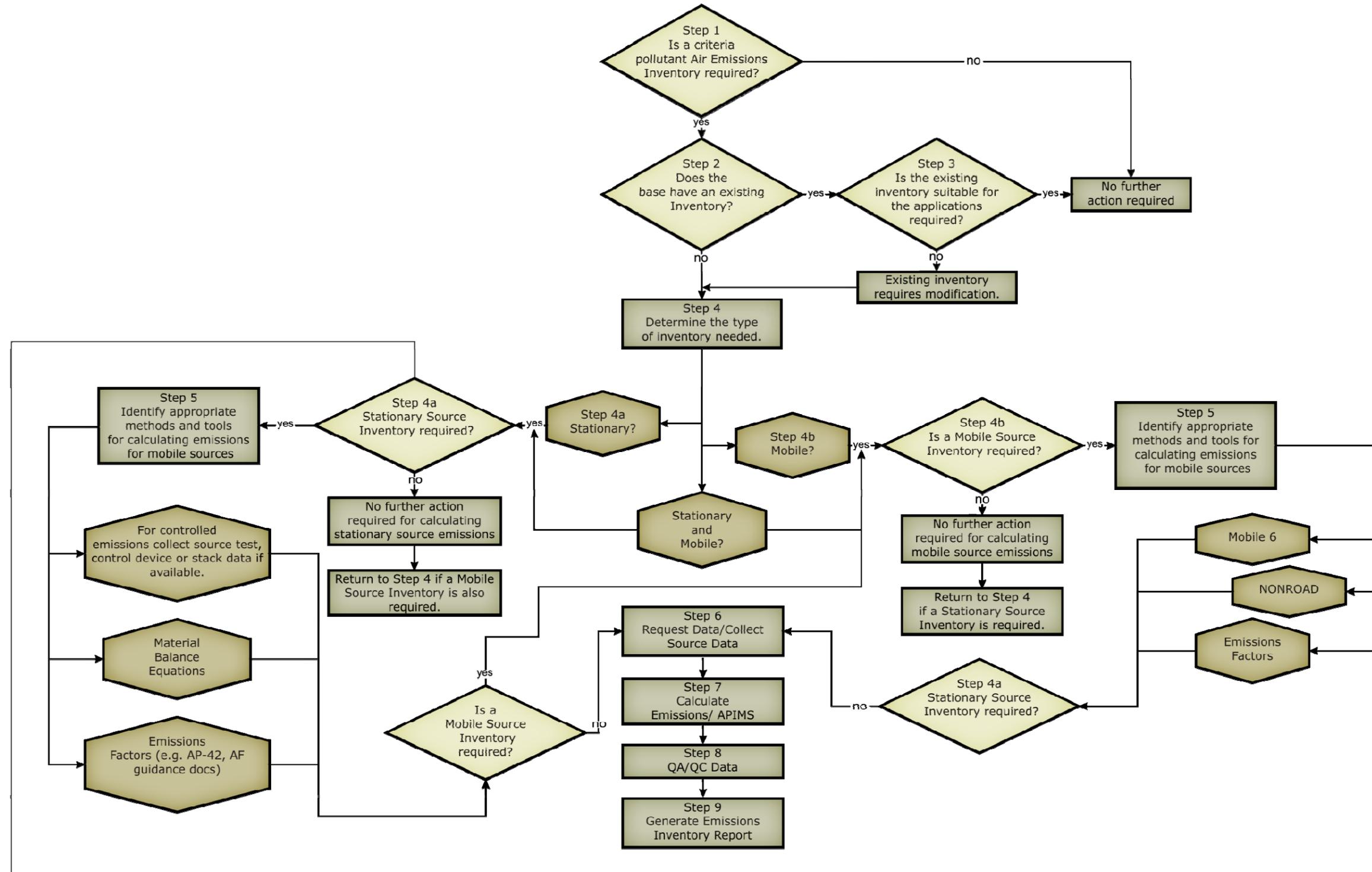


Process Flowchart for Stationary / Mobile Source Air Emissions Inventory



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Step 1: Is a Pollutant Air Emissions Inventory required?

The Clean Air Act and other Federal, State and local regulations require facilities to quantify and report the amount of air pollutant emissions released into the atmosphere to ensure they are in compliance with the various air pollution regulations as well as for planning purposes.

Quantification of air pollutant emissions is accomplished by conducting an air emissions inventory (AEI), a compilation of all the sources of air pollutant emissions at a given area for a certain period of time. An air emissions inventory can range from a simple summary of estimated emissions compiled from previously published emissions data to a comprehensive inventory of a facility using specific source test data that will be used to support compliance activities. Just as there are different types of emissions inventories, their usage is varied and continually expanding. Generally AEIs are completed on an annual basis. However Air Force regulations recommend that AEIs be updated no less frequently than every three years, if no periodic emission inventory requirements apply, to accurately reflect current emissions.

The following lists applicable regulatory requirements for performing Air Emission Inventories at Air Force locations:

- National Emissions Standards for Hazardous Air Pollutants (NESHAPS)
- Major Stationary Source Determination
- State Implementation Plans (SIPs)
- General Conformity
- National Environmental Policy Act (NEPA)
- Emergency Planning and Right-to-Know Act (EPCRA)
- State and Local Programs
- Air Force Instruction (AFI) 32-7040

AEI data are also used to perform toxic air pollutant modeling evaluations, conduct modeling for federally required criteria pollutant attainment and maintenance plans, and monitor progress and trends toward air pollutant reduction goals. Although regulatory requirements are the main reason to perform an air emissions inventory, air emissions inventories can be useful tools in helping individual facilities implement environmental programs and develop strategies for processes and methods for reducing air pollutants from their facilities such as pollution prevention programs, emissions trading opportunities, and Risk Assessments under the Risk Management Plan Section 112(r) of the CAA.

Step 2: Is there an existing emissions inventory?

Determine whether an emissions inventory already exists for the installation. A facility may have previously been involved in developing General Conformity or NEPA documentation and therefore been responsible for monitoring compliance and developing facility-wide emission inventories reports. Also, if a regulatory framework is already in place and a facility is currently operating under an existing permit such a Title V, most likely emissions have been recently characterized and a current facility wide emissions inventory is available.

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Step 3: Is the existing inventory suitable for the applications required?

Determine if the existing inventory is appropriate for the application required. For example ensure an existing inventory accounts for air emissions from sources and processes that require inventorying under applicable regulatory requirements. Also, make certain that data are current and reflects emissions generated by a facility for the period of time required under permits, by regulatory documentation, and emissions reductions strategies.

Step 4: Determine the type of emissions inventory needed.

Only stationary and certain mobile source emission source emissions are applicable to Air Force installations and should be included in pollutant inventories. Installation personnel should identify and document the stationary and mobile emission sources through installation records, personnel interviews, and facility inspections. In addition, the base year of the inventory needs to be established.

Step 4a: Is a Stationary Source Inventory required?

A stationary source is defined as a building, structure, facility, or installation that emits or may emit any regulated air pollutant or any air pollutant subject to regulation under the Clean Air Act's Section 112(b), *List of Pollutants*. The principal pollutant groups regulated under the CAA include criteria pollutants, hazardous air pollutants (HAPs), and ozone depleting substances (ODS. Specifically emissions of concern from stationary sources include the criteria pollutants Carbon Monoxide (CO), Nitrogen Oxides (NO_x), Volatile Organic Compounds (VOC), Sulfur Oxides (SO_x), Particulate Matter with an aerodynamic diameter ≤ 10 micrometers (PM₁₀), and Particulate Matter with an aerodynamic diameter ≤ 2.5 microns PM_{2.5}, Lead, _{as} well as certain HAPs. ODS which are most commonly used in air conditioning, refrigeration systems, fire suppression, and maintenance activities, include Class I and Class II compounds listed in 40 CFR 82.

A stationary source may be further defined as an individual emissions unit, a group of emissions units within the same building or all emissions units at an Air Force base. With regards to air permits a stationary source usually refers to the collection of all emissions units within a contiguous area under common control (fence line to fence line). Sources of stationary source emissions at Air Force facilities may consist of both combustion and non-combustion sources. Typical sources may include boilers/furnaces, space heaters, emergency generators, incinerators, fire training facilities, aircraft engine test facilities, fuel storage tanks, painting operations, deicing operations, solvent degreasers, and welding and woodworking shops.

Stationary sources are further divided into point and fugitive sources. According to the EPA, point sources are defined as those that are at a stationary location or fixed facility from which pollutants are discharged such as a pipe or a smokestack or are also considered any single identifiable source of pollution. Fugitive emissions are those that are simply not caught by a capture system or are vented through a chimney, stack or vent. Fugitive emissions can pass through windows and doors of a building or can be emissions caused by equipment leaks. Examples include emissions from painting and solvent use.

Step 4b: Is a Mobile Source Inventory required?

Mobile sources are any non-stationary source of air pollution. Typical sources of mobile source emissions at an Air Force installation include, privately owned vehicles (POVs), government owned

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vehicles (GOVs), aerospace ground support equipment, and non-road vehicles and engines. Examples of non-road equipment may include construction vehicles and equipment, industrial equipment (e.g. forklifts); landscaping equipment (e.g. lawnmowers, leaf and snow blowers); agricultural equipment, recreational equipment (e.g. all terrain vehicles and golf carts); and aircraft engines and marine engines.

Emissions from operation of on-road vehicles include exhaust and evaporative emissions from the combustion and volatilization of motor fuel. There are also fugitive particulate emissions attributable to on-road vehicle use due to road dust and break and tire wear of the vehicle. Specifically emissions of concern from the operation of mobile sources include the criteria pollutants NO_x, VOC, CO SO₂, PM_{2.5} and PM₁₀ as well as certain HAPs. Personnel conducting mobile source inventories will be required to collect data on base registered vehicles and equipment available from base information systems and the base Transportation office. This includes data on the mileage driven by the vehicles or the amount of time the equipment is in use.

Step 5: Identify Methods and Tools for Calculating Emissions:

Methodologies, models and calculation tools have been developed to assist in calculating emissions for the most common types of mobile and stationary emissions sources at Air Force installations. Specific emission estimation techniques and emission factors for preparation of an AEI are available for both mobile and stationary sources commonly operating at Air Force bases in the following documentation:

- Air Force Institute for Operational Health (AFIOH) *Air Emissions Inventory Guidance Document Volume I (Stationary Sources) and Volume II (Mobile Sources)*, August 2007.

Specific emissions measurements are generally the best and most accurate method to quantify emissions; however, source data are not always available. As an alternative, documents and databases contain emission factors that can be used to estimate air pollutant emissions for inventory purposes. The following sections discuss recommended emissions estimation methodologies and models for calculating air pollutant emissions from Stationary and Mobile Sources. If there is any doubt about the validity of methods, consult the appropriate REO or AFCEE/TDN personnel.

Are emissions controlled?

Perhaps the best method of estimating a source's emissions is the use of source test data or site-specific-stack test data as it reduces the number of assumptions regarding the applicability of emissions data to a source, as well as the control device efficiency, equipment variations, and fuel characteristics. In order to provide the most accurate result, the testing should be conducted over a sufficiently long period of time to produce results representative of conditions that would exist during the time period inventoried. Usually, results from continuous emission monitoring (CEM) are the preferred way to determine emission rates of pollutants. However, this is not often possible or practical, except for larger facilities. CEM measures and records actual emissions during the time period the monitor is operating and the data produced can then be used to estimate emissions for different operating periods.

Are you using Material Balance Equations to calculate emissions?

Material balances can also be very accurate but are limited to certain classes of emissions sources such as for solvent evaporation and the use of architectural coatings. Use of material balances involves the

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examination of a process to determine whether emissions can be estimated solely on knowledge of operating parameters, material compositions, and total material usage. The simplest material balance assumes that all solvent used in a process will evaporate to become air emissions somewhere at a facility. Material balances approach is most appropriate for use in situations where a high percentage of material is lost to the atmosphere.

Are you using Emissions Factors?

One of the most useful methods available for estimating emissions for both stationary and, mobile sources is the emission factor. Emission factors are estimates of the quantity of pollutant released to the atmosphere as a result of some activity such as combustion or industrial production, divided by the level of that activity. The majority of emissions factors are expressed as a single number, with the assumption that a linear relationship exists between emissions and the specified activity level over the probable range of application. Since emission factors are typically averages obtained from data with a wide range of representation and varying degrees of accuracy, emissions calculated this way for a given facility are likely to differ from that facility's actual emissions. Therefore it's recommended that source-specific data be obtained whenever possible to determine the most accurate emissions estimate.

- **AP-42**

The US Environmental Protection's *Compilation of Air Pollutant Emission Factors AP-42* is the preferred source of emissions factors. You can download and print specific sections of this document that contain factors for specific emissions sources you are required to inventory from the EPA's website at <http://www.epa.gov/ttn/chief/ap42/index.html>.

- **The Factor Information REtrieval (FIRE) Data System**

Data System is a database containing EPA's recommended emission estimation factors for criteria and hazardous air pollutants. The EPA's Factor Information Retrieval System (FIRE) is a consolidation of emission factors for criteria pollutants and HAPs that includes emission factors from EPA documents such as *AP-42* and the *Locating and Estimating Air Emissions* series, factors derived from state-reported test data, and factors taken from literature searches.

The following emissions models can be used to assist in calculating certain emissions sources.

- **MOBILE6.2 Vehicle Emissions Modeling Software** is an emission factor model for estimating mobile source emissions. MOBILE6 can predict highway emissions of HC, CO, NO_x, CO₂, and PM, and toxics from cars, motorcycles, light- and heavy-duty trucks under various conditions. The model accounts for the emission impacts of factors such as changes in vehicle emission standards, changes in vehicle populations and activity, and variation in local conditions such as temperature, humidity and fuel quality. EPA plans to eventually replace MOBILE6 and NONROAD with the Motor Vehicle Emission Simulator or MOVES, a new system to estimate emissions for on-road and nonroad sources. This system will encompass the necessary tools, algorithms, data and guidance necessary for use in all official analyses associated with regulatory development, compliance with statutory requirements, and inventory projections. The current MOBILE6 program, guidance and training documents are available for download on EPA's website at <http://www.epa.gov/otaq/m6.htm>

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- **NONROAD2005** is EPA's NONROAD emissions estimating software model and is recommended for estimating emissions from the operation of all nonroad vehicles and equipment. NONROAD can predict emissions of six exhaust pollutants (HC, NO_x, CO, CO₂, SO_x and PM) for 260 specific types of non-road equipment based on model year and various fuels types.
- **TANKS 4.09** - The EPA's Windows-based TANKS program estimates volatile organic compound (VOC) and hazardous air pollutant (HAP) emissions from fixed and floating roof storage tanks. TANKS is based on the emission estimation procedures from Chapter 7 of EPA's AP-42. The methodologies and step-by-step procedures used to calculate VOC emissions from storage tanks can also be found in section 7.1.3 of AP-42. However since these manual procedures involve a comprehensive set of equations and data, it is recommended that the EPA's TANKS program be used to calculate emissions from liquid storage tanks. The program can be downloaded from EPA's website at <http://www.epa.gov/ttn/chief/software/tanks/>.

Other models and automated tools are also available to help estimate air pollutant emissions for such sources such as municipal solid waste landfills, EPA's Landfill Gas Emissions Model (Land GEM) and wastewater treatment facilities, EPA's WATER9 model used to estimate air emissions of individual waste constituents in wastewater collection, storage, treatment, and disposal facilities.

Air Program Information Management System (APIMS) is an information management system used by the Air Force to track and prepare Air Emission Inventories and manage data necessary to demonstrate regulatory compliance. APIMS stores data for air emission source categories, individual emission sources, emission source equipment and control devices, algorithms needed to calculate emissions, and specific air quality permit requirements. APIMS is currently being used at many Air Force installations to calculate air emissions for required annual facility emissions inventories as well as to manage Title V Permit monitoring, record keeping, and reporting requirements.

Step 6: Request Data/ Perform Data Collection

In order to calculate the emissions needed to assemble an air emissions inventory, certain data inputs are required. Data inputs depend on the emissions unit or source for which you are estimating emissions. For example, when estimating emissions for external combustion units such as boilers, data to be collected should include the type/size of the combustor, firing configuration, fuel type, control devices used and their efficiencies, operating capacity, actual operating time for the inventoried period, and information on the overall operation and maintenance conducted on the unit. When collecting data, maximum operating parameters of emissions units and equipment should also be captured in order to calculate Potential to Emit (PTE) emissions. Potential emissions are important as they are used to categorize a source a major or minor for criteria air pollutants and either major or area for hazardous air pollutants.

The AFIOH guidance documents "*Emissions Inventory Guidance Document for Stationary Sources*" provides a listing of the required data elements for each source type based on calculation methodologies for those sources. A series of forms as an appendix to these documents have also been prepared by AFIOH/RSEQ to aid in the collection of AEI data from selected sources.

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Requests for data should be made to the appropriate base personnel responsible for overseeing particular emissions sources. For example, Base Supply Fuels Management should be contacted for a listing of storage tanks located on base, for information concerning the fuels stored in each tank (e.g., fuel type, annual throughput, etc.) and for the physical information required on each tank (e.g., tank type, volume, dimensions, color/shade, condition, etc.).

In some cases multiple Air Force shops perform similar emissions generating activities and will need to be contacted to ensure all emissions sources have been accounted for and captured in the inventory. For example, abrasive blasting operations may occur at Vehicle Maintenance, Aerospace Ground Support Equipment, and base Power Plants.

Requests for data should be made well in advance of any deadlines for submission to regulatory agencies in order to ensure there is sufficient time to complete the calculations and prepare necessary inventory reports and forms.

Step 7: Calculate Emissions

To prepare an emissions inventory at an Air Force installation, emissions are calculated for all relevant sources and regulated pollutants using the latest and most accurate emissions estimation techniques and then totaled. "Regulated pollutants" include those emissions addressed by federal, state or local regulations.

Emissions calculations are usually performed electronically using spreadsheets or other air quality management databases such as APIMS. If a base is required to conduct emissions inventories on a regular basis (e.g. annually or semiannually), formatted spreadsheet templates are recommended for the convenience of the installation air quality managers in completing data calculations and for reviewing and comparing results from previous inventories.

If there's doubt about the validity of methods, base personnel should first consult with REO/AFCEE and then if necessary contact local regulators or EPA Regional Office for further guidance.

Actual Emissions:

Air Emissions Inventories are used to determine "actual emissions." Actual emissions are the actual rate of emissions from a source of any regulated pollutant, calculated using the unit's actual operating hours, production rates, and types of materials processed, stored, or combusted over a specific period of time, excluding excess emissions from a malfunction or startups and shutdowns.

Actual Emissions are usually required to be quantified for sources at a site for submittal to state and local air pollution control agencies often to satisfy a permit condition which requires emissions reporting for specific permitted sources at intervals throughout the year or on a rolling basis (e.g., quarterly emissions or emissions on a rolling 12-month basis). Finally, actual emissions may be required as annual or semi-annual demonstration of compliance and emissions fee determination for bases with a Title V Operating Permit.

Potential to Emit:

Calculate Potential to Emit. A source's potential to emit (PTE) or potential emit are an essential part of an air emissions inventory. PTE is defined in (40 CFR 70.2) as the maximum capacity of a stationary source to emit a pollutant under its physical and operational design. Potential emissions

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are used to categorize a source a major or minor for criteria air pollutants and either major or area for hazardous air pollutants. Generally, emissions for PTE can be calculated based on the maximum capacity of a stationary source or if a particular emission source is permitted. PTE is calculated based on any enforceable permit limitations written into the base's permit. Since compliance costs may vary greatly depending on a source's regulatory status, therefore it's important that the base's calculated PTE emissions are as accurate as possible to ensure classification of a facility as a major or minor source is realistic.

Step 8: Quality Assurance and Quality Control of Emissions Calculations

Review all emissions calculations to ensure calculation methods are valid and emissions totals are accurate and make sense for the sources inventoried. Check all calculations, compare results of emissions totals to previous year's AEI reports if available, and if possible request a third party independent review of the data.

Step 9: Generate emissions inventory report

Emissions calculations are usually performed electronically using spreadsheets or other air quality management databases such as APIMs. If a base is required to conduct emissions inventories on a regular basis (e.g. annually or semiannually), formatted spreadsheet templates are recommended for the convenience of the installation air quality managers in completing data calculations and for reviewing and comparing results from previous inventories.

As required by AFI 32-7040, emissions inventory data must be provided to federal, state and local/regional regulatory agencies as required or upon request. Installations shall submit their most recent AEI in electronic format to AFIOH and their parent Command within 30 days of final AEI report completion. In most cases the completed inventory is submitted as a written report and the inventory calculations in Excel spreadsheet workbook format are included as appendices to the report. Currently, the Air Force and the EPA do not specify any particular format for preparing air emissions inventory reports. Therefore, unless state and local regulatory agencies specify a certain format, inventory reports are usually in the format chosen by the person(s) or organization(s) who prepared the inventory. A recommended format for AEI inventory reports is also provided as an Appendix in the AFIOH Air Emissions Inventory Guidance Document.

If APIMS is used by the installation to calculate criteria pollutant and hazardous air pollutant emissions, it can also create inventory reports for the installation. The system can be used to assist in managing and reporting compliance data in the form of AEI reports required for submission to federal, state and local regulatory agencies.