



## **ADEQ Guidance on How to Comply with the Arizona State Hazardous Air Pollutant Program**

The purpose of this guidance is to provide businesses with assistance in determining whether they are subject to the new HAP program and, if so, in complying with the program's requirements. This document provides guidance on estimating HAP emissions, determining the program's applicability, increasing flexibility through alternative methods of compliance and air quality modeling methodologies that may be used as part of an RMA.

This document constitutes guidance only. It is not a substantive policy statement and is not intended to impose any obligations on businesses subject to the state HAPs program beyond those imposed by the state HAPs rule or other relevant regulations.

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## List of Acronyms

AAC	Ambient Air Concentrations
A.A.C	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
A.R.S.	Arizona Revised Statutes
AZMACT	Arizona Maximum Achievable Control Technology
BDL	Below Detection Limit
Btu	British Thermal Unit
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CEMS	Continuous Emission Monitoring System
EPA	Environmental Protection Agency
FIRE	Factor Information Retrieval
GEP	Good Engineering Practice
g/s	Grams Per Second
HAP	Hazardous Air Pollutant
HAPRACT	Hazardous Air Pollutant Reasonable Available Control Technology
hr/yr	Hours Per Year
K	Kelvin
lb/yr	Pounds Per Year
MACT	Maximum Achievable Control Technology
m	Meter
mg/m <sup>3</sup>	Milligrams Per Cubic Meter
m/s	Meters Per Second
MSDS	Material Safety Data Sheet
PEMS	Predictive Emissions Monitoring System
PTE	Potential To Emit
RM	Reference Method
RMA	Risk Management Analysis
TPY	Tons Per Year

TTN Technology Transfer Network  
VOC Volatile Organic Compound

## 1 Arizona State HAP Program Overview

On January 1, 2007, a new Arizona State Hazardous Air Pollutant (HAP) Program became effective. As required by Arizona Revised Statutes (A.R.S.) § 49-426.06, the program requires certain new and modified sources of HAP emissions to install control technology in order to reduce the risk those emissions pose to human health. Sources subject to the program that are able to demonstrate through a risk management analysis (RMA) that their emissions will not adversely affect human health are eligible for an exemption from the control technology requirement.

The rules implementing the program are published in Title 18, Chapter 2, Article 17 of the Arizona Administrative Code, which is available online at [www.azsos.gov/public\\_services/Title\\_18/18-02.pdf](http://www.azsos.gov/public_services/Title_18/18-02.pdf). The June 9, 2006, Notice of Final Rulemaking, which explains the purpose of the rule and the basis for its adoption, is available at [www.azsos.gov/public\\_services/Register/2006/23/final.pdf](http://www.azsos.gov/public_services/Register/2006/23/final.pdf). (Go to page 42 of the linked document for the beginning of the rule preamble and to page 110 for the rule language.)

The purpose of this guidance is to provide businesses with assistance in determining whether they are subject to the new HAP program and, if so, in complying with the program's requirements. This document provides guidance on estimating HAP emissions, determining the program's applicability, increasing flexibility through alternative methods of compliance and air quality modeling methodologies that may be used as part of an RMA.

This document constitutes guidance only. It is not a substantive policy statement and is not intended to impose any obligations on businesses subject to the state HAPs program beyond those imposed by the state HAPs rule or other relevant regulations.

### 1.1 Businesses Subject to the Program

Your business is subject to the state HAPs program if it meets both of the following conditions:

1. You are planning to construct a new *stationary source* or to make a *modification* to an existing stationary source.
  - A *stationary source* consists of all of the pollutant emitting activities that:
    - are located on contiguous or adjacent property;
    - are owned by the same person or by persons under common control; and
    - belong to the same two-digit code as published in the Standard Industrial Classification (SIC) Manual.

In most instances, your entire plant site will constitute a single stationary source.

- A *modification* is a physical or operational change that results in a greater than "de minimis" increase in the emissions of any HAP from a stationary source. The HAP de minimis levels are specified in Table 1 of the rule (attached as [Appendix A](#)) and discussed in section [3.1 below](#).

2. The stationary source is a **major source** or a **covered minor source** of **HAP** emissions.
  - The **HAPs** currently subject to the program are the federal HAPs listed under section 112(b) of the federal Clean Air Act.
  - A **major source** is a stationary source that has the potential to emit more than 10 tons per year of a single HAP or 25 tons per year of a combination of HAPs.
  - A **covered minor source** is a stationary source that:
    - has the potential to emit between 1 ton and 10 tons of a single HAP or 2.5 tons and 25 tons of a combination of HAPs; and
    - belongs to one of the source categories, identified by four-digit SIC codes, specified in Table 2 of the rule (attached as [Appendix B](#)).
    - A source's **potential to emit** a pollutant is its capacity to emit the pollutant operating at its maximum capacity taking into account any enforceable operational limits or control requirements. See section [2.12 below](#).

Emissions subject to a federal emission limit in 40 C.F.R. Part 61 or 63 are exempt from the program. In addition, stationary sources that voluntarily elect to subject themselves to a Part 61 or Part 63 emission limit are eligible for an exemption. A permit applicant should consult with ADEQ permitting staff to determine whether either of these exemptions is available.

The Arizona Administrative Code requires that sources subject to the state HAPS program obtain an air quality permit prior to commencing construction of, or making a modification to any source. Since the rules require a pre-construction permit, the Department recommends that companies intending to construct or modify a source that is subject to the HAPS program schedule a pre-application meeting. A pre-application meeting will help to ensure that appropriate documentation and information is included in the permit application and will help the permitting process to go more smoothly and quickly. A pre-application meeting can be scheduled by calling the Air Quality Permits Section at (602) 771-2338.

## 1.2 Program Requirements

A stationary source that is subject to the program must install a specified level of control technology, unless it qualifies for an exemption. Major sources that are not subject to an emission limitation in a Federal NESHAP must install Arizona Maximum Achievable Control Technology (AZMACT). Covered minor sources must install Hazardous Air Pollutant Reasonably Available Control Technology (HAPRACT).

AZMACT is an emission standard that requires the maximum degree of reduction in emissions of the hazardous air pollutants subject to this chapter, including a prohibition on such emissions where achievable, and that the ADEQ Director, after considering the cost of achieving the emission reduction and any non-air quality health and environmental impacts and energy requirements, determines to be achievable. HAPRACT is defined as an emission standard that the Director determines is reasonably available for a source, taking into consideration the estimated actual air quality impact of the standard, the cost of complying with the standard, the

demonstrated reliability and widespread use of the technology required to meet the standard and any non-air quality health and environmental impacts and energy requirements.

The level of technology that qualifies as AZMACT or HAPRACT is determined on a case-by-case basis. Sections R18-2-1706 and R18-2-1707 of the HAP rule specify procedures for identifying AZMACT and HAPRACT. In general, they require the applicant for a permit subject to the state HAPs program to identify the range of available controls and to justify the selection of a particular level of control. AZMACT and HAPRACT standards will generally take the form of numerical emission limits, unless there is no reliable method of measuring the emissions subject to the limit, in which case the Director will impose a design, equipment, work practice or operational standard.

A stationary source may obtain an exemption from AZMACT or HAPRACT by conducting an RMA which demonstrates that HAP emissions from the source will not adversely affect human health. Procedures for conducting an RMA are set forth in section R18-2-1708 of the rule. Guidance on conducting an RMA can be found in sections [3.2](#) and [3.3](#) below.



## 2 Developing Emission Estimates

Accurate emission estimates are key to determining the applicability of the Arizona State Hazardous Air Pollutant Program. Emission estimates are used to determine whether a stationary source is major or covered minor and whether an increase in emissions resulting from a physical or operational change is greater than de minimis. In addition, only HAP emissions that exceed de minimis levels at either a new or modified source are subject to the program.

Accurate emission estimates are also a necessary component of any RMA.

Owners and operators of individual facilities are responsible for developing and providing proper and accurate estimates of their emissions.

### 2.1 Emission Estimation Methods and Preferred Methods

There are five major types of emission estimation techniques:

- Assumption of compliance with permit limits
- Monitoring or direct measurement
- Emission factors
- Mass balance
- Engineering calculations

The preferred method for estimating emissions is to use direct or indirect measurement. This includes continuous emission monitoring systems (CEMS) or predictive emissions monitoring systems (PEMS) (see section [2.3.1 below](#)). However, CEMS/PEMS are not often possible or practical, except for larger facilities such as electric utilities, refineries or pulp and paper mills where continuous monitoring may be required by state or federal regulations. In addition, CEMS and PEMS are usually only required for criteria pollutants and not for HAPs.

Use of site-specific stack tests under a single or a range of representative conditions is usually the next preferable method (see section [2.3.2 below](#)). Stack testing at other facilities with similar operations may also be utilized in some cases.

The EPA has published (in paper copy and electronically), the *Compilation of Air Pollutant Emission Factors - Volume I: Stationary Point and Area Sources (AP-42)*, which is constantly being updated and improved. Not all industries are addressed in AP-42. This guidance document provides a discussion of methods that might be employed in cases where judgment and interpretation of data may be appropriate for facilities or for the situation where AP-42 emission factors are under development, but not yet published. Users are encouraged to periodically check other sources of information to assure that they are using the best available information at the time. AP-42 emission factors may be found on EPA's Technology Transfer Network (TTN) Web page: [www.epa.gov/ttn/chief/ap42/index.html](http://www.epa.gov/ttn/chief/ap42/index.html).

EPA also has an electronic application called Factor Information Retrieval (*FIRE*) [cfpub.epa.gov/oarweb/index.cfm?action=fire.main](http://cfpub.epa.gov/oarweb/index.cfm?action=fire.main). *FIRE* is a database management system containing EPA's recommended emission estimation factors for criteria and hazardous air

pollutants. *FIRE* includes information about industries and their emitting processes, the chemicals emitted, and the emission factors themselves. *FIRE* allows easy access to criteria and HAP emission factors obtained from AP-42, EPA's *Locating and Estimating* series documents ([www.epa.gov/ttn/chiefl/le/index.html](http://www.epa.gov/ttn/chiefl/le/index.html)) and other EPA documents.

**Many industrial groups may provide information on emission estimation techniques for specific industry types.** Vendors of new equipment may supply emission information for new equipment, but this is often limited to criteria pollutants and not HAPs. More often facility management and engineers use emission factors, which have varying degrees of uncertainty but at least are consistent.

Mass balance calculations are often used to calculate emissions from chemical processes and chemical usage when test data, emission factors, or other calculation methods are not available. For example, mass balance is typically used to calculate volatile organic compounds (VOCs) and organic HAP emissions from chemical processes, such as painting operations, pesticide application, and miscellaneous chemical usage. In conducting mass balance calculations, the weight percent of a chemical constituent is multiplied by the amount of product used. Chemical constituent data are obtained from material safety data sheets (MSDSs) on file at the installation, requested from the manufacturer or obtained from the Hazardous Material Information System or Certified Product Data Sheets (CPDS) or Internet sources. Many MSDSs can be found at [www.siri.org/msds/index.php](http://www.siri.org/msds/index.php).

The following sections provide information on how to calculate emissions using the various methods described above and provide reference material and example calculations.

## 2.2 Compliance with Permit Limits

If emissions potentially subject to the HAPs program are already subject to a permit limit, the permit applicant may be able to estimate HAP emissions by assuming compliance with the limit. In many instances it will be necessary to combine this method with the mass balance approach described in section [2.5 below](#). For example, if a solvent process is subject to a pounds-per-hour limit on VOC emissions, the emissions of a particular VOC HAP could be estimated by multiplying that limit by the weight-percent concentration of the HAP in the solvent.

## 2.3 Monitoring or Direct Measurement

The direct measurement obtained from source testing provides a snapshot of the releases during the test period. Contaminant concentrations are multiplied by the flow rate to obtain a release value per unit time. This value is then multiplied by the total period of operation to determine the release over a specific time period. This method is one of the more accurate methods of estimating emissions.

### 2.3.1 Continuous/Predictive Emissions Monitoring

CEMS are the equipment utilized to determine a gas or particulate matter concentration or emission rate using pollutant analyzer measurements in conjunction with a conversion method (e.g., equation, graph or program) to produce results in units of the applicable emission limitation or standard. CEMS are required under some EPA regulations for either continuous compliance determinations or determination of exceedances of the standards. The applicable federal rule will

specify the reference methods to be used to substantiate the accuracy and precision of the CEMS. Performance specifications are used for evaluating the acceptability of the CEMS at the time of or soon after installation and whenever specified in the regulations.

PEMS are the equipment utilized for the determination of a gas concentration or emission rate using process or control device operating parameter measurements in conjunction with a conversion method (e.g., equation, graph or program) to produce results in units of the applicable emission limitation or standard. See the following Web site for more information on this subject: [www.epa.gov/ttn/emc/cem.html](http://www.epa.gov/ttn/emc/cem.html).

40 CFR Part 75 contains more information about CEMS and procedures for filling in data when no valid hour or hours of data have been recorded by a monitor or monitoring system.

### 2.3.2 Reference Method Stack Testing

A stack test measures the amount of a specific pollutant being emitted. It can be used to demonstrate capture efficiency of a capture system or the destruction efficiency of a control device used to reduce emissions. Typically, a test will involve the use of three one-hour test runs, using the average of the three runs for the test results. Stack testing methods are prescribed by EPA. Reference methods (RM) exist for a wide-variety of criteria and hazardous air pollutants. The methods specify detailed procedures to be followed in conducting the stack tests. Stack testing is highly technical and complex and should be conducted by trained and qualified personnel only. These services can be obtained from many different firms. More detail on stack testing can be found at <http://www.epa.gov/ttn/emc/>.

In stack testing, non-detect or below detection levels are often encountered. The “limit of detection” is the smallest amount of a substance that an analytical method can reliably distinguish from zero. More formally, it is the minimum concentration or amount of a target analyte that produces a signal the tester can distinguish, at a specified confidence level, from the signal produced by a blank. The “limit of quantification” is the minimum concentration or amount of an analyte that a method can measure with a specified degree of precision.

A laboratory should report its limit of detection, identify its procedure for measuring the limit of detection, and label results below the detection limit as “below detection limit (BDL).” The stack testing firm must report the experimentally measured limit of detection and the procedure used to measure it whether or not individual results are above or below the detection limit. If the average results of samples from the same test show some results are BDL and other results are above the detection limit, then the average test result should be calculated based on half the detection level for result(s) that show BDL. For example, three hourly test results for formaldehyde from a certain process show the following: 1.8 lb/hr; BDL; and 3.2 lb/hr. The laboratory has reported a detection level that would be equivalent to 1 lb/hr. The average results should be calculated as follows:

$$\frac{1.8 \text{ lb/hr} + 0.5 \text{ lb/hr} + 3.2 \text{ lb/hr}}{3} = 1.83 \text{ lb/hr}$$

If all three tests showed a BDL, then ADEQ would agree that the pollutant does not need to be evaluated for that process.

### 2.3.3 Similar Unit RM Stack Test

With ADEQ approval during the permitting process, stack testing and monitoring data from off-site locations may sometimes be used to estimate emissions at some facilities. The alternate location should have similar processes using similar units as the facility calculating emission estimates. If located in another state or country, ADEQ must be provided a thorough review of the data and testing methods, prior to allowing the use of that information.

## 2.4 Emission Factors

An emission factor is a tool that can be used to estimate emissions to the atmosphere. Basically, an emission factor is the emission rate relative to the level of source activity. It is usually expressed as a weight of substance emitted per unit of material processed and is derived from direct measurement of actual emission loads from a range of similar plants or equipment. Emission factors are frequently used for estimating air releases.

This method is useful where the relationship between the emission and the activity is well defined. Emission factors can be effective for estimating fugitive emissions in specific conditions or from combustion sources. However, site-specific characteristics may introduce inaccuracies to the use of generic emission factors. Emission factors can be provided for both uncontrolled emission sources and those with control devices.

The basic equation used to calculate releases using emission factors is as follows

$$E_{pol} = P * EF$$

Where,

$E_{pol}$  = Emissions of a particular pollutant (lb/yr)

P = Process Amount (including fuels)

EF = Emission Factor (lb/unit of process)

**Example** – Calculation of formaldehyde emissions from an oil fired boiler based on the following process parameters and the AP-42 emission factor:

- Fuel: No. 2 fuel oil.
- Boiler maximum heat input rating: 48 MMBtu/hr.
- The fuel analysis also shows the heat content of No. 2 fuel oil to be 139,000 Btu/gallon.
- The AP-42 emission factor for formaldehyde from No. 2 fuel combustion is  $3.30 * 10^{-2}$  lb/10<sup>3</sup> gallons.

Emissions of formaldehyde are calculated as follows:

$$E_{pol} = P * EF$$

1. Determine the appropriate Emission Factor (EF):

$$EF = \frac{3.30 * 10^{-2} \text{ lb}}{1000 \text{ gal}}$$

2. Calculate the appropriate Process Amount (P):
  - Emission factor is given in terms of pounds of formaldehyde emitted per thousand gallons of fuel consumed;
  - The appropriate Process Amount for this equation is the amount of fuel that the boiler consumes per hour; and
  - Fuel consumption is estimated by dividing the boiler's maximum heat input rating by the amount of heat content that is available in a gallon of fuel:

$$P = \frac{48 * 10^6 \frac{Btu}{hr}}{139,000 \frac{Btu}{gal}} = 345 \frac{gal}{hr}$$

3. Calculate the hourly emissions of Formaldehyde:

$$E_{formaldehyde} = P * EF = 345 \frac{gal}{hr} * 3.30 * 10^{-2} \frac{lb}{1,000 gal} = 1.14 * 10^{-2} \frac{lb}{hr}$$

4. Potential Annual Emissions of Formaldehyde are calculated as follows:

$$E_{formaldehyde} = 1.14 * 10^{-2} \frac{lb}{hr} * 8,760 \frac{hr}{yr} = 99.8 \frac{lb}{yr}$$

### 2.4.1 Vendor or Manufacturer's Emission Factors

It is possible to obtain emission factors that have been certified by vendors/manufacturers of certain types of equipment. The vendor/manufacturer supplied emission factor can be based on actual or measured data, or on theoretical calculations. Emission factors are typically supplied for operating at normal and maximum design operating conditions. When considering the validity of these emission factors, it is important to determine the basis for the specification. One vendor's/manufacturer's definition of design or nominal operating conditions can often differ from another's. In addition, you should determine if the specification is based on one or multiple tests of identical units (the more tests, the more reliable the emission factor). Approval for use of a vendor/manufacturer supplied emission factor should be obtained from ADEQ during the permitting process.

### 2.4.2 Fugitive Leaks – Emission Factor

EPA has developed emission factors associated with equipment leaks at petroleum facilities and chemical plants. The EPA document *Protocol for Equipment Leak Emission Factors* is available at <http://www.epa.gov/ttn/chieff/efdocs/equiplks.pdf>. The factors presented in this document can be used for estimating emissions of VOC HAPs by using the percentage of the given air toxic to the total VOC emission rate.

**Example** – A chemical manufacturing facility has 145 valves in active light liquid VOC service. The material is 3% benzene. Calculate fugitive benzene emissions from valve leaks.

- The VOC emission factor from Table 2-1 in the *Protocol for Equipment Leak Emission Factors* is 0.00597 kg/hr/valve (0.0132 lb/hr/valve).
- VOC emissions would be calculated as :  
 $145 \text{ valves} * 0.0132 \text{ lb/hr/valve} = 1.914 \text{ lb/hr}$
- Benzene emissions would be calculated as:  
 $1.914 \text{ lb/hr} * 3\% = 0.057 \text{ lb/hr}$
- Annual benzene emissions would be calculated as:  
 $0.057 \text{ lb/hr} * 8,760 \text{ hr/yr} = 499 \text{ lb/yr}$

Note that 8,760 hours per year is equivalent to 24-hours per day and 365 days per year.

## 2.5 Mass Balance

Emissions from solvent tanks/machines, many surface coating operations and miscellaneous chemical usage are typically calculated using a mass balance approach. In addition, mass balance can also be used to estimate emissions from fuel combustion (see section [2.5.2 below](#)).

### 2.5.1 Mass Balance Approach for Solvent Usage, Surface Coating Operations and Miscellaneous Chemical Usage

In general, for uncontrolled solvent tanks/machines the quantity of solvent emitted is approximately equal to the total amount of fresh solvent/chemical added to the cleaning unit minus the amount of waste solvent/chemical that is removed from the unit for recycling/disposal. With the mass balance approach, the following equation is used to calculate emissions:

$$E_{\text{pol}} = [(VA - VR) * D] * [WP]$$

Where,

$E_{\text{pol}}$  = Emissions of a particular pollutant (lb/yr)

VA = Volume of fresh solvent/chemical added to the unit (gal/yr)

VR = Volume of waste solvent/chemical removed from the unit for recycling/disposal (gal/yr)

D = Density of the solvent (lb/gal)

WP = Weight percent of the pollutant in the solvent (%)

The emission of VOC HAPs associated with surface coating operations and miscellaneous chemical usage at a facility provides another example of the mass balance approach. It is assumed the entire solvent portion of a coating or miscellaneous chemical evaporates. The following equation is used:

$$E_{\text{pol}} = VC * D * WP$$

Where,

$E_{pol}$  = Emissions of a particular pollutant (lb/yr) [Note: pollutant must be a VOC or an organic HAP]

VC = Volume of chemical used (gal/yr)

D = Density of the chemical (lb/gal)

WP = Weight percent of the pollutant in the chemical (%)

If control devices are present it may be appropriate to apply control factors to the amount of VOC HAP that is calculated to be released by the above equation (see section [2.8 below](#) for a discussion on control devices).

**Example** – Calculate VOC and methanol emissions from the use of denatured alcohol using material balance based on content of material.

- Quantity of chemical used: 3.8 gal
- Chemical Density: 6.8 lb/gal
- VOC and organic HAP weight percentages: VOC (100%), Methanol (4.61%)

$$E_{pol} = VC * D * WP$$

$$E_{VOC} = 3.8 \text{ gal/yr} * 6.8 \text{ lb VOC/gal} * (100\%) = 25.8 \text{ lb VOC/yr}$$

$$E_{Meth} = 3.8 \text{ gal/yr} * 6.8 \text{ lb Meth/gal} * (4.61\%) = 1.2 \text{ lb Meth/yr}$$

## 2.5.2 Fuel Combustion Mass Balance Approach

If the metal components of a fuel are known, then a mass balance approach can be used to estimate emissions. Assuming that all the material in the fuel is emitted to the atmosphere, the following equation would be used.

$$E_{pol} = FW * WP$$

Where,

$E_{pol}$  = Emissions of a particular pollutant (lb/hr)

FW = fuel weight (lb –fuel/hour), which can be calculated by knowing the amount of fuel burned and the density of the fuel

WP = weight percent of the contaminant in fuel

If an analysis of the ash is available, and the quantity generated over a period of time is known, it may be appropriate to subtract the amount that is present in the ash from the amount emitted to the atmosphere. In addition, if control devices are present it is appropriate to apply control factors to the amount calculated (see section [2.8 below](#) for a discussion of control devices).

**Example** – Calculate arsenic emissions using material balance based on fuel analysis.

- Fuel: No. 2 fuel oil.
- Boiler maximum heat input rating: 48 MMBtu/hr.
- The heat content of No. 2 fuel oil: 139,000 Btu/gallon.

- Density of No. 2 fuel oil: 7.26 lb/gal
- Fuel analysis reveals that arsenic is present at 0.00015% by weight
- Emissions of arsenic are calculated as follows:

$$E_{\text{pol}} = \text{FW} * \text{WP}$$

$$\text{FW} = \frac{48 \times 10^6 \text{ Btu} / \text{hr}}{139,000 \text{ Btu} / \text{gal}} * 7.26 \frac{\text{lb} - \text{oil}}{\text{gal}} = 2,507 \frac{\text{lb} - \text{oil}}{\text{hr}}$$

$$E_{\text{arsenic}} = 2,507 \frac{\text{lb} - \text{oil}}{\text{hr}} * 0.00015\% = 3.8 * 10^{-3} \frac{\text{lb} - \text{arsenic}}{\text{hr}}$$

Potential Annual Emissions of arsenic are calculated as follows:

$$E_{\text{arsenic}} = 3.8 * 10^{-3} \frac{\text{lb}}{\text{hr}} * 8,760 \frac{\text{hr}}{\text{yr}} = 33 \frac{\text{lb}}{\text{yr}}$$

## 2.6 Engineering Calculation

Engineering calculations use standard physical and chemical laws and constants to estimate emissions. These may include equilibrium constants, thermodynamic properties of processes, chemical reactions, pressure constants and physical laws such as Boyle's Law. Engineering calculations may be used to estimate emissions from processes with well-known chemical reactions or operating efficiencies. EPA documents such as *Control of Volatile Organic Compound Emissions from Batch Processes*, EPA-453/R-93-017 provide examples of using engineering calculations to estimate emissions. The EPA Tanks program (see section [2.7 below](#)) is also based on engineering calculations.

## 2.7 Emissions Software

EPA has developed software for calculating emissions from specific operations. The two most commonly used EPA emissions programs are TANKS and WATER9. These software programs are based on one of the emission estimation methods described above.

- TANKS is a computer software program that estimates VOC and HAP emissions from fixed-roof and floating-roof storage tanks. TANKS is based on the emission estimation procedures from [Chapter 7](#) of AP-42. The TANKS software is available for free download on the EPA's TTN Web page located at: <http://www.epa.gov/ttn/chief/software/tanks/index.html>. TANKS uses chemical, meteorological, roof fitting, and rim seal data to generate emissions estimates for several types of storage tanks including:
  - vertical and horizontal fixed roof tanks
  - internal and external floating roof tanks
  - domed external floating roof tanks
  - underground tanks



- WATER9 is a computer program and consists of analytical expressions for estimating air emissions of individual waste constituents in wastewater collection, storage, treatment, and disposal facilities. The software also provides a database listing many organic compounds and procedures for obtaining reports of constituent fates, including air emissions and treatment effectiveness. The WATER9 software is available for free download at <http://www.epa.gov/ttn/chief/software/water/index.html>.
- Licensed emissions calculation software is also available from various vendors. ADEQ approval for the use of any such software should be sought during the permitting process.

## **2.8 Control of Emissions**

A wide variety of equipment is available to control emissions. AP-42 provides quite a bit of information on control efficiencies for common air pollution sources such as boilers. Vendors will also provide information about the control of emissions. Vendors can often also provide pollutant specific control factors. Often these control factors are also appropriate to apply to HAP emissions. For example, a baghouse that controls emissions of particulate matter would also control metal HAPs that are emitted in particulate form. Some metals (such as mercury) may be emitted as a vapor and not controlled by a control device that controls particulate matter. Similarly control devices that control VOC can be assumed to control VOC HAPs to a similar level. However, some control devices (such as condensers, carbon beds, etc.) will control certain VOC HAPs with lower vapor pressures better than others. For these control devices it may be necessary to do a fairly detailed chemical by chemical evaluation of control efficiencies. Approval for applying control factors for emissions of HAPs should be obtained from ADEQ during the permitting process.

## **2.9 Emission Calculation Methods Summary**

Table 2-1 summarizes the methods discussed above and provides a convenient reference for the preferred emission calculations method to be used. The table presents the general hierarchy of preferred emission estimate methods, which are dependent on the application.

**Table 2-1  
General Hierarchy of Methods for Calculating Emissions<sup>a</sup>**

<b>Method Category</b>	<b>Method</b>	<b>Description</b>
Enforceable Permit Limit	Assumed Compliance with Limit	Assumption that emissions are equal to permit limit; will often be combined with HAP concentration data
Monitoring or Direct Measurement	CEMS/PEMS	Continuous or predictive emissions monitoring data
	EPA RM Stack Test	EPA RM test data with advance notification and opportunity for observation by the ADEQ
	Similar Unit EPA RM Test	EPA RM stack test data may be used for determining the emissions of similar equipment when:  (A) Tests are performed by persons qualified by training and experience to perform said tests.  (B) Copies of the tests results and methods are available for review by the ADEQ
Engineering Calculations/Emission Factors	TANKS	EPA Software
Engineering Calculations/Emission Factors	WATER9	EPA Software
Emission Factor and Monitoring or Direct Measurement	Vendor/Manufacturer's Test Data	Emission factors developed during testing performed by vendors/manufacturers at their own testing facilities.
Emission Factor	Other EPA Documents/Software	EPA and EPA-contracted industry-specific emission study data, EIIP Technical Documents, Locating and Estimating Documents, FIRE

Method Category	Method	Description
Mass Balance	Mass Balance	The quantification of emissions by measuring the difference between materials going into and out of a process (initial versus final). Mass balance is usually calculated on an annual basis.
Mass Balance/Emission Factors	Fuel Usage Data	Factors based on accurately metered fuel consumption.
Engineering Calculations	Engineering Calculations	Emission estimates based on chemical or physical processes.
Engineering Calculations/Emission Factors	Licensed Software	Licensed software from various vendors for calculating emissions.
Other	ADEQ Approved Method	ADEQ approval before use is strongly recommended.

<sup>a</sup> Actual hierarchy of the emission estimation method is dependent on the application.

## 2.10 Other Sources of Emissions Information

Other sources of information on emission calculations may be obtained from various locations including state Web pages and databases, association Web pages and industry specific Web sites and databases.

### 2.10.1 Air Waste Management Association

The Air Waste Management Association ([www.awma.org](http://www.awma.org)) publishes monthly journals and holds regional and national meetings. The journals and proceedings from the meetings may contain specific information about emissions and emission factors from specific process or industrial groups.

### 2.10.2 Industrial Groups

Many industrial groups have information about emissions from their specific industrial group. These industrial groups usually require some type of membership to access the data. Some examples include:

- American Composites Manufacturers Association – [www.acmanet.org/ga/emissionsopenmolding.cfm](http://www.acmanet.org/ga/emissionsopenmolding.cfm)
- American Chemical Society (ACS) – [www.chemistry.org](http://www.chemistry.org)
- American Electroplating & Surface Finishes Society (AESF) – [www.aesf.com](http://www.aesf.com)
- American Petroleum Institute (API) – [www.api.org](http://www.api.org)

- American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) – [www.ashrae.org](http://www.ashrae.org)
- Association for Iron & Steel Technology (AIST) – [www.aist.org](http://www.aist.org)
- National Council for Air Stream Improvement (NCASI) – [www.ncasi.org](http://www.ncasi.org) (NCASI has published numerous documents on emissions from pulp and paper facilities as well as wood products manufacturing.)
- Composite Panel Association (CPA) – [www.pbmdf.com](http://www.pbmdf.com)
- National Mining Association (NMA) – [www.nma.org](http://www.nma.org)
- Portland Cement Association (PCA) – [www.cement.org](http://www.cement.org)
- Center for the Polyurethanes Industry – [www.polyurethane.org/s\\_api/index.asp](http://www.polyurethane.org/s_api/index.asp)
- Synthetic Organic Chemical Manufacturers Association (SOCMA) – [www.socma.com/index.htm](http://www.socma.com/index.htm)

### 2.10.3 State Websites and Databases

Some state databases have emission factors available. If an applicant plans to use data obtained from these databases, the applicant should obtain approval from ADEQ during the pre-application stage. The following are Web site links for some states that have data available at their Web sites:

- California – [www.arb.ca.gov/ei/catef/catef.htm](http://www.arb.ca.gov/ei/catef/catef.htm)
- North Carolina – <http://daq.state.nc.us/>
- Oregon – [www.deq.state.or.us/search.htm](http://www.deq.state.or.us/search.htm)
- Texas – [www.tceq.state.tx.us/comm\\_exec/forms\\_pubs/pubs/rg/rg-360\\_05/index.html](http://www.tceq.state.tx.us/comm_exec/forms_pubs/pubs/rg/rg-360_05/index.html)
- Illinois – [www.epa.state.il.us/air/aer/forms/long.pdf](http://www.epa.state.il.us/air/aer/forms/long.pdf)

Other states or local agencies may also provide additional emission information.

### 2.11 Averaging Periods

It will frequently be necessary to develop separate emission rates for a HAP to represent short-term emissions and long-term emissions. For example, many HAPs have both hourly and annual de minimis levels. For these pollutants, a source will need to develop both hourly and annual emissions estimates, since an increase that exceeds either level will subject the source to the HAP program. It may also be necessary to develop short-term and long term estimates for input to models to estimate impacts for comparison to both the acute and chronic ambient air concentrations (AACs) listed in Table 3 of Arizona Administrative Code (A.A.C.) R18-2-1708 (attached as [Appendix C](#)).

## 2.12 Potential to Emit

The determination whether a stationary source exceeds the major source or covered minor source emissions threshold is based on a source's potential to emit (PTE). PTE refers to the amount of a certain pollutant that a facility could release into the air operating at its maximum capacity (even if the facility never actually emitted that amount). A facility's maximum capacity is based on the amount of input material that can be used and production rates. Usually it should be assumed the process can operate for 24-hours per day, 365 days per year. PTE, however, does take into account the design limitations of the facility, as well as any controls or limits on operations imposed in the facility's permit.

A common type of design limitation might involve setting operating rates or operating time limits for certain equipment. For example, in a paint spraying booth at an auto-body shop, there is a limitation on the number of vehicles that can be painted and dried in a given amount of time based on the time it takes to perform each task (e.g., preparation of the painted surface, paint drying, etc.). In estimating the PTE it would not have to be assumed that the paint spraying equipment operates every hour throughout the year. However, it would have to be assumed the business operated every hour throughout the year.

Other examples would include permit limits or conditions that can be applied to reduce the PTE. Some examples would be:

- The use of pollution control devices
- Restriction on the rate or time of operation of the facility or processes
- Limitations on the amounts of raw material or fuel used

## 3 Permitting Procedures for the ADEQ HAP Program

### 3.1 HAP Permit Applicability

A major source of state HAPs is defined as a stationary source that has facility-wide emissions or the potential to emit any state HAP greater than 10 TPY or 25 TPY of any combination of state HAPs. A covered minor source of state HAPs is defined as a stationary source that:

1. After construction or modification has a facility-wide PTE in amounts greater than 1 TPY but less than 10 TPY of a single HAP or greater than 2.5 TPY year but less than 25 TPY of any combination of HAPs; and
2. Belongs to one of the categories designated in Table 2, R18-2-1702.

Under A.A.C. R18-2-1705, a major or covered minor source that will be newly constructed or undergo a modification is required to obtain a permit or a significant permit revision meeting the requirements of the HAP program. A “modification” is a physical or operational change that increases the projected actual emissions of HAPs or results in the projected actual emission of a state HAP not previously emitted by more than the listed de minimis amount in Table 1 of A.A.C. R18-2-1702. A modification is subject to the program if it occurs (1) at a major source, (2) at a covered minor source or (3) at a minor source in a covered category with potential emissions below 1 and 2.5 TPY that, as a result of the modification exceed that amount.

The actual emission increase used for the comparison to the relevant de minimis amount is the difference between actual emissions before the modification and the actual emissions after the modification. It is possible for a source to take voluntary enforceable limits (e.g. annual fuel use, annual hours of operation) that would reduce its actual emissions or PTE to less than the thresholds that would trigger AZMACT or HAPRACT or the de minimis amounts (see [section 3.4 below](#)).

The requirement to install AZMACT or HAPRACT, or to perform an RMA to avoid AZMACT or HAPRACT, applies only to HAPs with a PTE greater than de minimis amounts after construction or modification.

Some examples of activities that would trigger the Arizona State HAPs program are as follows:

- A facility makes a physical change that increases formaldehyde and toluene emissions. The facility is a covered minor source because it emits styrene in excess of 1 TPY and belongs to one of the categories listed in Table 2, R18-2-702. The actual formaldehyde emissions increase exceeds the de minimis level, but neither the actual toluene emissions increase nor the level of total toluene emissions after the change exceeds the de minimis levels for that pollutant. The covered minor source is subject to HAPRACT, unless the facility elects to conduct an RMA for formaldehyde. Since toluene emissions do not exceed the de minimis levels, an RMA for toluene would not be required.
- A covered minor source makes a “modification” that produces new formaldehyde emissions in excess of 1 TPY (these emissions also exceed the de minimis levels for formaldehyde) and a change in actual toluene emissions in excess of the de minimis level. The applicant may choose to establish HAPRACT or may conduct an RMA for

both formaldehyde and toluene which demonstrates that installation of HAPRACT is not necessary to prevent adverse health effects.

- A covered minor source makes a “modification” that increases formaldehyde emissions. Total actual emissions of formaldehyde after the modification exceed 1 TPY but the change in actual formaldehyde emissions does not exceed the de minimis level. The Minor source will not be subject to HAPRACT.
- A new facility in a covered category has a potential to emit formaldehyde that exceeds 1 TPY but is less than 10 TPY. The potential to emit formaldehyde also exceeds the de minimis levels. The source will be subject to HAPRACT unless the facility elects to conduct an RMA for formaldehyde which demonstrates that installation of HAPRACT is not necessary to prevent adverse health effects.
- A new facility has a formaldehyde PTE that exceeds 1 TPY but is less than 10 TPY, and a total HAPs PTE that exceeds 2.5 TPY but is less than 25 TPY. The source is not a listed source category as described in [Appendix B](#). The facility will not be subject to HAPRACT.

The above examples would apply to major sources in a similar manner except that the source would be required to install AZMACT instead of HAPRACT.

### 3.2 Risk Management Analysis

A.A.C. R18-2-1708 allows the applicant to conduct any of four successively more complex RMAs in order to show that the imposition of HAPRACT or AZMACT is unnecessary. If the analysis shows impacts greater than the appropriate AAC, then the facility would either impose the appropriate control technology or proceed to a higher tier analysis. When conducting these analyses, the applicant should follow EPA’s *Guideline on Air Quality Models* codified in 40 CFR 51, Appendix W, located on the EPA Website at [http://www.epa.gov/scram001/guidance\\_permit.htm](http://www.epa.gov/scram001/guidance_permit.htm) and the *Air Dispersion Modeling Guidelines for Arizona Air Quality Permits*, which is available at <http://www.azdeq.gov/function/laws/download/hapsguide.pdf>.

The four tiered levels of the RMA are described in A.A.C. R18-2-1708(B). For a typical modeling analysis an applicant would need to conduct modeling at any location defined as “ambient air.” R18-2-101 defines ambient air as “. . . that portion of the atmosphere, external to buildings, to which the general public has access.” For a typical industrial setting this would mean the modeling analysis should be conducted for any area located outside the source’s process area boundary. Under the Tier 3 and Tier 4 procedures for chronic (annual) exposure only, the applicant has the option to propose an alternative area on the basis of institutional or engineering controls that prevent long-term access and that are permanent and enforceable outside the source’s permit. These controls would alleviate the need to evaluate the excluded area for long-term (annual) exposure in critical areas but this area would still need to be evaluated for acute exposures. For example:

- Deed restrictions could be imposed on a portion of land owned by the facility that would prohibit future construction of residences or other buildings where people would congregate.
- A facility could propose that it would patrol its property boundary. Again this would have to be included in the property deed or by some other permanent and enforceable method outside the air permit.
- Other options for limiting chronic exposure, which will need to be approved by the ADEQ through the permitting process.

Tier 4 allows for refined modeling. If modeling is conducted under Tier 4, submittal of a modeling protocol is required prior to the submission of any modeling results. It is recommended that facilities that wish to conduct a Tier 4 modeling analysis schedule a pre-application meeting with ADEQ prior to the submission of a permit application in order to discuss the process and the required elements of a modeling protocol. To assist in those discussions, a modeling protocol checklist is included in [Appendix D](#). This checklist can be used as an outline for the modeling protocol. The checklist can be used whether the applicant is employing screening or refined modeling techniques following the guidance referenced above. The latest version of the AMS/EPA Regulatory Model (AERMOD) ordinarily should be selected for conducting the refined air dispersion modeling analysis. AERMOD is the preferred model as listed in the EPA's *Guideline on Air Quality Models*, Appendix W. Since the Arizona modeling guidance has not yet been updated to include guidance on using AERMOD, section [3.3 below](#) provides some additional guidance for using AERMOD.

ADEQ may consult with the Arizona Department of Health Services in evaluating the adequacy of Tier 4 RMAs.

### **3.3 Refined Modeling**

AERMOD is used to assess the impact of air emissions from a variety of industrial sources. The AERMOD model predicts pollutant concentrations from point, area, volume or flare sources for surface and elevated sources, and in simple and complex terrain. The AERMOD modeling system can be downloaded from the EPA's Support Center for Regulatory Models (SCRAM) Web site at [http://www.epa.gov/scram001/dispersion\\_prefrec.htm](http://www.epa.gov/scram001/dispersion_prefrec.htm).

AERMOD is actually a modeling system with three separate modules: AERMOD (AERMIC Dispersion Model), AERMAP (AERMOD Terrain Preprocessor), and AERMET (AERMOD Meteorological Preprocessor).

AERMET is the meteorological preprocessor for the AERMOD. Input data can come from hourly cloud cover observations, surface meteorological observations and twice-a-day upper air soundings. Output includes surface meteorological observations and parameters and vertical profiles of several atmospheric parameters. Pre-processed, AERMOD-ready meteorological files may be available. For further information, please contact ADEQ's Air Quality Evaluation Unit at (602) 771-2347.

AERMAP is a terrain preprocessor designed to simplify and standardize the input of terrain data for AERMOD. Input data include receptor terrain elevation data. The terrain data in the form of



USGS digital elevation model (DEM) may be downloaded from the GeoCommunity Web site: <http://www.geocomm.com>, or other on-line services.

### 3.3.1 Land Use Analysis

The selection of the appropriate dispersion coefficients in the AERMOD model is dependent on the land use within three kilometers of the facility. The land use typing scheme should be determined by the method outlined in the “Correlation of Land Use and Cover with Meteorological Anomalies,” Auer, Jr., A.H., *Journal of Applied Meteorology*, 17:636-643, 1978. The Auer technique, recommended in the EPA’s *Guideline on Air Quality Models*, established four primary land use types: industrial, commercial, residential, and agricultural. Industrial, commercial, and high density residential multi-family housing, multi-story areas are classified as urban, while agricultural and common residential areas are considered rural. For modeling purposes, an area is defined as urban if more than 50 percent of the surface within 3 kilometers of the source falls under an urban land use type. Otherwise, the area is determined to be “rural.” Note that there are very few locations within Arizona that would be classified as urban areas using this classification scheme. If an applicant is proposing to use an urban scheme it is suggested that they contact the ADEQ Air Quality Evaluation Unit at (602) 771-2347 for prior concurrence.

### 3.3.2 AERMOD Modeling Options

The regulatory default options should be used in AERMOD. The regulatory default option is controlled from the MODELOPT keyword on the CO pathway. To ensure that the regulatory option is chosen the secondary keyword “DFAULT” should be input. The regulatory default option in AERMOD implements the following default options:

- Use the elevated terrain algorithms requiring input of terrain height data;
- Use stack-tip downwash (except for building downwash cases);
- Use the calms processing routines;
- Use the missing data processing routines;
- Use a 4-hour half life for exponential decay of SO<sub>2</sub> for urban sources.

Rural dispersion parameters are the default used by AERMOD, unless the URBANOPT keyword is used. If the land use analysis demonstrates that the area surrounding the facility is urban, this will allow AERMOD to incorporate the effects that urban areas have on the dispersion parameters.

### 3.3.3 Meteorological Data

The AERMET module is a three-stage processing routine. The first stage involves extraction of the data from a surface file and upper air file, then subjecting it to a quality assurance check in the form of acceptable data ranges. The second stage merges all the data available in to a single data file. The third stage establishes the boundary layer parameters from the merged data and generates the two meteorological files that are read by the AERMOD module and consist of:

- A file of the hourly boundary layer parameters;

- A file that includes the wind speed, wind direction, temperature, and standard deviation of the fluctuating components of the wind at multiple levels.

Preprocessed, AERMOD ready meteorological files may be available directly from the ADEQ. For further information, please contact ADEQ’s Air Quality Evaluation Unit at (602) 771-2347. With ADEQ approval it is possible to process on-site meteorological data for use in AERMOD.

The use of applicant-processed, on-site meteorological data or other meteorological data requires the calculation of the boundary layer parameters that are dependent on the surface conditions in the vicinity of the facility being modeled. Obstacles to wind flow, surface moisture and reflectivity all affect the calculation and are quantified by the assignment of three variables: surface roughness length, surface albedo and Bowen ratio. These site-specific variables can be assigned to vary by month and season. These variables are chosen by reviewing topography and land use within a 3-km radius around the facility and determining the predominant land use category. The climate and the predominant land use in the vicinity of the facility determines what values will be chosen to characterize the site.

### 3.3.4 Source Parameters

AERMOD can model three source types, identified as point, area and volume sources. The source parameters vary depending on source types. Stacks and flares are typical point sources. Point source parameters required by AERMOD include: emission rate in grams per second; stack height in meters; stack inner diameter in meters; stack gas exit velocity in meters per second; and stack gas exit temperature in degrees Kelvin. Volume and area sources require initial dimension and release height calculations that can be found in the EPA’s *User’s Guide for the AMS/EPA Regulatory Model-AERMOD* that can be found at the following Web site: [http://www.epa.gov/scram001/dispersion\\_prefrec.htm#aermod](http://www.epa.gov/scram001/dispersion_prefrec.htm#aermod).

### 3.3.5 Emission Rates

See section 2 for a discussion on emission rate calculations and preferred methods.

### 3.3.6 Receptor Grid

AERMOD accepts Cartesian grid receptor networks or polar grid receptor networks, with either uniform or non-uniform spacing. Discrete receptor locations can be referenced to a Cartesian or polar system. The default units for receptor elevations are meters.

An example of a typical Cartesian receptor grid used in an air quality modeling analysis follows. Cartesian receptors that are inside the process area should be excluded from the receptor grid. The fence-line should be represented by discrete receptors at 50 meter intervals. The Cartesian receptor grid can be centered on the stack with the following spacing:

<b>Distance From Stack (D):</b>	<b>Receptors Must be Located:</b>
0 meters $\leq$ D $\leq$ 500 meters	Every 50 meters
500 meters $\leq$ D $\leq$ 1 kilometers	Every 100 meters

1 kilometer $\leq D \leq$ 3 kilometers	Every 200 meters
3 kilometers $\leq D \leq$ 5 kilometers	Every 500 meters
5 kilometers $\leq D \leq$ 10 kilometers	Every 1000 meters

### 3.3.7 Good Engineering Practice (GEP) Stack Height

A good engineering practice (GEP) stack height evaluation should be conducted to determine if inclusion of building wake effects will be required in the modeling analysis. Procedures used in this analysis should be in accordance with those described in the EPA’s *Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations - Revised)*, EPA 450/4-80-023R, June 1985. The document can be found at the following Web site: [www.epa.gov/scram001/guidance/guide/gep.pdf](http://www.epa.gov/scram001/guidance/guide/gep.pdf).

GEP formula stack height, as defined in 40 CFR Part 51, is expressed as  $GEP = H_b + 1.5L$ , where  $H_b$  is the building height and  $L$  is the lesser of the building height or maximum projected width. Both the height and width of the structure are determined from the frontal area of the structure projected onto a plane perpendicular to the wind.

The GEP stack height should be calculated from dominant nearby buildings and process structures. “Nearby” is defined as the distance up to five times the lesser of the height or width of a structure, but not greater than one-half mile. The GEP analysis should consider all structures at the facility. Structures located less than  $1L$  apart in the cross-wind direction are treated as one structure in the analysis. Structures can be combined using the EPA’s Building Profile Input Program - Plume Rise Model Enhancements (BPIP-PRIME) computer program. BPIP-PRIME is available at [www.epa.gov/scram001/dispersion\\_related.htm](http://www.epa.gov/scram001/dispersion_related.htm).

A GEP stack height analysis should be performed to evaluate the potential for building downwash on the stack(s). The stack and influencing buildings should be located on a plant map. The stack height and relevant building dimensions are then evaluated using the BPIP-PRIME. BPIP-PRIME determines which buildings may cause downwash for a stack for each of the 36 wind directions ( $10^\circ$  sectors). The building-specific dimensions produced by BPIP-PRIME are then used as input in AERMOD. Each stack that is being modeled should be evaluated by BPIP-PRIME.

### 3.3.8 Cavity Analysis

The current version of AERMOD has incorporated the PRIME algorithm. PRIME addresses the entire structure of the wake from the cavity immediately downwind of the building to the far wake. A separate cavity analysis is not required.

### 3.3.9 Presentation of Results

The modeling results should be presented in tabular form comparing the modeling results to the appropriate AACs. Tables should also be included that show the modeled emission rates and the stack/volume/area source parameters. It is preferred that metric units be used, since most air quality models are based on metric units. Figures and maps of stack locations, building dimensions and property (fence-line) should be submitted. North directional arrows and map

scales are required. Refined modeling input and output files should be submitted on a CD or DVD to ADEQ.

### **3.4 Alternative Methods for Compliance**

There are many alternative methods that may be used to allow a facility to avoid being subject to the Arizona State HAP Program or to lower the emissions of HAPs or enhance their dispersion into the atmosphere to allow for compliance through the RMA process and not require add-on controls. The ADEQ is willing to assist with establishing permit limits that would help a facility reduce emissions such that the Arizona State HAP Program would not apply or to help a facility meet the RMA requirements. These might include:

- Annual fuel combustion limits.
- Production limits.
- Hours of operation limits.
- Chemical substitution.
- Creating emission offsets by shutting down an operation or substituting chemicals. (This can be counted as a reduction of HAP emissions for purposes of calculating a source's potential to emit.)
- If the facility is having difficulty showing compliance with acute (i.e., one-hour) AACs, the facility could spread their emissions out over a longer period by taking short-term limits.
- Install less expensive control options that would limit emissions to less than the 1 TPY/2.5 TPY thresholds or the de minimis levels.
- To show compliance with the acute standards, a facility could limit the operation of certain processes emitting similar pollutants during the same short-term period. This could be included in a permit conditions such as – Process A will not operate when Process B is operating.
- Collect and emit fugitive emissions through stacks.
- Stack modifications, including:
  - Raising stacks
  - Removing/modifying rain caps
  - Turning non-vertical stack to the vertical position
  - Increasing stack exit velocity

In addition, under R18-2-1708, a stationary source can obtain pre-approval for future changes by incorporating them into an alternative operating scenario (AOS) and performing an RMA demonstrating that emissions from the AOS will not result in adverse human health effects. The AOS may contain a range of operating conditions if the RMA demonstrates no adverse effects from operations within that range. For example:

- A coating facility conducts an RMA demonstrating that after the addition of a spray booth located at the process area boundary, emissions from the facility will not cause adverse health effects. Since fugitive emissions, such as those from a spray coating operation, typically have the maximum impact at the point nearest the source, ADEQ would pre-approve the addition of another spray booth at any location in the process area.
- An AOS specifying emissions caps for various HAPs commits to no change in the location of the stack emitting the HAPs or in other stack parameters that affect the dispersion of air pollutants. If a scientifically sound RMA demonstrated no adverse health effects from emissions up to cap levels and used the current stack location and parameters, ADEQ would approve the AOS. The source would then be free to make any changes consistent with the AOS without being subject to the state HAP program.

### **3.5 Additional Help for Small Businesses**

The Air Quality Division's Small Business Assistance Program provides information and technical assistance to small business owners regarding applicable regulatory requirements and assists businesses with complying with those requirements. Information on the ADEQ Small Business Assistance Program can be found at <http://www.azdeq.gov/environ/air/compliance/sba.html> or by calling the Air Quality Division at (602) 771-2308 and requesting to speak with a permit engineer.

In Maricopa County contact the Business Resource Division (602) 506-5102 or on the Web at: [http://www.maricopa.gov/aq/divisions/business\\_resource/Default.aspx](http://www.maricopa.gov/aq/divisions/business_resource/Default.aspx).

In Pima County contact the Small Business Waste Assistance Program (SBWAP) at the City of Tucson Fire Prevention at (520) 791-4014 or on the Web at: <http://www.deq.pima.gov/waste/smallbusinwaste.html>.

In Pinal County contact [Don Gabrielson](#) at (520) 866-6929.

## Appendix A - De Minimis Amounts

*Arizona Administrative Register / Secretary of State*

### Notices of Final Rulemaking

**Table 1. State HAPs De Minimis Levels**

<u>Chemical</u>	<u>De Minimis (lb/hr)</u>	<u>De Minimis (lb/yr)</u>
<u>1,1,1-Trichloroethane (Methyl Chloroform)</u>	<u>117</u>	<u>14,247</u>
<u>1,1,2,2-Tetrachloroethane</u>	<u>N/A</u>	<u>0.20</u>
<u>1,3-Butadiene</u>	<u>N/A</u>	<u>0.39</u>
<u>1,4-Dichlorobenzene</u>	<u>N/A</u>	<u>1.9</u>
<u>2,2,4-Trimethylpentane</u>	<u>51</u>	<u>N/A</u>
<u>2,4-Dinitrotoluene</u>	<u>N/A</u>	<u>0.13</u>
<u>2-Chloroacetophenone</u>	<u>N/A</u>	<u>0.19</u>
<u>Acetaldehyde</u>	<u>N/A</u>	<u>5.3</u>
<u>Acetophenone</u>	<u>1.4</u>	<u>2,261</u>
<u>Acrolein</u>	<u>0.013</u>	<u>0.129</u>
<u>Acrylonitrile</u>	<u>N/A</u>	<u>0.17</u>
<u>Antimony Compounds (Selected compound: Antimony)</u>	<u>0.71</u>	<u>9.0</u>
<u>Arsenic Compounds (Selected compound: Arsenic)</u>	<u>N/A</u>	<u>0.0027</u>
<u>Benzene</u>	<u>N/A</u>	<u>1.5</u>
<u>Benzyl Chloride</u>	<u>N/A</u>	<u>0.25</u>
<u>Beryllium Compounds (Selected compound: Beryllium)</u>	<u>0.000707</u>	<u>0.0049</u>
<u>Biphenyl</u>	<u>2.1</u>	<u>1,130</u>
<u>bis(2-Ethylhexyl) Phthalate</u>	<u>0.71</u>	<u>3.0</u>
<u>Bromoform</u>	<u>0.42</u>	<u>11</u>
<u>Cadmium Compounds (Selected compound: Cadmium)</u>	<u>N/A</u>	<u>0.0065</u>
<u>Carbon Disulfide</u>	<u>18</u>	<u>4,522</u>
<u>Carbon Tetrachloride</u>	<u>N/A</u>	<u>0.78</u>
<u>Carbonyl Sulfide</u>	<u>1.7</u>	<u>N/A</u>
<u>Chlorobenzene</u>	<u>57</u>	<u>6,442</u>
<u>Chloroform</u>	<u>N/A</u>	<u>2.2</u>
<u>Chromium Compounds (Selected compound: Hexavalent Chromium)</u>	<u>N/A</u>	<u>0.0010</u>
<u>Cobalt Compounds (Selected compound: Cobalt)</u>	<u>N/A</u>	<u>0.0042</u>
<u>Cumene</u>	<u>53</u>	<u>2,583</u>

## Appendix A - De Minimis Amounts

*Arizona Administrative Register / Secretary of State*

### Notices of Final Rulemaking

<u>Cyanide Compounds (Selected compound: Hydrogen Cyanide)</u>	<u>0.22</u>	<u>19</u>
<u>Dibenzofurans</u>	<u>1.4</u>	<u>45</u>
<u>Dichloromethane (Methylene Chloride)</u>	<u>20</u>	<u>25</u>
<u>Dimethyl formamide</u>	<u>9.3</u>	<u>194</u>
<u>Dimethyl Sulfate</u>	<u>0.018</u>	<u>N/A</u>
<u>Ethyl Benzene</u>	<u>14</u>	<u>6,442</u>
<u>Ethyl Chloride (Chloroethane)</u>	<u>71</u>	<u>64,420</u>
<u>Ethylene Dibromide (Dibromoethane)</u>	<u>N/A</u>	<u>0.020</u>
<u>Ethylene Dichloride (1,2-Dichloroethane)</u>	<u>N/A</u>	<u>0.45</u>
<u>Ethylene glycol</u>	<u>2.8</u>	<u>2,583</u>
<u>Ethylidene Dichloride (1,1-Dichloroethane)</u>	<u>354</u>	<u>3,230</u>
<u>Formaldehyde</u>	<u>N/A</u>	<u>0.90</u>
<u>Glycol Ethers (Selected compound: Diethylene glycol, monoethyl ether)</u>	<u>14</u>	<u>19</u>
<u>Hexachlorobenzene</u>	<u>N/A</u>	<u>0.026</u>
<u>Hexane</u>	<u>659</u>	<u>13,689</u>
<u>Hydrochloric Acid</u>	<u>0.93</u>	<u>129</u>
<u>Hydrogen Fluoride (Hydrofluoric Acid)</u>	<u>0.56</u>	<u>90</u>
<u>Isophorone</u>	<u>0.71</u>	<u>12,946</u>
<u>Manganese Compounds (Selected compound: Manganese)</u>	<u>0.14</u>	<u>0.32</u>
<u>Mercury Compounds (Selected compound: Elemental Mercury)</u>	<u>0.058</u>	<u>1.9</u>
<u>Methanol</u>	<u>53</u>	<u>25,830</u>
<u>Methyl Bromide</u>	<u>15</u>	<u>32</u>
<u>Methyl Chloride</u>	<u>67</u>	<u>582</u>
<u>Methyl Hydrazine</u>	<u>N/A</u>	<u>0.0024</u>
<u>Methyl Isobutyl Ketone (Hexone)</u>	<u>28</u>	<u>19,388</u>
<u>Methyl Methacrylate</u>	<u>18</u>	<u>4,522</u>
<u>Methyl Tert-Butyl Ether</u>	<u>N/A</u>	<u>46</u>
<u>N, N-Dimethylaniline</u>	<u>1.4</u>	<u>45</u>
<u>Naphthalene</u>	<u>N/A</u>	<u>0.35</u>

## Appendix A - De Minimis Amounts

### Arizona Administrative Register / Secretary of State

#### Notices of Final Rulemaking

<u>Nickel Compounds (Selected compound: Nickel Refinery Dust)</u>	<u>N/A</u>	<u>0.049</u>
<u>Phenol</u>	<u>3.3</u>	<u>1,295</u>
<u>Polychlorinated Biphenyls (Selected Compound: Aroclor 1254)</u>	<u>N/A</u>	<u>0.12</u>
<u>Polycyclic Organic Matter (Selected compound: Benzo(a)pyrene)</u>	<u>N/A</u>	<u>0.013</u>
<u>Propionaldehyde</u>	<u>N/A</u>	<u>5.3</u>
<u>Propylene Dichloride</u>	<u>14</u>	<u>26</u>
<u>Selenium Compounds (Selected compound: Selenium)</u>	<u>0.028</u>	<u>113</u>
<u>Styrene</u>	<u>31</u>	<u>6,442</u>
<u>Tetrachloroethylene (Perchloroethylene)</u>	<u>N/A</u>	<u>2.0</u>
<u>Toluene</u>	<u>109</u>	<u>146,766</u>
<u>Trichloroethylene</u>	<u>N/A</u>	<u>0.10</u>
<u>Vinyl Acetate</u>	<u>22</u>	<u>1,295</u>
<u>Vinyl Chloride</u>	<u>N/A</u>	<u>1.3</u>
<u>Vinylidene Chloride (1,2-Dichloroethylene)</u>	<u>2.1</u>	<u>1,295</u>
<u>Xylene (Mixed Isomers)</u>	<u>98</u>	<u>644</u>



## Appendix B - Minor Source Categories

*Arizona Administrative Register / Secretary of State*

### Notices of Final Rulemaking

**Table 2. State HAPs Minor Source Categories**

<u>Primary SIC Code</u>	<u>Source Category</u>
<u>2434</u>	<u>Wood Kitchen Cabinets</u>
<u>2451</u>	<u>Mobile Homes</u>
<u>2621</u>	<u>Paper Mills</u>
<u>2679</u>	<u>Converted Paper Products, n.e.c.<sup>1</sup></u>
<u>2851</u>	<u>Paints and Allied Products</u>
<u>2911</u>	<u>Petroleum Refining</u>
<u>3086</u>	<u>Plastics Foam Products</u>
<u>3088</u>	<u>Plastics Plumbing Fixtures</u>
<u>3089</u>	<u>Plastics Products, n.e.c.<sup>1</sup></u>
<u>3241</u>	<u>Cement, Hydraulic</u>
<u>3281</u>	<u>Cut Stone and Stone Products</u>
<u>3296</u>	<u>Mineral Wool</u>
<u>3312</u>	<u>Blast Furnaces and Steel mills</u>
<u>3331</u>	<u>Primary Copper</u>
<u>3411</u>	<u>Metal Cans</u>
<u>3444</u>	<u>Sheet Metal Work</u>
<u>3451</u>	<u>Screw Machine Products</u>
<u>3479</u>	<u>Metal Coating and Allied Services</u>
<u>3585</u>	<u>Refrigeration and Heating Equipment</u>
<u>3672</u>	<u>Printed Circuit Boards</u>
<u>3999</u>	<u>Mfg. Industries, n.e.c.<sup>1</sup></u>
<u>4922</u>	<u>Natural Gas Transmission</u>
<u>5169</u>	<u>Chemicals and Allied Products, n.e.c.<sup>1</sup></u>
<u>5171</u>	<u>Petroleum Bulk Stations and Terminals</u>

<sup>1</sup> Not Elsewhere Classified

## Appendix C - Ambient Air Concentrations

Arizona Administrative Register / Secretary of State

Notices of Final Rulemaking

See Table 3 below.

**Table 3. Acute and Chronic Ambient Air Concentrations**

<u>Chemical</u>	<u>Acute AAC</u> <u>(mg/m<sup>3</sup>)</u>	<u>Chronic AAC</u> <u>(mg/m<sup>3</sup>)</u>
<u>1,1,1-Trichloroethane (Methyl Chloroform)</u>	<u>2,075</u>	<u>2.30E+00</u>
<u>1,1,2,2-Tetrachloroethane</u>	<u>18</u>	<u>3.27E-05</u>
<u>1,3-Butadiene</u>	<u>7,514</u>	<u>6.32E-05</u>
<u>1,4-Dichlorobenzene</u>	<u>300</u>	<u>3.06E-04</u>
<u>2,2,4-Trimethylpentane</u>	<u>900</u>	<u>NA</u>
<u>2,4-Dinitrotoluene</u>	<u>5.0</u>	<u>2.13E-05</u>
<u>2-Chloroacetophenone</u>	<u>NA</u>	<u>3.13E-05</u>

## Appendix C - Ambient Air Concentrations

*Arizona Administrative Register / Secretary of State*

### Notices of Final Rulemaking

<u>Acetaldehyde</u>	<u>306</u>	<u>8.62E-04</u>
<u>Acetophenone</u>	<u>25</u>	<u>3.65E-01</u>
<u>Acrolein</u>	<u>0.23</u>	<u>2.09E-05</u>
<u>Acrylonitrile</u>	<u>38</u>	<u>2.79E-05</u>
<u>Antimony Compounds (Selected compound: Antimony)</u>	<u>13</u>	<u>1.46E-03</u>
<u>Arsenic Compounds (Selected compound: Arsenic)</u>	<u>2.5</u>	<u>4.41E-07</u>
<u>Benzene</u>	<u>1,276</u>	<u>2.43E-04</u>
<u>Benzyl Chloride</u>	<u>26</u>	<u>3.96E-05</u>
<u>Beryllium Compounds (Selected compound: Beryllium)</u>	<u>0.013</u>	<u>7.90E-07</u>
<u>Biphenyl</u>	<u>38</u>	<u>1.83E-01</u>
<u>bis(2-Ethylhexyl) Phthalate</u>	<u>13</u>	<u>4.80E-04</u>
<u>Bromoform</u>	<u>7.5</u>	<u>1.72E-03</u>
<u>Cadmium Compounds (Selected compound: Cadmium)</u>	<u>0.25</u>	<u>1.05E-06</u>
<u>Carbon Disulfide</u>	<u>311</u>	<u>7.30E-01</u>
<u>Carbon Tetrachloride</u>	<u>201</u>	<u>1.26E-04</u>
<u>Carbonyl Sulfide</u>	<u>30</u>	<u>NA</u>
<u>Chlorobenzene</u>	<u>1,000</u>	<u>1.04E+00</u>
<u>Chloroform</u>	<u>195</u>	<u>3.58E-04</u>
<u>Chromium Compounds (Selected compound: Hexavalent Chromium)</u>	<u>0.10</u>	<u>1.58E-07</u>
<u>Cobalt Compounds (Selected compound: Cobalt)</u>	<u>10</u>	<u>6.86E-07</u>
<u>Cumene</u>	<u>935</u>	<u>4.17E-01</u>
<u>Cyanide Compounds (Selected compound: Hydrogen Cyanide)</u>	<u>3.9</u>	<u>3.13E-03</u>
<u>Dibenzofurans</u>	<u>25</u>	<u>7.30E-03</u>
<u>Dichloromethane (Methylene Chloride)</u>	<u>347</u>	<u>4.03E-03</u>
<u>Dimethyl formamide</u>	<u>164</u>	<u>3.13E-02</u>
<u>Dimethyl Sulfate</u>	<u>0.31</u>	<u>NA</u>
<u>Ethyl Benzene</u>	<u>250</u>	<u>1.04E+00</u>
<u>Ethyl Chloride (Chloroethane)</u>	<u>1,250</u>	<u>1.04E+01</u>
<u>Ethylene Dibromide (Dibromoethane)</u>	<u>100</u>	<u>3.16E-06</u>
<u>Ethylene Dichloride (1,2-Dichloroethane)</u>	<u>405</u>	<u>7.29E-05</u>

## Appendix C - Ambient Air Concentrations

*Arizona Administrative Register / Secretary of State*

### Notices of Final Rulemaking

<u>Ethylene glycol</u>	<u>50</u>	<u>4.17E-01</u>
<u>Ethylidene Dichloride (1,1-Dichloroethane)</u>	<u>6,250</u>	<u>5.21E-01</u>
<u>Formaldehyde</u>	<u>17</u>	<u>1.46E-04</u>
<u>Glycol Ethers (Selected compound: Diethylene glycol, monoethyl ether)</u>	<u>250</u>	<u>3.14E-03</u>
<u>Hexachlorobenzene</u>	<u>0.50</u>	<u>4.12E-06</u>
<u>Hexane</u>	<u>11,649</u>	<u>2.21E+00</u>
<u>Hydrochloric Acid</u>	<u>16</u>	<u>2.09E-02</u>
<u>Hydrogen Fluoride (Hydrofluoric Acid)</u>	<u>9.8</u>	<u>1.46E-02</u>
<u>Isophorone</u>	<u>13</u>	<u>2.09E+00</u>
<u>Manganese Compounds (Selected compound: Manganese)</u>	<u>2.5</u>	<u>5.21E-05</u>
<u>Mercury Compounds (Selected compound: Elemental Mercury)</u>	<u>1.0</u>	<u>3.13E-04</u>
<u>Methanol</u>	<u>943</u>	<u>4.17E+00</u>
<u>Methyl Bromide</u>	<u>261</u>	<u>5.21E-03</u>
<u>Methyl Chloride</u>	<u>1,180</u>	<u>9.39E-02</u>
<u>Methyl Hydrazine</u>	<u>0.43</u>	<u>3.96E-07</u>
<u>Methyl Isobutyl Ketone (Hexone)</u>	<u>500</u>	<u>3.13E+00</u>
<u>Methyl Methacrylate</u>	<u>311</u>	<u>7.30E-01</u>
<u>Methyl Tert-Butyl Ether</u>	<u>1,444</u>	<u>7.40E-03</u>
<u>N, N-Dimethylaniline</u>	<u>25</u>	<u>7.30E-03</u>
<u>Naphthalene</u>	<u>75</u>	<u>5.58E-05</u>
<u>Nickel Compounds (Selected compound: Nickel Refinery Dust)</u>	<u>5.0</u>	<u>7.90E-06</u>
<u>Phenol</u>	<u>58</u>	<u>2.09E-01</u>
<u>Polychlorinated Biphenyls (Selected Compound: Aroclor 1254)</u>	<u>2.5</u>	<u>1.90E-05</u>
<u>Polycyclic Organic Matter (Selected compound: Benzo(a)pyrene)</u>	<u>5.0</u>	<u>2.02E-06</u>
<u>Propionaldehyde</u>	<u>403</u>	<u>8.62E-04</u>
<u>Propylene Dichloride</u>	<u>250</u>	<u>4.17E-03</u>
<u>Selenium Compounds (Selected compound: Selenium)</u>	<u>0.50</u>	<u>1.83E-02</u>
<u>Styrene</u>	<u>554</u>	<u>1.04E+00</u>
<u>Tetrachloroethylene (Perchloroethylene)</u>	<u>814</u>	<u>3.20E-04</u>

## Appendix C - Ambient Air Concentrations

*Arizona Administrative Register / Secretary of State*

### Notices of Final Rulemaking

<u>Toluene</u>	<u>1,923</u>	<u>5.21E+00</u>
<u>Trichloroethylene</u>	<u>1,450</u>	<u>1.68E-05</u>
<u>Vinyl Acetate</u>	<u>387</u>	<u>2.09E-01</u>
<u>Vinyl Chloride</u>	<u>2,099</u>	<u>2.15E-04</u>
<u>Vinylidene Chloride</u> <u>(1,2-Dichloroethylene)</u>	<u>38</u>	<u>2.09E-01</u>
<u>Xylene (Mixed Isomers)</u>	<u>1,736</u>	<u>1.04E-01</u>

## APPENDIX D

### Arizona Program to Control Emissions of HAPs Modeling Protocol Checklist

This modeling protocol checklist has been provided to aid air quality specialists in developing a written modeling protocol describing how the Risk Management Analysis (RMA) modeling will be performed.

#### 1) Introduction and Project Background

- Company, Facility Name and Location, Contact information
- Overview of Project – description of new or modified source(s)

#### 2) Dispersion Model to be Used

- SCREEN
- AERSCREEN
- AERMOD

#### 3) Meteorological Data to be Used

- SCREEN3 Default Full Data
- AERSCREEN Default Full Data

- On-Site Meteorological Data – Processed for use in AERMOD

Years Available: \_\_\_\_\_

How was the data processed?

Who processed the data including name and phone number

How was missing data evaluated?

Note: Pre-processed, AERMOD-ready meteorological files may be available from ADEQ. For further information, please contact ADEQ's Air Quality Evaluation Unit at (602) 771-2347.

#### 4) Emission and Source Data

- Facility Layout – location of sources, buildings (with heights), property boundary, fencelines, scale, and true north indicator
- Pollutant Emission Rate Calculations – indicate how pollutant emission rates were derived (AP-42 emission factors, mass balance, etc.)
- Point Source Parameters (emission rates, UTM coordinates, stack height, stack elevation, stack diameter, stack gas exit velocity, stack gas exit temperature, indicate if stack is capped and non-vertical) for each emission point
- Methodology for including area and volume sources in modeling analysis
- Methodology for including/excluding sources from the modeling analysis

#### 5) SCREEN3 Air Quality Modeling Methodology

- Building Downwash – identify and describe the critical structure used for building downwash dimensions

##### Terrain Elevation Data

- Simple – no terrain heights used (flat terrain)
- Simple – terrain heights above stack base but below stack height
- Complex – terrain above stack height (within 5 kilometers of facility)

##### Receptors

- Minimum Distance - shortest distance to property boundary (fenceline)
- Automated Distance Array - starting at property boundary extending to distance sufficient to capture maximum concentration
- Discrete Receptors

##### Cavity Analysis

- Regulatory Building Downwash Option
- Non-Regulatory Building Downwash Option – Schulman-Scire
- Fumigation Option Used

**6) AERSCREEN Air Quality Modeling Methodology**

AERSCREEN is not currently available from the EPA.

**7) AERMOD Air Quality Modeling Methodology**

Land-Use Determination

- Rural - For modeling purposes, an area is defined as rural if  $\geq 50$  percent of the surface within 3 kilometers of the source falls under a rural land use type.
- Urban - For modeling purposes, an area is defined as urban if  $> 50$  percent of the surface within 3 kilometers of the source falls under an urban land use type
- Regulatory Default Option Used – DFAULT keyword
- Non-Regulatory Options Used – provide keywords of non-regulatory options
  - 1)\_\_\_\_\_ 2)\_\_\_\_\_
  - 3)\_\_\_\_\_ 4)\_\_\_\_\_

Averaging Periods Modeled

- 1-hour    3-hour    8-hour    24-hour    Annual
- GEP Analysis (Building Downwash) – provide scaled plot plan of buildings, with heights, used in BPIP-PRIME

Receptors – provide figures showing inner grids and outer grids

- Flat Terrain Used
- Terrain Elevations Used
  - default, meters    feet
  - Source: AERMAP processed USGS Digital Elevation Models (DEMs)
  - Other Source: \_\_\_\_\_



7) **AERMOD Air Quality Modeling Methodology (cont'd)**

Polar Grid

Model Generated                       Discrete

1) Origin: \_\_\_\_\_

2) Spacing of Rings (m): \_\_\_\_\_

3) Number of directionals: \_\_\_\_\_

4) Increment (in °) for defining directionals: \_\_\_\_\_

5) Starting direction of polar system: \_\_\_\_\_

Cartesian Grid

Model Generated                       Discrete

1) Origin: \_\_\_\_\_

2) Spacing: (Grid one = innermost grid, Grid five=outermost grid)

Fenceline: \_\_\_\_\_meters

Grid One: \_\_\_\_\_meters

Grid Two: \_\_\_\_\_meters

Grid Three: \_\_\_\_\_meters

Grid Four: \_\_\_\_\_meters

Grid Five: \_\_\_\_\_meters

Discrete – single receptors placed on sensitive locations such as schools, hospitals, daycare facilities, etc.