, above ground level in feet. Enter "0" for ground-based sources.

Area Source Length (if a Rectangular Source): Enter the Maximum Horizontal Dimension of the Source, or length of the longest side, in feet.

Area Source Width (if a Rectangular Source): Enter the Minimum Horizontal Dimension of the Source, or length of the shortest side, in feet.

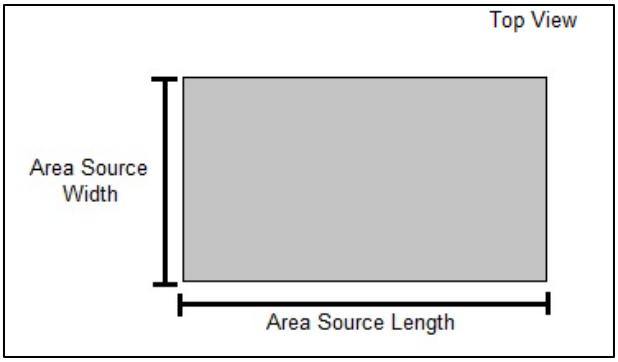


Figure 4. Area source parameter illustration.

Radius of the Circle (if a Circular Source): Enter the radius of the circle of the source, in feet.

Optional
Orientation Angle: Enter the orientation angle of the area source in degrees (0-360).
Initial Vertical Dimension of Plume: Enter the initial vertical dimension of the area source plume in feet.

Section 2e - For Flares Only:
Heat Release Rate: Enter the maximum heat release rating of the flare in calories per second (cal/s).

Optional (if known)
Radiative Heat Loss Fraction: enter the radiative heat loss fraction of the flare.

Section 3 – Emission Rates:
The emission rates reported should be appropriate for the pollutant averaging times as outlined below.

Pollutant		Averaging Time	Emission Rate
Carbon Monoxide (CO)		8 hours	lbs/8-hours
		1 hour	lbs/hour
Nitrogen Dioxide (NO_2)		1 hour	lbs/hour
		1 year	tons/year
Ozone (O_3)		8 hours	lbs/8-hours
Particulate Matter	$PM_{2.5}$	1 year	tons/year
		24 hours	lbs/day
	PM_{10}	24 hours	lbs/day
Sulfur Dioxide (SO_2)		1 hour	lbs/hour
Lead (Pb)		Rolling 3 month average	lbs/3 months

Emission rates for lbs/hour, lbs/day or lbs/8-hour should represents the worst-case emission rate that could occur in any given time period. Emission scenarios that are continuous enough or frequent enough to contribute significantly to the maximum daily concentrations should be included. See the examples in the modeling guidance document section 8.k. for assistance.

It is recommended the applicant consult MCAQD for any intermittent sources they are unsure of including.

Section 4 – Building/Downwash Parameters (if applicable, only point sources):
Provide information for the largest buildings in the region of influence of the stack. Provide building information only for point sources. An example for all building downwash parameters is provided in Figure 5. The region of influence is defined as a building that is within five times the lesser of its height or width from the stack.

If the applicant has a Building Profile Input Program for Plume Rise Model Enhacements (BPIPPRM) file, this should be provided to the Department instead of the parameters outlined below.

Building Height: Enter the height of the dominant building, above ground level in feet.

Building Length: Enter the Maximum Horizontal Building Dimension, or length of the longest side, in feet.

Building Width: Enter the Minimum Horizontal Building Dimension, or length of the shortest side, in feet.

Distance between Stack and Center of the Building: Enter the distance between the stack and the center of the building in feet.

Maximum Building Dimension Angle to North: Enter the angle (in degrees) from North of the longest side of the building. Angle range is 0 to 179 degrees. If unable to provide, ensure that site buildings are included on site plan required by the air permit application.

Direction of Stack from Center of the Building: Enter the angle (in degrees) from North of the stack location relative to the center of the building. Angle range is 0 to 360 degrees. If unable to provide, ensure that site buildings are included on site plan required by the air permit application.

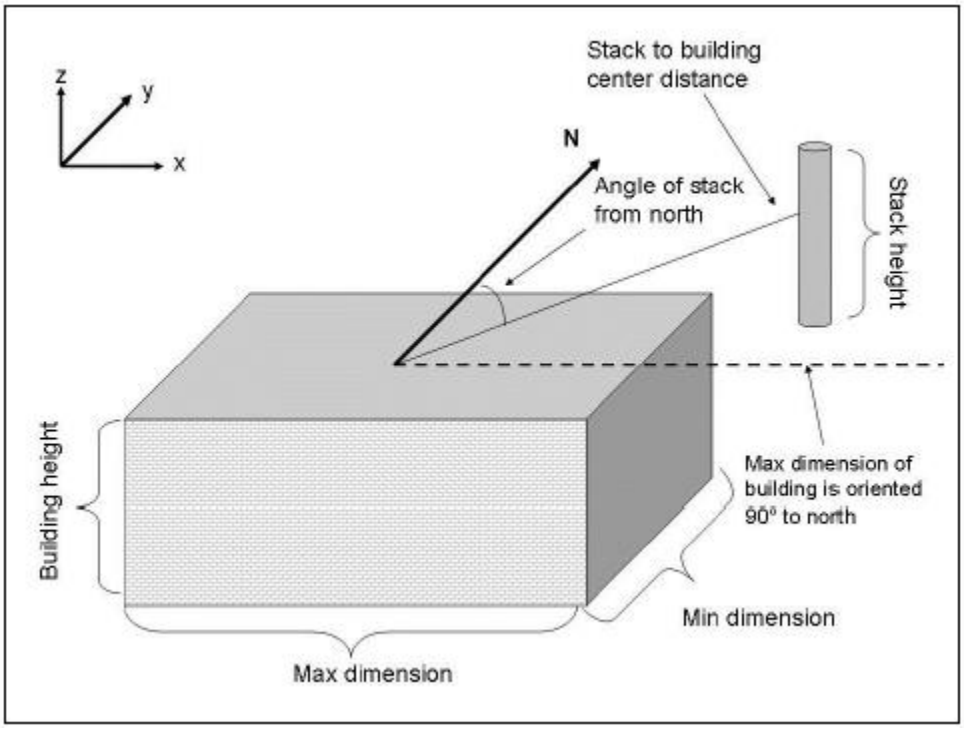


Figure 5. Stack and building orientation for a building oriented 90 degrees to north and stack oriented 45 degrees to north. (From U.S. EPA's AERSCREEN User's Guide, EPA-454/B-15-005)

Section 5 – Surface Characteristics:

Provide information on the surface characteristics of the facility. The applicant may either use AERMET seasonable tables selecting Surface Profile Type and Climate Profile types or user defined values for Surface Roughness, Bowen Ratio and Albedo.

Surface Profile Type: Select the surface profile type that best fits.

Water, Coniferous Forest, Cultivated Land, Deciduous Forest, Grassland, Desert Shrubland, Swamp or Urban

Climate Profile: Dry should be used as the Climate Profile for Maricopa County, however, if Wet or Average are more representative please provide an explanation for their use.

OR

Surface Roughness: Provide the surface roughness for the facility area.

Bowen Ratio: Provide the Bowen ratio for the facility area.

Albedo: Provide albedo for the facility area.

Maricopa County

Air Quality Department

Return completed form to:
Maricopa County Air Quality Department
1001 N Central Ave, Suite 125, Phoenix, AZ 85004
Phone (602) 506-6010 Fax (602) 372-0587
AQPermits@mail.maricopa.gov

AERSCREEN Input Form

Complete one form for each source at the facility.

Section 1 - Facility Information

Business Name:
Facility/Registered Entity Name (if different):
Current Permit Number (if applicable):
Address of Site:
City: Zip Code:

Contact Person Details: Name: Title:
Email: Phone:

Section 2 - Emission Point Characterisitics

Section 2a - Stack or Release Type

Vertical Stack:	☐	Complete Section 2b	Volume: ☐	Complete Section 2c
Capped Stack:	☐	Complete Section 2b	Area: ☐	Complete Section 2d
Horizontal Stack:	☐	Complete Section 2b		
Flare:	☐	Complete Sections 2b and 2e		

Description of the Source:

Source ID:

Source Coordinates (for all sources): Latitude Longitude

Distance From Source to the Nearest Property Line: (ft)

Section 2b - For Stacks/Point Sources Only:		POINT	
Stack Height (Above Ground):	(ft)		
Inside Stack Diameter:	(ft)		
Stack Exhaust Temperature:	(°F)		(indicate if ambient)
Stack Exit Flow Rate OR Velocity:			
Exit Velocity:	(fps)		
OR			
Flow Rate:	(ACFM)		

Section 2c - For Volume Sources Only:		VOLUME
Initial Lateral Dimension of the Volume Source:	(ft)	
Initial Vertical Dimension of the Volume Source:	(ft)	
Centerpoint Height Above Ground:	(ft)	

Section 2d - For Area Sources Only:		AREA
Release Height (Above Ground):	(ft)	
Area Source Length of Long Side (if Rectangular Area Source):	(ft)	
Area Source Length of Short Side (if Rectangular Area Source):	(ft)	
Radius of Circle (if Circular Area Source):	(ft)	
Orientation Angle (if applicable):	(Degrees)	
Initial Vertical Dimension of the Plume (if applicable):	(ft)	

Section 2e - For Flares Only:		FLARE
Heat Release Rate:	cal/s	
Radiative Heat Loss Fraction (if known):		

Section 3 - Emission Rates:

		Carbon Monoxide (CO)	Nitrogen Oxides (NOx)	Particulate Matter ($PM_{2.5}$)	Particulate Matter (PM_{10})	Sulfur Dioxide (SO_2)	Lead (Pb)
Emission Rate - Maximum Hourly:	(lb/hr)						
Emission Rate - Maximum 8 Hour:	(lbs/8-hours)		—	—	—	—	—
Emission Rate - Maximum Daily:	(lbs/day)	—	—			—	—
Emission Rate - Annual:	(tons/yr)						
Emission Rate - Maximum 3 Month Average:	(lbs/3 months)	—	—	—	—	—	

Include an explanation as to how emissions were determined.

Section 4 - Building/Downwash Parameters (if applicable, only applies to point sources):

Building Height:	(ft)
Building Length:	(ft)
Building Width:	(ft)
Distance Between Stack and Center of the Building:	(ft)
Maximum Building Dimension Angle to True North:	degrees
Direction of Stack From Center of the Building:	degrees

If the applicant has a Building Profile Input Program for Plume Rise Model Enhancements (BPIPPRM), this should be provided to the Department instead of the parameters above

Section 5 - Surface Characteristics

If the applicant has an existing AERSURFACE output file for surface characterisitics, this should be provided to the Department instead of the parameters below.

If using the AERMET seasonable Tables:

Surface Profile Type:		(Select from the drop down list)
Climate Profile:	Dry	(If Wet or Average should be used, please explain)

If using user defined values:

Surface Roughness:	
Bowen Ratio:	
Albedo:	

Appendix C – Modeling Protocol Checklist

MODELING PROTOCOL CHECKLIST

MCAQD recognizes that many air quality specialists have their own preferred formats for protocols. MCAQD does not wish to mandate that permit applicants use a specific modeling protocol format. Instead, MCAQD has generated a listing of typical protocol elements as an aid in developing a modeling protocol. This listing does not address all possible components of a protocol. Case-by-case judgments should be used to decide if additional aspects of the analysis need to be included in the protocol or if certain elements are not necessary in a given situation. An example modeling protocol outline is provided below.

General Project Information						
Owner/Operator						
Facility Name						
Facility Address						
Contact Person Name, Title, Email, Phone Number						
Facility Classification	Title V ☐		Non-Title V ☐			
Application Type	New Source ☐		Modification ☐			
Current Permit Number (if applicable)						
Location (UTM or Latitude/Longitude Coordinates)						
Attainment/Maintenance Pollutants [1]	PM_{10} ☐	$PM_{2.5}$ ☐	NO_2 ☐	SO_2 ☐	CO ☐	Pb ☐
Non-Attainment Pollutants [1]	PM_{10} ☐	$PM_{2.5}$ ☐	NO_2 ☐	SO_2 ☐	CO ☐	Pb ☐
Pollutants Modeled	PM_{10} ☐	$PM_{2.5}$ ☐	NO_2 ☐	SO_2 ☐	CO ☐	Pb ☐
Dispersion Model						
Regulatory Default Options	Yes ☐		No ☐			
Dispersion Parameters	Rural ☐		Urban ☐			
General brief description of facility operations						
Overview of the project						
General Regional Characteristics						
Maps and description of local topography, land use of the area surrounding the facility. Also discuss if there are significant human or natural activities that would contribute to background levels. Map should show the source location with respect to the following:						
• Urban areas						
• Non-attainment areas						
• Topographic features (terrain, river valleys, lakes, etc.)						
• Ambient air quality monitoring station(s)						
• Meteorological observation locations						
Description of regional climatology and meteorology. Focus should be given to discussions of meteorological parameters that most significantly influence the modeling analysis, such as regional and terrain-induced wind patterns.						
Detailed Facility Layout						
The source must provide a *scaled site plan with a north arrow* indicated that contains the following information:						
• Locations of emission points (i.e. smokestacks, vents, etc.) at the facility. Clearly label all emission points that will be modeled. Emission point names should be traceable to a table that contains other required modeling information such as stack parameters and emission rates.						
• Location of process equipment (i.e. storage tanks, silos, conveyors, etc.), lay down areas, parking lots,						

haul roads, maintenance roads, storage piles, etc.
• Location of all buildings at the facility. In addition, the applicant must indicate the height of each building (for single tiered buildings) and/or the height of each building tier (for multi-tiered buildings) on a site plan. If a site plan becomes too crowded, a table listing all this information can be provided instead, with the building ID traceable on the plot.
• Location of the facility's fence line and process area boundaries
• Location and name of any roads and/or properties adjacent to the facility (if applicable).
• Location of nearest residences, schools, and offsite workplaces.
Emission Profiles
Identify all emission units included in the modeling analysis and make them traceable to a facility site plan.
Provide brief but sufficient description of emission generation processes for each source (or source category).
If multiple emission scenarios are involved, evaluate each scenario and provide assumptions, conditions and methodologies for emission evaluation.
Identify maximum potential short-term emission rates for all modeled pollutants in lb/hr (or lb/day) and g/sec. The maximum short-term emission rate for each source should be used to demonstrate compliance with all short-term averaging standards and guidelines. It is important that the applicant provide emissions information for all averaging times to be considered in the modeling analysis. Potential short-term emission "spikes" from highly fluctuating short-term emissions sources (such as some types of kilns) also need to be characterized and considered in the modeling analysis.
Identify maximum potential long-term emission rates for all modeled pollutants in tons/yr and in g/sec.
Identify hr/day and hr/yr operational limits assumed for each source.
Loads Analysis
A loads analysis is required for equipment that may operate under a variety of conditions that could affect emission rates and dispersion characteristics. A loads analysis is a preliminary modeling exercise in which combinations of parameters (e.g. ambient temperature, source loads, relative humidity, etc.) are analyzed to determine which combination leads to the highest modeled impact. For example, turbines should be evaluated at varying loads and temperatures to determine the worst-case modeled impact.
Stack Parameters
Describe how each modeled source is characterized (i.e. point source, area source, volume source, etc.).
For stacks, indicate if the stack is oriented vertically/horizontally and if a fixed rain cap is present.
List assumed stack parameters, including: stack height, diameter, exhaust temperature, and exhaust flowrate, and make this information traceable to a facility site plan and emission inventory table.
Modeling Approach
Description of model selection.
Description of model inputs/defaults and modeling methods proposed.
Pollutants and sources considered.
Methodology of determining source configuration. Include the following:
• Volume Source: Explain how the initial lateral and vertical dimension and release height were determined.
• Point Source: Explain how the stack exit velocity is derived. For a stack that multiple sources emit through, provide parameters used to derive the overall stack parameters, especially exit velocity and exit temperature.
• Line Source: Explain the source type and the configuration of the contributing individual sources.
• Other Type of Source: Provide a brief description of how the source configuration was determined.
Land use classification analysis.
Description of the process area boundary.
Proposed process area boundary and receptor grid configurations.
Identification of the coordinate system and datum used to plot the receptors.
Discussion regarding the meteorological data proposed.

Justification for the use of meteorological data if it's not based on the nearest meteorological monitoring station.
Good Engineering Practice (GEP) stack height analysis.
Justification of the background air quality monitoring data to be used.
Include a description of terrain elevation data (types) used and how the elevation data was used to assign terrain elevation and hill height scales.
Special Modeling Considerations
Address any case-by-case modeling requirements raised by MCAQD (if applicable).
Discussion of any specific modeling considerations for the following:
• 1-hour NO_2 NAAQS
• 1-hour SO_2 NAAQS
• $PM_{2.5}$ NAAQS
• PM NAAQS
• Lead NAAQS
• Open burning/open detonation sources
• Buoyant line sources
Comparison with Acceptable Air Quality Levels
In the final report, provide a comparison between modeled concentrations and the following as applicable:
• Significance levels
• NAAQS
References
Provide reference to any documents or guidelines used to conduct the modeling, including:
• 40 CFR 51 Appendix W
• EPA Modeling Guidelines
• MCAQD Guidelines
A copy of the reference should be provided to MCAQD if requested.

[1] Current attainment status for each pollutant can be obtained from the following web site: http://www3.epa.gov/airquality/greenbook/ancl.html

Appendix D –Monitor Locations

Figure 2- 2015 Air monitoring sites near Metropolitan Phoenix; including available wind datasets.

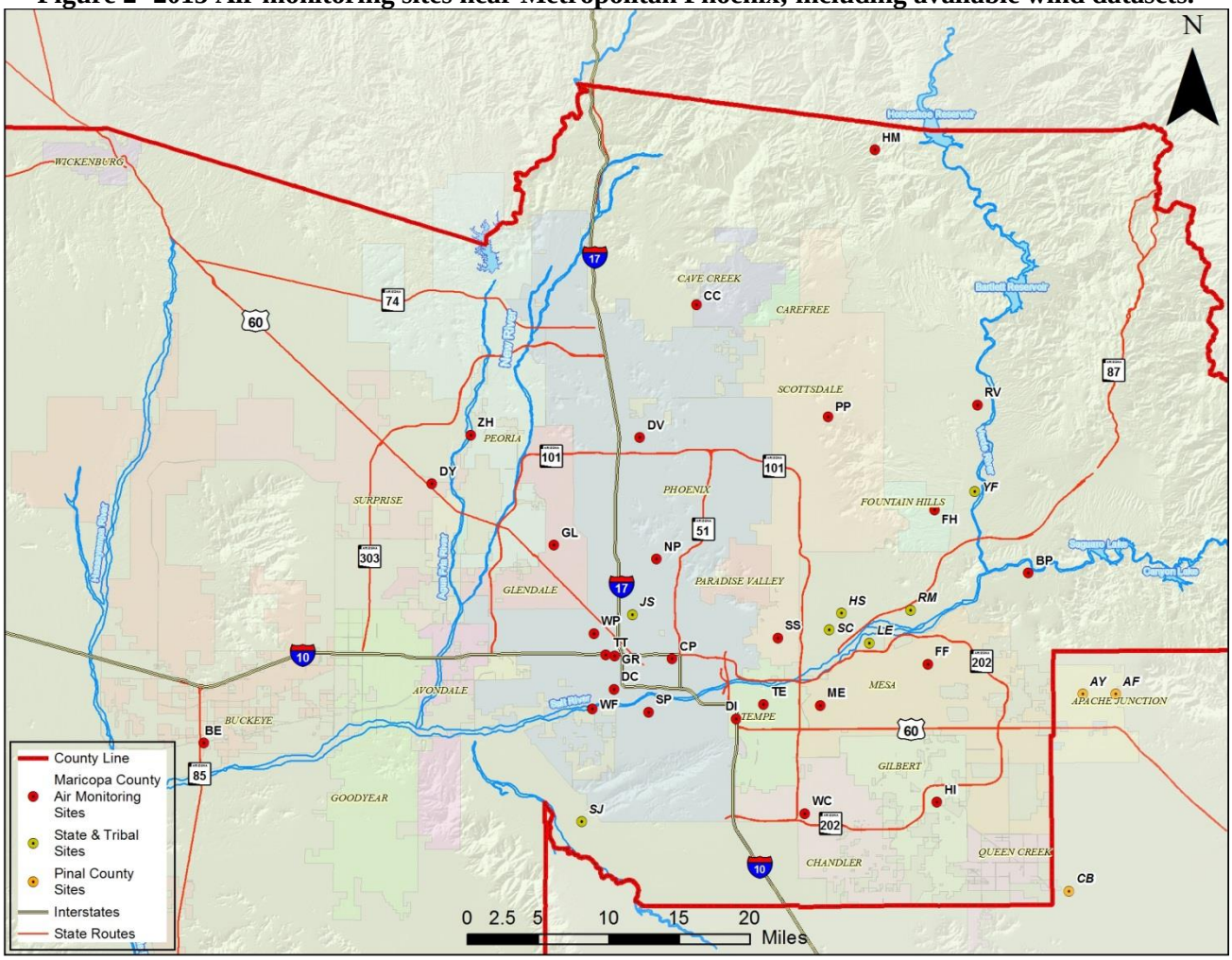


Table 5 - Information and parameters monitored at MCAQD monitors.

Site Abbr	Site Name	Address	City	AQS Code	Pollutants Monitored							Wind Data
					O_3	CO	NO_2	SO_2	PM_{10}	$PM_{2.5}$	Pb	
BP	Blue Point	Usery Pass Rd. & Bush Highway	Not in a city	04-013-9702	X							X
BE	Buckeye	Hwy 85 & MC 85	Buckeye	04-013-4011	X	X	X		X			X
CC	Cave Creek	32nd St. & Carefree Highway	Phoenix	04-013-4008	X							X
CP	Central Phoenix	16th St & Roosevelt St.	Phoenix	04-013-3002	X	X	X	X	X			X
DV	Deer Valley	10th Ave. & Deer Valley Rd.	Phoenix	04-013-4018							X	X
DI	Diablo	1919 W Fairmont Dr.	Tempe	04-013-4019		X	X			X		X
DC	Durango Complex	27th Ave. & Durango St.	Phoenix	04-013-9812				X	X	X		X
DY	Dysart	Dysart Rd & Bell Rd.	Surprise	04-013-4010	X	X			X			X
FF	Falcon Field	McKellips & Greenfield Rd.	Mesa	04-013-1010	X							X
FH	Fountain Hills	Palisades & Fountain Hills Blvd.	Fountain Hills	04-013-9704	X							X
GL	Glendale	59th Ave & W. Olive	Glendale	04-013-2001	X	X			X	X		X
GR	Greenwood	27th Ave. & Interstate 10	Phoenix	04-013-3010		X	X		X			X
HI	Higley	Higley Rd. & Chandler Blvd.	Gilbert	04-013-4006					X			X
HM	Humboldt Mountain	N Seven Springs Rd. & Bartlett Lake Rd.	Not in a city	04-013-9508	X							
ME	Mesa	Broadway Rd. & Alma School Rd.	Mesa	04-013-1003	X	X			X	X		X
NP	North Phoenix	7th Street & Dunlap Ave.	Phoenix	04-013-1004	X	X			X	X		X
PP	Pinnacle Peak	Pima Rd & Pinnacle Peak Rd.	Scottsdale	04-013-2005	X							X
RV	Rio Verde	Forest Rd & Del Ray Ave.	Rio Verde	04-013-9706	X							

Site Abbr	Site Name	Address	City	AQS Code	Pollutants Monitored							
					O3	CO	NO2	SO2	PM10	PM2.5	Pb	Wind Data
SP	South Phoenix	Central Ave. & Broadway Rd.	Phoenix	04-013-4003	X	X			X	X		X
SS	South Scottsdale	Scottsdale Rd. & Thomas Rd.	Scottsdale	04-013-3003	X	X			X			X
TE	Tempe	College Ave. & Apache Blvd.	Tempe	04-013-4005	X	X			X	X		X
TT	Thirty-Third	Interstate 10 & Mooreland Rd.	Phoenix	04-013-4020		X	X					X
WC	West Chandler	Ellis St & Frye Rd.	Chandler	04-013-4004	X	X			X			X
WF	West 43rd Ave	43rd Ave. and Broadway Rd.	Phoenix	04-013-4009					X			X
WP	West Phoenix	39th Ave. & Earll Dr.	Phoenix	04-013-0019	X	X	X		X	X		X
ZH	Zuni Hills	108th Ave. & Deer Valley Rd.	Sun City	04-013-4016					X			X

Table 6 - Information and parameters monitored at ADEQ and tribal monitors; includes Pinal County monitors that are near the Maricopa County border.

Site Abbr	Site Name	Agency	Address	City	AQS Code	Pollutants Monitored							
					O_3	CO	NO_2	SO_2	PM_{10}	$PM_{2.5}$	Pb	Wind Data
JS	JLG (Supersite)	ADEQ[1]	4530 North 17th Avenue	Phoenix	04-013-9997	X	X	X	X	X	X	X	X
YF	Fort McDowell/Yuma Frank	FMYN[2]	18791 Yuma Frank Road	Ft McDowell	04-013-5100	X				X			
SJ	St. Johns	GRIC[3]	4208 West Pecos	Laveen	04-013-7003	X				X			
SC	Senior Center	SRPMIC[4]	10844 East Osborn Road	Scottsdale	04-013-7020	X				X	X		
RM	Red Mountain	SRPMIC[4]	15115 Beeline Highway	Scottsdale	04-013-7021	X							
LE	Lehi	SRPMIC[4]	3230 North Stapley Drive	Scottsdale	04-013-7022	X				X			
HS	High School	SRPMIC[4]	4827 North Country Club Drive	Scottsdale	04-013-7024					X			
AY	AJ Maintenance Yard	Pinal County AQD	305 E Superstition Blvd	Apache Junction	04-021-3001	X							
AF	AJ Fire Station	Pinal County AQD	3955 E Superstition Blvd	Apache Junction	04-021-3002					X	X		
CB	Combs	Pinal County AQD	301 E Combs Rd	Queen Creek	04-021-3009					X			

[1] ADEQ: Arizona Department of Environmental Quality
[2] FMYN: Fort McDowell Yavapai Nation
[3] GRIC: Gila River Indian Community
[4] SRPMIC: Salt River Pima-Maricopa Indian Community

Appendix E – List of Reference Documents

Below are some documents that individuals could review for more in-depth information regarding modeling:

- *Guideline on Air Quality Models* (GAQM) as codified in 40 CFR 51, Appendix W (U.S. EPA, 2005);
- *Draft New Source Review Workshop Manual* (U.S. EPA, 1990);
- *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources* (U.S. EPA, 1992a);
- Guidance and clarification memoranda issued by the EPA Office of Air Quality Planning and Standards (OAQPS);
- Memorandum: *Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 ,National Ambient Air Quality Standard* (Air Quality Modeling Group, C439-0 I, March, 2011)
- Memorandum: *Haul Road Workgroup Final Report Submission to EPA-OAQPS* (Haul Road Workgroup Final Report, December, 2011)