Area Source Inventories

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AREA SOURCE OVERVIEW

This section of the Technical Support Documentation (TSD) gives information describing how the Area Source Inventory is developed.

Area Sources are typically smaller, yet pervasive sources that do not qualify as point sources under the relevant emissions cutoffs. Area sources encompass more widespread sources that may be abundant, but that, individually, release small amounts of a given pollutant. These are sources for which emissions are estimated as a group rather than individually. Examples typically include dry cleaners, residential wood heating, auto body painting, and consumer solvent use. With the exception of certain oil and gas industry sources, area sources generally are not required to submit individual emissions estimates. Oil and gas industry inventory methods are detailed in a separate TSD. Though they are part of the Area source inventory, they will not be mentioned extensively in this document.

The main distinction between point and area sources is the methodology used to estimate emissions. Point sources are inventoried individually and area sources are inventoried collectively and given as county totals. The only exception to this distinction is based on Utah Administrative Code R307-150 which requires a triennial emissions inventory submission from "sources with Standard Industrial Classification codes in the major group 13 that have uncontrolled actual emissions greater than one ton per year for a single pollutant of PM_{10}, $PM_{2.5}$, oxides of nitrogen, oxides of sulfur, carbon monoxide or volatile organic compounds. These sources include, but are not limited to, industries involved in oil and natural gas exploration, production, and transmission operations; well production facilities; natural gas compressor stations; and natural gas processing plants and commercial oil and gas disposal wells, and ponds."

The term "process" is used here to name an operation or activity that produces emissions. Area sources include broad groups of processes such as:

1. Commercial and consumer solvent usage;
2. Stationary fuel combustion;
3. Material storage and distribution;
4. Waste treatment and disposal;
5. Miscellaneous industrial manufacturing operations;
6. Miscellaneous sources (agricultural/forest burning, structure fires, mining, and construction); and

7. Fuel distribution

Each of these broad groups of processes contains a number of more specific groups or categories that share similar emission processes and emission estimation methods.

Activity data is used to calculate area source categories. This data includes population, employment, VMT, fuel usage, animal, crop, oil and gas industry throughput submissions, and other estimates. A list of the individual data tables and sources of the data used in the calculation processes is included in the relevant Excel input workbook or R script. This activity data workbook and R script contains annual activity data by county, and details emissions summations by category from database queries or applicable EPA/NOMAD (NOnpoint Methods Advisory group) tool outputs and additional emissions estimates ("gap filling"). All databases, workbooks, and scripts are available upon request.

Area sources were adjusted for potential overlaps and double counts with point sources. Adjusted categories include bakeries, mining and quarrying, fuel combustion, degreasing solvents, publicly owned treatment works (POTW), and municipal landfills.

Emissions data from area source inventory, EPA/NOMAD tool outputs and gap filling emissions are, after being compiled, processed through the Sparse Matrix Operating Kernel Emissions model (SMOKE) which adjusts the data for the desired episode and applies additional relevant controls.

The base year inventory is the primary inventory from which other inventories are derived. Thus, all inventories are consistent with data provided in the base year inventory.

The 2017 base year was selected as the foundation for this SIP and the 2023 projection year was projected based on this year. The 2017 inventory year was the best emissions inventory on hand when the SIP process began.

The projection year inventory (2023) projects future air pollution emissions. The goal in developing emission projections is to attempt to account for as many of the important variables that affect future year emissions as possible. Emission projections provide a basis for developing control strategies for this State Implementation Plans (SIPs), conducting attainment analyses, and tracking progress towards meeting air quality standards.

Emission projections are a function of change in activity (growth or decline) combined with changes in the emission rate or controls applicable to the source. To a large extent, projection inventories are based on forecasts of industrial growth, population growth, changes in land use patterns, and transportation growth.

The way the area source categories were projected is explained in the "Activity Data for Estimation Methods" section of the TSD.

INPUT DATA

ACTIVITY DATA FOR ESTIMATION METHODS

Emissions from area sources are nearly always estimated using some type of calculation procedure. Direct measurement of area source emissions is hardly ever practical because of technical and cost considerations.

There are four basic approaches for developing an area source emission estimate:

- Extrapolation from a sample set of the sources (surveys, permit files, or other databases);
- Material balance method;
- Mathematical models; and
- Emission factors applied to activity levels.

The calculation procedures determine what data is used to estimate the area source emissions. A list of the individual data tables and sources of the data used in the calculation processes is included in the relevant Excel input or R script. These data are used in the calculations to estimate emissions for area sources.

Control strategy projections are estimates of future year emissions that also include the expected impact of modified or additional control regulations. State and local planners should determine if any future scheduled regulations, whether at the Federal, State, or local level, apply to sources in their area.

Future year emissions may also be affected by fuel switching, fuel efficiency improvements, improvements in performance due to economic influences, or any occurrence that alters the emission producing process. Programs other than those aimed at reducing the emissions of the criteria pollutants of interest may affect the future year emissions. These may include energy efficiency programs and pollution prevention programs. These should all be reflected in the projections through the future year control factor, emission factor, or in some cases, by adjusting the activity growth forecast.

Control factors and emission factors vary by source category and are continuously being revised and improved based on field and laboratory measurements. States also examine the future year control factor or emission factor in relation to the base year value to ensure any existing controls are not double-counted by taking additional credit in the future year.

<u>Overview of Projection Methods</u>

Emission projections for area sources depend upon the change in source level activity and changes in the emission factor applicable to the source. For area sources, the most appropriate equation used to project emissions is:

$E_{fy} = E_{by} * G * C$

Where:

E_{fy} = projection year emissions
E_{by} = base year emissions
G = growth factor
C = control factor, accounting for changes in emission factors or controls

The base year activity (fuel use, employment, population) will vary depending on the source category. The growth activity type should align with the base year activity type as closely as possible. The above equation is only an example of the necessary calculation for emission projections; further complicating factors required for an accurate projection may require the development of a more vigorous equation.

As with point sources, area source projections can be made using local studies or surveys or through surrogate growth indicators, to approximate the rise and fall in expected activity. The most commonly used surrogate growth indicators are those parameters typically projected by various census data sources such as population, housing, land use, and employment.

Area sources rarely have detailed information based on surveys of individual emitters. Generally surrogate growth rates, as characterized by source type, must be used. While surrogate growth indicators such as employment and population are reasonable estimators of future air pollution-generating activity for traditional area source emitters (manufacturing, population-based activities), other indicators may be more appropriate for non-traditional emitters. Policy changes which may lead to increased or decreased activity in a category must also be considered. For example, future emissions from agricultural tilling will be affected by trends towards conservation tillage as well as total acres tilled. Projections of total acres tilled may not trend with agricultural earnings as operations due to changes in crop yields. The amount of prescribed burning which takes place each year is driven by the policy of Federal and State forest and land management agencies.

The projection year control factor for area sources should account for both changes in emissions due to new levels of control required by Federal, State, and local regulations and process modifications or technology improvements. Emitters in the manufacturing sector, such as industrial, commercial, and institutional fuel combustion, may be assigned a traditional control measure to limit emissions. However, for many area sources, conventional control methods are often inapplicable; instead, control of area source emissions may involve process modifications such as limiting agricultural burning practices, paving with emulsified asphalt or concrete, or stabilization of dirt roads. The control factors should also account for market-driven process changes, such as the move toward lower-solvent or water-based paints (this can be both market and regulatory-driven) and conservation tillage.

It is noteworthy that spatial issues may also impact area source projections. Urban sprawl may result in decreases in area source emissions related to farming, such as agricultural tillage and managed burning. Conversely, urban sprawl may then result in increases in other area source emissions associated with residential areas, such as dry cleaning and consumer solvent use.

Specific growth indicators and controls for projecting emissions for various area source categories are included in the Excel area source calculation or in the attached R script.

SUMMARY TABLES

SUMMARY TABLES

The area source calculation workbook is included in this submission along with several other workbooks and source files: an input workbook with activity data used in the calculation workbook, sources files (appendices) for the activity data, an R script used for automatically updating emission values, and model data output workbooks. These files were used to generate outputs for use in SMOKE.

While area source inputs for SMOKE incorporate currently applied controls (with the exception of residential wood combustion rules), they do not include the effectiveness of any control strategies applied as a result of applicable proposed SIP controls. SMOKE also adjusts the area source and applicable oil and gas calculation workbook emissions from tons per year by county to the episode timeframe of interest as well as boundary/area of interest. An explanation of how the various area source categories were calculated is found in the "Area Source Categories" section of this TSD.

Table 1: Base year (2017) post SMOKE area source (nonpoint) NOx and VOC anthropogenic inventory for the Northern Wasatch Front Nonattainment Area.

NWF NAA 2017 base year		
Sector	**NO_x TPD**	**VOC TPD**
Livestock	-	0.69
Nonpoint	5.36	8.51
2 - 5 MMBTU boilers	0.91	0.05
Other Nonpoint Sources	4.45	8.46

Table 2: Projected year (2023) post SMOKE area source (nonpoint) NOx and VOC anthropogenic inventory for the Northern Wasatch Front Nonattainment Area.

NWF NAA 2023 future year		
Sector	**NO_x TPD**	**VOC TPD**
Livestock	-	0.71
Nonpoint	4.85	8.26
2 - 5 MMBTU boilers	0.87	0.05
Other Nonpoint Sources	3.99	8.21

AREA SOURCE CATEGORIES

Individual reports for the area source categories are found in the category spreadsheets for the relevant years, and are included in the Excel area source calculation or in the attached R script. These spreadsheets calculate the emissions and contain a list of assumptions, emission factors, equations and references for the specific categories and are included in this submission.

Some categories that are included in the workbook were not used in the SMOKE process because emissions from these categories do not occur in the county and/or during the time period of interest. The categories not included in are indicated by their absence in the SMOKE output.