A Procedure for Estimating Nonpoint Source Air Pollutant Emissions from Industrial, Commercial, and Institutional Fuel Combustion

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ABSTRACT

The purpose of this paper is to provide documentation of a methodology to assist State, Local, and Tribal agencies in estimating nonpoint source emissions from Industrial, Commercial, and Institutional (ICI) fuel combustion for the 2011 National Emission Inventory. Fuels considered include coal, distillate oil, natural gas, liquefied petroleum gas, kerosene and wood. One of the key data sources for this methodology is total state-level ICI energy consumption data released annually as part of the Energy Information Administration's State Energy Data System (SEDS). This paper describes fuel-specific activity data adjustments that must be made to the SEDS data to account for the fraction of energy consumed for non-fuel combustion activities (e.g., energy used as product feedstocks), as well as the portion of SEDS fuel consumption associated with sources whose emissions are included in the nonroad inventory. Procedures for allocating state-level data to counties, and a nonpoint source to point source category crosswalk for use in performing point source activity subtractions will also be discussed.

INTRODUCTION

Emissions from Industrial, Commercial, and Institutional (ICI) fuel combustion contribute significant emissions to most areas' total emissions inventory. Unless all ICI combustion emission sources are covered in a geographic area's point source inventory, it is necessary for inventory preparers to estimate ICI combustion nonpoint source emissions. Because there are specific challenges associated with estimating ICI nonpoint source emissions activity/rates, inventory reviewers have observed a number of problem areas in past source category inventory efforts.

The purpose of this paper is to assist inventory preparers by identifying details that can be overlooked when estimating annual emissions for these source categories. These issues are described within the context of detailing the ICI nonpoint source emissions estimation method developed in support of EPA's National Emissions Inventory (NEI). The paper mostly focuses on methods and data sources for developing credible nonpoint source emissions activity data for these source categories. Sample activity data calculations are provided to facilitate understanding of the importance of specific steps in the process. The paper also briefly touches on issues related to selection of emissions factors.

METHODS

This section first provides an overview of ICI combustion nonpoint source emissions estimation methods and data inputs. This is followed by a discussion of emissions activity data adjustments that address potential double-counting issues.

Overview

ICI combustion nonpoint source emissions are calculated using Equation 1. The sector reference represents either Industrial or Commercial/Institutional, and fuel types include, but are not limited to, bituminous coal, natural gas, and distillate oil.

Equation (1) $E_{s,f} = A_{s,f} * F_{s,f}$

where

E = Emissions
A = Emissions Activity
F = Emission Factor
s = sector
f = fuel type

The key emissions activity data inputs in the emissions estimation methodology are:

1. Total Industrial and total Commercial/Institutional energy consumption by fuel type and state for a given year;
2. Industrial energy consumed for non-fuel purposes by fuel type and state in that year;
3. ICI distillate oil and liquefied petroleum gas (LPG) consumption by state from nonroad mobile sources for the year of interest;
4. ICI energy consumption by sector, state, and fuel type for point sources for the given year; and
5. County-level employment by ICI sector and state for the year of interest.

The method also relies on emission factors relating emission rates to the volume of energy burned by sector/fuel type, and the sulfur and ash content of coal consumed in each sector by state for the given year.

ICI combustion emissions are directly related to the sector, type, and volume of fuel burned. The Energy Information Administration (EIA) is responsible for developing official federal government estimates of energy consumption. The EIA estimates annual energy consumption at the state-level as part of the State Energy Data System (SEDS).[1] The SEDS reports energy consumption estimates by state, sector, fuel type, and year. The SEDS provides data for each of five consuming sectors, including Industrial and Commercial. The SEDS' definition of "Commercial" includes Institutional sector use as SEDS defines the Commercial sector as "an energy-consuming sector that consists of service-providing facilities and equipment of: businesses; Federal, State, and local governments; and other public organizations, such as religious, social, or fraternal groups. The Commercial sector includes institutional living quarters. It also includes sewage treatment facilities." The EIA also publishes additional detailed estimates of state-level fuel oil and kerosene consumption estimates in their *Fuel Oil and Kerosene Sales* publication.[2] As described in the following section, this publication provides state-level annual end use sales of No.1, No. 2, and No. 4 distillate fuel oil for commercial, industrial, oil company, farm, off-highway construction, and other uses – these data can be used to differentiate stationary from mobile source distillate fuel consumption.

Activity Data Adjustments

The above EIA sources provide the initial data inputs for estimating combustion emissions for the sectors of interest. There are a number of fundamental issues with these data that are important to understand to ensure that they are properly used. This section identifies these issues, and how each is addressed in the emissions estimation method.

SEDS Data

There are multiple data series reported in SEDS for industrial coal consumption. In particular, there are separate data series for:

- Coal consumed by the industrial sector – listed as CLICP;
- Coal consumed at coke plants (coking coal) – identified as CLKCP; and
- Coal consumed by industrial users other than coke plants – identified as CLOCP.

Rather than compiling data for CLICP, it is more appropriate to select data representing a sub-set of total sector coal consumption. Data for CLOCP should be compiled for the emissions estimation method because coal consumed by coke plants is not really combusted, and all coke plants should be accounted for in the point source inventory.

Because of different emissions characteristics for certain pollutants, it is important to develop coal consumption estimates by type of coal (i.e., anthracite versus bituminous/subbituminous). Because SEDS does not provide coal consumption estimates by type of coal, information provided in an EIA coal distribution report can be used to estimate the proportion of each type of coal consumed in each sector/state. Specifically, the EIA's "Domestic Distribution of U.S. Coal by Destination State, Consumer, Destination and Method of Transportation" reports information on the origin/type of coal distributed to "Industrial Plants Excluding Coke," and the "Commercial & Institutional" sector.[3]

Nonroad Mobile Source Consumption

The SEDS industrial sector distillate oil and LPG consumption data include consumption from activities that should be inventoried as part of the nonroad mobile source sector: farming, logging, mining, and construction. To avoid double-counting of LPG consumption, it is possible to obtain the volume of nonroad LPG consumption via a run of EPA's NONROAD model.

NONROAD model LPG consumption estimates for agriculture, logging, mining, and construction source categories can be compared to SEDS total industrial sector LPG consumption to estimate the proportion of LPG industrial sector consumption attributable to nonroad mobile sources. For the NEI, we ran NONROAD nationally via the National Mobile Inventory Model (NMIM) for 2006 and calculated that approximately 9 percent of total industrial sector LPG consumption was from nonroad mobile sources. We then multiplied the SEDS industrial sector LPG estimates by 91 percent to yield industrial sector LPG consumption from stationary sources.

To address the fact that EIA's industrial sector distillate oil consumption estimates include consumption from nonroad mobile sources, we start with an EIA data source that provides more detailed consumption information. Table 1 displays the specific fuel types for which EIA's *Fuel Oil and Kerosene Sales* reports state-level industrial sector distillate fuel consumption estimates. The approach to removing nonroad mobile source consumption relies on these data and assumptions used in the regulatory impact analysis (RIA) for EPA's nonroad diesel emissions rulemaking.[4] Table 1 displays the

assumptions that were applied to the *Fuel Oil and Kerosene Sales* industrial sector distillate oil consumption estimates reported to estimate total stationary source industrial sector consumption.

Table 1. Stationary Source Adjustments for Industrial Sector Distillate Fuel Consumption

Sector	Distillate Fuel Type	% of Total Consumption from Stationary Sources
Industrial	No. 1 Distillate Fuel Oil	60
	No. 2 Distillate Fuel Oil	100
	No. 2 Distillate/Low and High Sulfur Diesel	15[a]
	No. 4 Distillate Fuel Oil	100
Farm	Diesel	0
	Other Distillate Fuel Oil	100
Off-Highway (Construction and Other)	Distillate Fuel Oil	5
Oil Company	Distillate Fuel Oil	50

[a] This value differs from the 0% assumption adopted in EPA's nonroad diesel emissions rulemaking because it is known that some diesel fuel is used by stationary sources (a 15 percent value was selected for use as an approximate mid-point of a potential range of 8 to 24% stationary source use computed from a review of data from the EIA's *Manufacturing Energy Consumption Survey* and *Fuel Oil and Kerosene Sales*).

Analogous adjustments can be used to address distillate and LPG consumption in the Commercial/Institutional sector. For LPG, EPA's NONROAD model can provide the volume of Commercial sector nonroad LPG consumption, which can then be compared to SEDS total Commercial sector LPG consumption. For the NEI, EPA nationally ran NONROAD via NMIM for 2006 and calculated that approximately 18 percent of SEDS total Commercial sector LPG consumption was from nonroad mobile sources. We then multiplied the SEDS Commercial sector LPG estimates by 82 percent to estimate Commercial sector LPG consumption from stationary sources.

For distillate fuel, Table 2 presents the assumptions that were applied to the state-level Commercial sector distillate oil consumption data published in *Fuel Oil and Kerosene Sales* to estimate Commercial sector stationary source sector consumption.

Table 2. Stationary Source Adjustments for Commercial Sector Distillate Fuel Consumption

Sector	Distillate Fuel Type	% of Total Consumption from Stationary Sources
Commercial	No. 1 Distillate Fuel Oil	80
	No. 2 Distillate Fuel Oil	100
	No. 2 Distillate/Ultra-Low, Low, and High Sulfur Diesel	0[a]
	No. 4 Distillate Fuel Oil	100

[a] A very small portion of total commercial/institutional diesel is consumed by point sources (SCC 203001xx).

Non-Fuel Use

Some Industrial sector energy is consumed for non-fuel purposes. For example, natural gas is used as a feedstock in chemical manufacturing plants and to make nitrogenous fertilizer, and LPG is used to create intermediate products that are made into plastics. To estimate the volume of fuel that is associated with ICI combustion, it is necessary to subtract the volume of energy consumption for non-fuel uses from the total volume of energy consumption.

To identify the percentage of total energy consumption from non-fuel uses, we reviewed information from EIA's 2005 national greenhouse gas (GHG) inventory[5] and EIA's 2002 *Manufacturing Energy Consumption Survey*.[6] All industrial sector fuel types for which EIA's GHG inventory assumes 100 percent energy use as non-fuel (asphalt and road oil, feedstocks, lubricants, miscellaneous petroleum products, pentanes plus, special naphthas, and waxes) were excluded from inventory calculations. For fuel types for which non-fuel use occurs, but is less than 100 percent, we used region-specific data from EIA's 2002 *Manufacturing Energy Consumption Survey* (MECS) to estimate the percentage of total energy consumption attributable to non-fuel uses. The 2002 MECS non-fuel energy consumption data treat coal that is used to produce coke as a feedstock, and therefore, MECS can not be used to represent non-coke coal consumption. In addition, the 2002 MECS data also treat "synthetic coal" that is ultimately combusted as regular coal, as a non-fuel (feedstock) use.[6] Because of these limitations of the 2002 MECS, we obtained from EIA a rough estimate of the percentage of non-coking coal that is used for non-fuel purposes (while also treating "synthetic coal" as a fuel use). Based on the EIA's estimate that 5-10 percent of non-coke coal is used for non-fuel purposes, we assumed that 7 percent of non-coke plant industrial sector coal consumption is for non-fuel purposes.[7] Table 3 presents the non-fuel use percentages applied to estimate industrial fuel combustion activity.

Table 3. Industrial Sector Non-Fuel Use Estimates

	% of Total Energy Consumption from Non-Fuel Use				
Fuel	**Northeast**	**South**	**Midwest**	**West**	**Source**
Distillate Oil	5[a]	9[b]	9[b]	5[a]	2002 MECS
LPG	41[a]	98	88	41[a]	2002 MECS
Natural Gas	1	15	6	41	2002 MECS
Non-Coke Coal	7[c]	7[c]	7[c]	7[c]	Lorenz, 2009
Residual Oil	0	25[b]	25[b]	8	2002 MECS

[a] Due to withheld data, value represents combination of Northeast and West region data.
[b] Due to withheld data, value represents combination of Midwest and South region data.
[c] Region-specific values not available.

Point Source Adjustment

To ensure that fuel consumption is not double-counted in the point source inventory, it is also necessary to subtract point source inventory fuel use from the fuel consumption estimates developed from the above steps. Equation 2 illustrates the approach to performing point source subtractions.

Equation (2) $N_{sf} = T_{s,f} - P_{s,f}$

where

N = Nonpoint fuel consumption
T = Total fuel consumption
P = Point source fuel consumption
s = sector
f = fuel type

The first necessary step in the point source subtraction procedure is to identify how each ICI combustion nonpoint source classification code (SCC) links to associated ICI combustion point SCCs. We have developed two such crosswalks: one between each Industrial fuel combustion nonpoint SCC and related point SCCs, and an analogous crosswalk developed for Commercial/Institutional fuel combustion SCCs. Table 4 displays a sample of the crosswalk associated with the industrial wood combustion nonpoint source category (SCC 2102008000 – Industrial; Wood; Total: All Boiler Types). (The primary author can make the complete crosswalks available upon request.) One issue to note is that natural gas consumed as pipeline fuel is not included by the SEDS within the Industrial sector. Therefore, it is necessary to be sure to exclude pipeline natural gas consumption in performing industrial natural gas point source subtractions. This consumption may be included within industrial sector natural gas internal combustion engine records (SCC 202002xx).

Table 4. Point Source Categories Associated with Industrial Wood Nonpoint Source Combustion

Point SCC	SCC1 DESC	SCC3 DESC	SCC6 DESC	SCC8 DESC
10200901	External Combustion Boilers	Industrial	Wood/Bark Waste	Bark-fired Boiler
10200902	External Combustion Boilers	Industrial	Wood/Bark Waste	Wood/Bark-fired Boiler
10200903	External Combustion Boilers	Industrial	Wood/Bark Waste	Wood-fired Boiler - Wet Wood (>=20% moisture)
10200904	External Combustion Boilers	Industrial	Wood/Bark Waste	Bark-fired Boiler (< 50,000 Lb Steam) **
10200905	External Combustion Boilers	Industrial	Wood/Bark Waste	Wood/Bark-fired Boiler (< 50,000 Lb Steam) **
10200906	External Combustion Boilers	Industrial	Wood/Bark Waste	Wood-fired Boiler (< 50,000 Lb Steam) **
10200907	External Combustion Boilers	Industrial	Wood/Bark Waste	Wood Cogeneration
10200908	External Combustion Boilers	Industrial	Wood/Bark Waste	Wood-fired Boiler - Dry Wood (<20% moisture)
10200910	External Combustion Boilers	Industrial	Wood/Bark Waste	Fuel cell/Dutch oven boilers **
10200911	External Combustion Boilers	Industrial	Wood/Bark Waste	Stoker boilers **
10200912	External Combustion Boilers	Industrial	Wood/Bark Waste	Fluidized bed combustion boiler
39000989	Industrial Processes	In-process Fuel Use	Wood	General
39000999	Industrial Processes	In-process Fuel Use	Wood	General: Wood

An issue that must be considered is the geographic resolution at which point source subtractions should be performed. While the locations of point sources is accurately known at (and below) the county-level, the location of total ICI combustion activity is much less clear (see discussion of county allocation of activity in the section that follows). Because of the level of uncertainty associated with the county distribution of total ICI fuel consumption, we believe it is most appropriate to perform the ICI combustion point source subtractions at the state-level, and then allocate the resulting nonpoint source fuel consumption to counties.

Beginning with the 2008 NEI, EPA made a concerted effort to inform State/Local agencies that they have the responsibility to perform point source subtractions. The primary reason for this is that adjusting the nonpoint emission estimates to eliminate double-counting is best done by subtracting out the fuel consumed by sources in the point source inventory, and State/Local agencies are in a much better position to know this information. As a quality assurance check, the EPA reviewed 2008 NEI data submittals from State/Local agencies to see if point sources were accounted for properly. However, the EPA still believes that point source adjustments are the State/Local agency's responsibility, and therefore has no plans to perform these adjustments for the 2011 NEI.

County Allocation of State Activity

Because the EIA only reports energy consumption down to the state-level, it is necessary to develop a procedure to allocate EIA's fuel consumption estimates (after adjustments noted in sections above) to counties. For the NEI, the procedure relies on the use of allocation factors developed from the county-level number of employees in the Industrial sector and the county number of employees in the Commercial/Institutional sector. Because EIA fuel consumption data originate from fuel sector-specific surveys of energy suppliers, we reviewed these survey forms/instructions for further details on what individual economic sectors EIA considers to comprise the Industrial and Commercial sector. Based on this review, we compiled employment data for manufacturing sector North American Industrial Classification System (NAICS) codes (i.e., NAICS 31-33) for use in allocating Industrial fuel consumption. The only source of NAICS-code based EIA definitions of the Commercial energy sector is a "rough crosswalk" between Commercial building types and NAICS codes developed for EIA's Commercial Building Energy Consumption Survey (CBECS).[8] With the exception of NAICS code 814 (Private Households), this crosswalk links all NAICS codes between 42 and 92 with Commercial building energy consumption. The NEI method uses total county-level employment in NAICS codes 42 though 92 (excluding 814) to allocate state-level Commercial/Institutional fuel consumption estimates.

We compiled employment data for these NAICS codes from two Bureau of the Census publications *County Business Patterns* (for private sectors) and *Census of Governments* (for public administration sectors).[9,10] For NAICS code 92, we developed county-level employment estimates from local government employment data in the *Census of Governments*. Employment estimates from each source were then combined to estimate total Commercial/Institutional sector employment by county. We then allocated the state-level fuel consumption by fuel type estimates in each sector to each county using the ratio of the number of Industrial or Commercial/Institutional employees in each county in a given state.

Due to concerns with releasing confidential business information, *County Business Patterns* (CBP) withholds values for a given county/NAICS code if it would be possible to identify data for individual facilities. In such cases, the Census reports a letter code, representing a particular employment size range. We used the following procedure to estimate data for withheld counties/NAICS codes.

1. County-level employment for counties with reported values are totaled by state for the applicable NAICS code.
2. The value from step 1 is subtracted from the state employment value for the NAICS code.
3. Each of the withheld counties is assigned an initial employment estimate reflecting the midpoint of the CBP range code (e.g., code A, which reflects 1-19 employees, is assigned an estimate of 10 employees).
4. The initial employment estimates from step 3 are then summed to the state level.
5. The value from step 2 is divided by the value from step 4 to yield an adjustment factor to apply to the initial employment estimates to yield employment values that will sum to the state employment total for the applicable NAICS code.
6. The final county-level employment values are estimated by multiplying the initial employment estimates from step 3 by the step 5 adjustment factors.

The following illustrates the employment estimation procedure with an example of CBP data reported for Maine.

Table 5. NAICS Code 31-33 (Manufacturing) Employment Data for Maine

FIPSSTATE	FIPSCTY	NAICS	EMPFLAG	EMP
23	001	31----		6,774
23	003	31----		3,124
23	005	31----		10,333
23	007	31----		1,786
23	009	31----		1,954
23	011	31----		2,535
23	013	31----		1,418
23	015	31----	F	0
23	017	31----		2,888
23	019	31----		4,522
23	021	31----		948
23	023	31----	I	0
23	025	31----		4,322
23	027	31----		1,434
23	029	31----		1,014
23	031	31----		9,749

1. The total of employees not including counties 015 and 023 is 52,801.
2. *County Business Patterns* reports 59,322 state employees in NAICS 31—the difference is 6,521.
3. County 015 is given a midpoint of 1,750 (since range code F is 1,000-2,499) and County 023 is given a midpoint of 17,500.
4. State total for these two counties is 19,250.
5. 6,521/19,250 = 0.33875.

The final employment estimate for county 015 is 1,750 x 0.33875 = 593. The county 023 final employment estimate is computed as 17,500 x 0.33875 = 5,928.

Emission Factors

The EPA compiled criteria and hazardous air pollutant emission factors for ICI combustion nonpoint source fuel combustion categories in support of the 2008 nonpoint source NEI.[11] (These emission factors, which are too numerous to report here, can be obtained from the primary author.) With the exceptions noted below, these are the same emission factors that were used in preparing the 2002 nonpoint source NEI.

Since nonpoint sources are not individually inventoried, it is generally not possible to know what kind of combustor is being used. Is the fuel being combusted in boilers or engines, or both? What is the fraction of industrial boilers in a given county that have low-NO_x burners? We assume that all ICI nonpoint combustion takes place in boilers because we don't have good information for allocating the fuel between boilers and engines, but believe that more fuel is burned in boilers than engines. Since nonpoint source boilers (or engines) are located at facilities that are too small to be inventoried as point sources, they are also less likely to have emission controls. Therefore, we've decided to use uncontrolled emission factors. State/Local agencies can select more representative emission factors if they are able to better characterize local nonpoint source combustion practices/emission controls.

The SO_2 emission factors for Industrial and Commercial/Institutional coal combustion require information on the sulfur content of coal burned. Our review of estimates rom various sources indicated that the best/most current published source of bituminous/subbituminous coal was average sulfur content data from EIA's *Quarterly Coal Report*.[12] For Industrial and Commercial sector anthracite coal, we used the assumption from the 2002 NEI (0.89 percent), which is based on the sulfur content of anthracite coal seams in Pennsylvania.

Ammonia emissions were not estimated in the 2002 NEI's ICI fuel combustion nonpoint source inventory. Because there are no NH_3 emission factors available in *AP-42*, or EPA's *WebFIRE*, we used factors reported in an NH_3 emissions Emission Inventory Improvement Program guidance document.[13] Similarly, industrial LPG and wood combustion emission factors were newly obtained from an ICI fuel combustion study performed for the Central Regional Air Planning Association.[14]

Because the 2002 NEI PM emission factors for natural gas and LPG were deemed too high because of artifact formation in the test method (method 202) during stack testing, EPA developed a set of SCC-specific adjustment factors to apply to the 2002 NEI to better reflect PM emissions from these fuels. In preparation for the 2008 NEI, EPA developed revised natural gas PM emission factors by multiplying the 2002 NEI emission factors by these adjustment factors.

RESULTS AND CONCLUSIONS

The following sections present sample calculations illustrating the potential impact of the emission activity adjustments described above, and identify a few additional methodology refinements that could be considered in future ICI combustion nonpoint source inventory efforts. These calculations may not match those used in developing the 2008 NEI because they use data that are currently reported by EIA, and not the data that were available at the time that the 2008 NEI was prepared.

Example Calculations

1. *Selection of industrial coal consumption estimate*: For Pennsylvania, the 2008 SEDS reports the following industrial coal consumption estimates (values in thousand short tons):
    a. Industrial sector (CLICP) = 9,135;
    b. Coke plants (CLKCP) = 6,494; and
    c. Industrial users other than coke plants (CLOCP) = 2,641.

    In this example, selecting total Industrial coal consumption instead of the correct data series, would result in use of an estimate that is nearly 3.5 times too high.

2. *Splitting coal consumption by type*: For Pennsylvania, the EIA reports the following coal distribution data for 2008:
    a. Anthracite accounted for 202 thousand short tons of the total 2,404 thousand short tons (8.4 percent) of non-coke plant Industrial sector coal distributed to Pennsylvania; and
    b. Anthracite accounted for 85 thousand short tons of the total 214 thousand short tons (39.7 percent) of Commercial/Institutional sector coal distributed to Pennsylvania.

3. *Nonroad mobile source adjustment*: For Pennsylvania, the EIA reports the following Commercial sector distillate oil consumption estimates (values in thousand gallons):
    a. No. 1 Distillate = 1;
    b. No. 2 Distillate Fuel Oil = 128,836;
    c. No. 2 Distillate, Ultra Low/Low/High Sulfur Diesel = 55,519 +11,236 + 4,958 = 71,713; and
    d. No. 4 Distillate Fuel Oil = 891.

In this example, 71,713 + (1 * .80) = ~71,714 thousand gallons out of a total of 201,441 thousand gallons (35.6 percent) of Commercial sector distillate oil is assumed to be attributable to nonroad mobile sources.

4. *Nonfuel use:* the 2006 MECS reports the following industrial LPG estimates for the Northeast Census region that includes Pennsylvania (values in million barrels):
    a. Total LPG consumption = 6; and
    b. Non-fuel (feedstock) LPG consumption = 2.

    In this example, non-fuel use is estimated to account for 33.3% of total LPG consumption in Pennsylvania.

5. *Point source subtraction*: assuming that Pennsylvania's 2008 point source inventory accounts for 2,000 thousand short tons of Industrial sector non-coke bituminous coal consumption, then nonpoint Industrial sector sources are estimated to have combusted 641 thousand short tons of bituminous coal in 2008 (i.e., 2,641 – 2,000).

Future Refinements

The methods described in this paper provide a means to estimate ICI fuel combustion nonpoint source emissions. The following highlight potential revisions to the methods that may prove to result in more accurate estimates of emissions. Implementing these revisions would be of greatest importance in areas where the above procedures estimate ICI combustion nonpoint source emissions representing a significant proportion of total nonpoint source emissions. In addition to these refinements, it should be noted that EIA has released a more recent version of MECS (2006) that can be used to update the non-fuel use industrial energy consumption percentages displayed in Table 3.

- Perform local surveys to obtain more geographic/year-specific estimates of activity;
- For the Industrial sector, replace the employment-based allocation procedure with a procedure based on county-level estimates of total Industrial sector energy consumption. This could provide a significant different allocation in cases where the pure employment-based method over-allocates activity to counties with many employees in Industrial sectors that use little energy and vice-versa. Total Industrial sector energy consumption estimates can be computed from county-level Industrial sector employment data from CBP and energy intensity factors per employee by NAICS code from the EIA's *Annual Energy Outlook*;[15]
- Obtain fuel sulfur contents specific to the commercial sector (industrial sector sulfur content is currently assumed to be representative of commercial sector sulfur content);
- Review emission factors for potential revisions to account for the effects of recent ICI boiler/process heater MACT standards; and
- Perform local surveys to obtain more geographic/year-specific emission factors.

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KEY WORDS

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