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Acronyms and Chemical Notations

AEDT	Aviation Environmental Design Tool
AERR	Air Emissions Reporting Rule
APU	Auxiliary power unit
BEIS	Biogenics Emissions Inventory System
C1	Category 1 (commercial marine vessels)
C2	Category 2 (commercial marine vessels)
C3	Category 3 (commercial marine vessels)
CAMD	Clean Air Markets Division (of EPA Office of Air and Radiation)
CAP	Criteria Air Pollutant
CBM	Coal bed methane
CDL	Cropland Data Layer
CEC	North American Commission for Environmental Cooperation
CEM	Continuous Emissions Monitoring
CERR	Consolidated Emissions Reporting Rule
CFR	Code of Federal Regulations
CH4	Methane
CMU	Carnegie Mellon University
CMV	Commercial marine vessels
CNG	Compressed natural gas
CO	Carbon monoxide
CO2	Carbon dioxide
CSV	Comma Separated Variable
E10	10% ethanol gasoline
EDMS	Emissions and Dispersion Modeling System
EF	emission factor
EGU	Electric Generating Utility
EIS	Emission Inventory System
EAF	Electric arc furnace
EF	Emission factor
EI	Emissions Inventory
EIA	Energy Information Administration
EMFAC	Emission FACtor (model) – for California
EPA	Environmental Protection Agency
ERG	Eastern Research Group
ERTAC	Eastern Regional Technical Advisory Committee

FAA	Federal Aviation Administration
FACTS	Forest Service Activity Tracking System
FCCS	Fuel Characteristic Classification System
FETS	Fire Emissions Tracking System
FWS	United States Fish and Wildlife Service
FRS	Facility Registry System
GHG	Greenhouse gas
GIS	Geographic information systems
GSE	Ground support equipment
HAP	Hazardous Air Pollutant
HCl	Hydrogen chloride (hydrochloric acid)
Hg	Mercury
HMS	Hazard Mapping System
ICR	Information collection request
I/M	Inspection and maintenance
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated Planning Model
LRTAP	Long-range Transboundary Air Pollution
LTO	Landing and takeoff
LPG	Liquified Petroleum Gas
MARAMA	Mid-Atlantic Regional Air Management Association
MATS	Mercury and Air Toxics Standards
MCIP	Meteorology-Chemistry Interface Processor
MMT	Manure management train
MOBILE6	Mobile Source Emission Factor Model, version 6
MODIS	Moderate Resolution Imaging Spectroradiometer
MOVES	Motor Vehicle Emissions Simulator
MW	Megawatts
MWC	Municipal waste combustors
NAA	Nonattainment area
NAAQS	National Ambient Air Quality Standards
NAICS	North American Industry Classification System
NASS	USDA National Agriculture Statistical Service
NATA	National Air Toxics Assessment
NCD	National County Database
NEEDS	National Electric Energy Data System (database)
NEI	National Emissions Inventory
NESCAUM	Northeast States for Coordinated Air Use Management
NFEI	National Fire Emissions Inventory
NG	Natural gas
NH3	Ammonia
NMIM	National Mobile Inventory Model
NO	Nitrous oxide
NO2	Nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOx	Nitrogen oxides

O3	Ozone
OAQPS	Office of Air Quality Standards and Planning (of EPA)
OEI	Office of Environmental Information (of EPA)
ORIS	Office of Regulatory Information Systems
OTAQ	Office of Transportation and Air Quality (of EPA)
PADD	Petroleum Administration for Defense Districts
PAH	Polycyclic aromatic hydrocarbons
Pb	Lead
PCB	Polychlorinated biphenyl
PFAS	Per- and polyfluoroalkyl substances
PM	Particulate matter
PM25-CON	Condensable PM2.5
PM25-FIL	Filterable PM2.5
PM25-PRI	Primary PM2.5 (condensable plus filterable)
PM2.5	Particulate matter 2.5 microns or less in diameter, synonymous with PM25-PRI
PM10	Particular matter 10 microns or less in diameter, synonymous with PM10-PRI
PM10-FIL	Filterable PM10
PM10-PRI	Primary PM10 (condensable plus filterable)
POM	Polycyclic organic matter
POTW	Publicly Owned Treatment Works
PSC	Program system code (in EIS)
RFG	Reformulated gasoline
RPD	Rate per distance
RPP	Rate per profile
RPV	Rate per vehicle
RVP	Reid Vapor Pressure
Rx	Prescribed (fire)
SCC	Source classification code
SEDS	State Energy Data System
SFv1	SMARTFIRE version 1
SFv2	SMARTFIRE version 2
S/L/T	State, local, and tribal (agencies)
SMARTFIRE	Satellite Mapping Automated Reanalysis Tool for Fire Incident Reconciliation
SMOKE	Sparse Matrix Operator Kernel Emissions
SO2	Sulfur dioxide
SO4	Sulfate
TAF	Terminal Area Forecasts
TRI	Toxics Release Inventory
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USDA	United States Department of Agriculture
VMT	Vehicle miles traveled
VOC	Volatile organic compounds
USFS	United States Forest Service
WebFIRE	Factor Information Retrieval System
WLF	Wildland fire

WRAP	Western Regional Air Partnership
WRF	Weather Research and Forecasting Model

Section 1

Cooking

1.1 Sector Descriptions and Overview

Cooking is a source of both gaseous and particulate pollutants [ref 1 – ref 7]. Primary particulate emissions from cooking are predominantly organic carbon [ref 2, ref 5] and positive matrix factorization analysis of Aerosol Mass Spectrometry data from multiple cities in the United States suggest cooking contributes ~16% of observed organic aerosol and ~8% of observed PM2.5 in urban areas [ref 8 – ref 9]. In the NEI, emissions are estimated from the cooking of meat, including steak, hamburger, poultry, pork, and seafood, and french fries on five different cooking devices: chain-driven (conveyorized) charbroilers, underfired charbroilers, deep-fat fryers, flat griddles and clamshell griddles. The table below notes all SCCs covered in this source category and the SCCs for which the EPA generates default emissions.

Table **??** notes all SCCs covered in this source category and the SCCs for which the EPA generates default emissions.

1.2 EPA-developed estimates

To estimate emissions from commercial establishments, the amount of meat and french fries cooked on various cooking devices in each county is estimated. These estimates are year-specific and based on activity statistics from a 2001 telephone survey in southern California [ref 10] and annually varying restaurant count statistics from Open Street Map [ref 11]. These meat consumption estimates are then scaled to match estimates of commercially consumed meat consumption statistics from the U.S. Department of Agriculture's Food Availability Data System [ref 12]. The amount of french fries cooked by the foodservice industry is from a report prepared for Potatoes USA [ref 13]. For residential cooking sources, the mass of residentially consumed meat consumption statistics from the U.S. Department of Agriculture's Food Availability Data System are also used. The total amount of meat or french fries

Table 1.1: Cooking SCCs in the 2023 NEI.

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4	EPA
2302002000	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Charbroiling	Charbroiling Total	
2302002100	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking – Charbroiling	Conveyorized Charbroiling	X
2302002200	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking – Charbroiling	Under-fired Charbroiling	X
2302003000	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Frying	Deep Fat Frying	X
2302003100	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking – Frying	Flat Griddle Frying	X
2302003200	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking – Frying	Clamshell Griddle Frying	X
2812001000	Miscellaneous Area Sources	Food and Kindred Products: SIC 20	Residential Cooking - Total	Total	X
2810025000	Miscellaneous Area Sources	Other Combustion	Residential Grilling	Total	

Table 1.2: SIC codes used to classify restaurant types.

Restaurant Type	Primary SIC Code
Ethnic Food	5812-01
Fast Food	5812-03
Family	5812-05
Seafood	5812-07
Steak & BBQ	5812-08

cooked on each device is then multiplied by emissions factors for relevant pollutants to estimate emissions from cooking.

1.2.1 Activity Data

Activity data is the amount of meat consumed away from home and at home. For commercial cooking, these estimates are based on a 2001 telephone survey in southern California [ref 10] that reports the fraction of restaurants in a county that use different pieces of commercial cooking equipment by restaurant-type, the average number of cooking devices per restaurant, and the average mass of meat cooked on each device. The county-level number of various restaurant-types are retrieved from Open Street Map [ref 11]. Restaurant count statistics are pulled from this database using the SIC codes listed in Table **??**.

County-level restaurant count statistics are then multiplied by the fraction of restaurants in a county that use different pieces of commercial cooking equipment by restaurant-type, the average number of cooking devices per restaurant, and the average mass of meat cooked on each device. These values are summarized in Tables **??** - Tables **??**.

Table 1.3: Fraction of restaurants in a county that use different pieces of commercial cooking equipment by restaurant-type.

Restaurant Type	Conveyorized Char-broilers	Underfired Char-broilers	Deep-Fat Fryers	Flat Griddles	Clamshell Griddles
Ethnic	0.035	0.475	0.819	0.627	0.040
Fast Food	0.186	0.308	0.968	0.519	0.147
Family	0.101	0.609	0.914	0.829	0.014
Seafood	0.000	0.526	1.000	0.368	0.105
Steak & BBQ	0.069	0.552	0.828	0.897	0.000

Table 1.4: Average number of cooking devices per restaurant. Average of non-specific charbroiler and griddle used, where necessary.

Restaurant Type	Conveyorized Char-broilers	Underfired Char-broilers	Deep-Fat Fryers	Flat Griddles	Clamshell Griddles
Ethnic	1.62	1.54	1.63	1.88	1.80
Fast Food	1.07	1.58	3.10	1.43	2.09
Family	1.71	1.29	2.34	2.03	2.03
Seafood	1.10	1.10	2.47	1.11	1.50
Steak & BBQ	1.56	1.63	2.42	1.35	1.35

Table 1.5: Average mass of meat cooked per year on each cooking device (tons).

Meat Type	Conveyorized Char-broilers	Underfired Char-broilers	Deep-Fat Fryers	Flat Griddles	Clamshell Griddles
Steak	6.1	4.7	4.7	4.3	2.4
Hamburger	20.7	7.0	7.1	9.4	34.2
Poultry	10.7	8.4	14.9	5.2	5.7
Pork	1.5	3.8	1.5	2.9	3.1
Seafood	3.1	3.7	4.1	2.4	16.4
Other	NA	1.1	7.1	1.5	NA

The total mass of each type of meat commercially cooked on each appliance-type in a county is then estimated using the following equation:

$$Mc,t,a = \sum_{r}(R_{c,a} \times A_{r,a} \times N_{r,a}) \times T_{t,a} \times SF_t \tag{1.1}$$

Where:
$M_{c,t,a}$ = Estimated mass of commercially cooked meat in county (*c*) for each meat-type (*t*) on each appliance (*a*), in tons
$R_{c,r}$ = Number of restaurants in county (*c*) for each restaurant-type (*r*), in #
$A_{r,a}$ = Estimated percent of restaurants for each restaurant-type (*r*) containing > 1 appliance (*a*), in %
$N_{r,a}$ = Estimated number of appliances (*a*) for each restaurant-type (*r*), when appliance (*a*) is present, in #
$T_{t,a}$ = Average mass of meat cooked for each meat-type (*t*) on each appliance (*a*), in tons/appliance
SF_t = Scale factor for each meat-type (*t*) applied to ensure national-level meat consumption matches USDA statistics, in %
c = County
t = Meat-Type (e.g., Steak, Hamburger, etc.)
r = Restaurant-Type (e.g., Fast Food, Family, Seafood, etc.)
a = Appliance (e.g., Conveyorized Charbroiler, Underfired Charbroiler, etc.)

The Scale Factor in Eqn. (**??**) is year-specific and derived using meat consumption statistics from the U.S. Department of Agriculture's Food Availability Data System [ref 12]. Data on the total retail consumption (disappearance) of beef, pork, veal, and lamb, chicken and turkey, and seafood are retrieved, and using data from the USDA's Food Consumption and Nutrition Intakes, it is assumed that ~65% of meat is consumed at home and ~35% is consumed away from home (restaurants, fast food, school, etc.). These percentages are subsequently used to estimate consumption at home and scale commercial cooking meat consumption. In Table **??**, total residential and commercial meat consumption from the USDA's Food Availability Data System by meat-type estimates are provided for recent years. Table **??** illustrates the derivation of the Scale Factor used in Eqn. (**??**) for 2021.

Table 1.6: Total Retail Consumption from USDA Food Availability Data System

Year	U.S. Population [millions]	Beef [short tons]	Veal [short tons]	Pork [short tons]	Lamb [short tons]	Broilers [short tons]	Other Chicken [short tons]	Turkey [short tons]	Fish and Shellfish [short tons]
2017	325.206	9241066	32433	8084865	175957	14702927	190839	2670584	1957000
2018	326.924	9334729	36908	8254606	184520	15023743	210624	2639784	2006500
2019	328.476	9513368	33726	8531797	187058	15529076	206207	2624113	NA
2020	330.114	9620124	27430	8498334	200439	15794921	220422	2593854	NA
2021	332.141	9761741	26559	8396295	224643	15940560	228949	2536547	NA

* = Consumption statistics for fresh and frozen fish and shellfish is not available after 2018

Table 1.7: Scale Factor Derivation

Quantity	Steak**	Hamburger**	Poultry	Pork	Seafood	Other
USDA Consumption at Home*	3,172,566	3,172,566	12,158,936	5,457,592	1,305,599	163,281
USDA Commercial Consumption*	1,708,305	1,708,305	6,547,120	2,938,703	700,901	87,921
Base Methods Commercial Consumption	8,583,805	18,206,818	22,104,545	3,986,449	8,392,852	8,888,702
Scale Factor	0.20	0.09	0.30	0.74	0.08	0.01

* = Using data from the USDA's Food Consumption and Nutrition Intakes, it is assumed that ~65% of meat is consumed at home and ~35% is consumed away from home (restaurants, fast food, school, etc.). ** = It is assumed that half of all beef consumption reported in the USDA's Food Availability Data System is steak and half is hamburger.

The amount of french fries cooked in each county is calculated based on the amount of frozen potatoes used in the foodservice industry. The total amount of french fries cooked is reported at the national level. The process used to distribute the national amount of french fries cooked to the county-level is discussed in the next section.

1.2.2 Allocation Procedure

1.2.3 Emission Factors

1.2.4 Controls

There are no controls assumed for this category.

1.2.5 Emissions

$$E_{c,a} = Usage_{c,a} \times \frac{EF_a}{2000} \tag{1.2}$$

Where:
$E_{c,a}$ = Annual emissions in county *c* for application *a*, in short tons
$Usage_{c,a}$ = Liquid asphalt usage in county *c* for application *a*, in short tons
EF_a = Emission factor for application *a*, in lb/ton asphalt
a = Application types include hot-mix, warm-mix, cutback, and emulsified

1.2.6 Sample Calculations

Table **??** contains sample calculations for VOC emissions from emulsified asphalt (SCC: 2461022000). The values in these equations are demonstrating program logic and are not representative of any specific NEI year or county.

1.2.7 Improvements/Changes in the 2023 NEI

- Sector changed from "Commercial Cooking" to "Cooking" to include both commercial and residential cooking.
- Scale Factor are applied to the average amount of meat cooked on each cooking device to ensure national-level meat consumption matches USDA statistics.
- Emission Factors were updated

Table 1.8: Sample Calculations

Eq. #	Equation	Values	Result
1	$Usage_{s,a} = Usage_{sp,a} \times \frac{HA_s}{HA_{sp}}$	$172 \times \frac{6.5}{19.9}$	56 short tons of liquid asphalt usage for emulsified applications
2	Only applicable for hot- and warm-mix	–	–
3	$Usage_{c,a} = Usage_{s,a} \times \frac{\sum_r PVMT_c}{\sum_r PVMT_s}$	$56 \times \frac{2.38E^9}{5.15E^{10}}$	2.58 short tons of liquid asphalt usage for emulsified applications
4	$E_{c,a} = Usage_{c,a} \times \frac{EF_a}{2000}$	$2.58 \times \frac{197.52}{2000}$	0.26 short tons of VOC emissions from emulsified asphalt

1.2.8 Puerto Rick and U.S. Virgin Islands

Insufficient data exists to calculate emissions for the counties in Puerto Rico and the US Virgin Islands. As such, emissions are based on two proxy counties in Florida: 12011 (Broward County) for Puerto Rico and 12087 (Monroe County) for the U.S. Virgin Islands. Per-capita emission factors from Broward County and Monroe County are applied to Puerto Rico and the U.S. Virgin Islands, respectively.

1.3 References

1. R. Fortmann, P. Kariher and R. Clayton, Indoor Air Quality: Residential Cooking Exposures, ARCADIS Geraghty & Miller, Inc., Prepared for the State of California Air Resources Board; Contract Num: 97-330, 2001.
2. N. Gysel, W. A. Welch, C. L. Chen, P. Dixit, D. R. Cocker, 3rd and G. Karavalakis, Particulate matter emissions and gaseous air toxic pollutants from commercial meat cooking operations, Journal of Environmental Science, 2018, 65, 162-170.
3. F. Klein, S. M. Platt, N. J. Farren, A. Detournay, E. A. Bruns, C. Bozzetti, K. R. Daellenbach, D. Kilic, N. K. Kumar, S. M. Pieber, J. G. Slowik, B. Temime-Roussel, N. Marchand, J. F. Hamilton, U. Baltensperger, A. S. Prevot and I. El Haddad, Characterization of Gas-Phase Organics Using Proton Transfer Reaction Time-of-Flight Mass Spectrometry: Cooking Emissions, Environ Sci Technol, 2016, 50, 1243-1250.
4. T. Liu, Z. Wang, D. D. Huang, X. Wang and C. K. Chan, Significant Production of Secondary Organic Aerosol from Emissions of Heated Cooking Oils, Environ Sci Tech Let, 2018, 5, 32-37.
5. J. D. McDonald, B. Zielinska, E. M. Fujita, J. C. Sagebiel, J. C. Chow and J. G. Watson, Emissions from charbroiling and grilling of chicken and beef, J Air Waste Manag Assoc, 2003, 53, 185-194.
6. J. J. Schauer, M. J. Kleeman, G. R. Cass and B. R. T. Simoneit, Measurement of Emissions from Air Pollution Sources. 1. C1 through C29 Organic Compounds from Meat Charbroiling, Environ Sci Technol, 1999, 33, 1566-1577.
7. J. J. Schauer, M. J. Kleeman, G. R. Cass and B. R. T. Simoneit, Measurement of Emissions from Air Pollution Sources. 4. C1-C27 Organic Compounds from Cooking with Seed Oils, Environ Sci Technol, 2002, 36, 567-575.
8. P. L. Hayes, A. M. Ortega, M. J. Cubison, K. D. Froyd, Y. Zhao, S. S. Cliff, W. W. Hu, D. W. Toohey, J. H. Flynn, B. L. Lefer, N. Grossberg, S. Alvarez, B. Rappenglueck, J. W. Taylor, J. D. Allan, J. S. Holloway, J. B. Gilman, W. C. Kuster, J. A. De Gouw, P. Massoli, X. Zhang, J. Liu, R. J. Weber, A. L. Corrigan, L. M. Russell, G. Isaacman, D. R. Worton, N. M. Kreisberg, A. H. Goldstein, R. Thalman, E. M. Waxman, R. Volkamer, Y. H. Lin, J. D. Surratt, T. E. Kleindienst, J. H. Offenberg, S. Dusanter, S. Griffith, P. S. Stevens, J. Brioude, W. M. Angevine and J. L. Jimenez, Organic aerosol composition and sources in Pasadena, California, during the 2010 CalNex campaign, J Geophys Res-Atmos, 2013, 118, 9233-9257.
9. Y. L. Sun, Q. Zhang, J. J. Schwab, K. L. Demerjian, W. N. Chen, M. S. Bae, H. M. Hung, O. Hogrefe, B. Frank, O. V. Rattigan and Y. C. Lin, Characterization of the sources and processes of organic and inorganic aerosols in New York city with a high-resolution time-of-flight aerosol mass apectrometer, Atmos Chem Phys, 2011, 11, 1581-1602.

10. M. Potepan, Charbroiling Activity Estimation, Public Research Institute, Prepared for the California Air Resources Board and the California Environmental Protection Agency; Contract Num: 98-721, 2001.
11. Open Street Map, 2023.
12. United States Department of Agriculture, Food Availability per Capita Data System.
13. Technomic, 2020. Domestic Sales and U.S. Potato Utilization Report. Prepared for Potatoes USA.
14. Norbeck, Joseph, 1997. Further Development of Emission Test Methods and Development of Emission Factors for Various Commercial Cooking Operations. Prepared for the South Coast Air Quality Management District.
15. C. A. Alves, M. Evtyugina, E. Vicente, A. Vicente, C. Goncalves, A. I. Neto, T. Nunes and N. Kovats, 2022. "Outdoor charcoal grilling: Particulate and gas-phase emissions, organic speciation and ecotoxicological assessment." Atmos Environ. 285.

Section 2

Solvents: Asphalt

2.1 Sector Descriptions and Overview

Liquid asphalt is a petroleum-derived substance used in paving applications, such as the construction of roads, parking lots, driveways, and airport runways, as well as non-paving applications, such as the manufacturing of roofing shingles. While liquid asphalt can be found in natural deposits, most is produced from crude oil. Vacuum distillation separates components of crude oil based on boiling point. Products generated from this process include naptha, gasoline, diesel, and liquid asphalt, the last of which has a boiling point greater than 500 °C. As a result, most volatile, light fractions of organics are separated from liquid asphalt during distillation and prior to use.

In paving applications, liquid asphalt can be applied cold or heated. If applied cold, additional components must be added to lower the viscosity of the material, which allows it to be spread upon a surface (e.g., roadway surface). Cutback asphalt (SCC: 2461021000) is a cold application process that involves mixing the liquid asphalt with petroleum solvents (e.g., naphtha, kerosene, fuel oil, diesel, etc.). Following application, these higher volatility solvents evaporate, leaving the asphalt in place. Due to this increased organic emissions potential, cutback asphalts have grown less common over time and this process now constitutes ~1% of liquid asphalt is use [ref 1]. Emulsified asphalt (SCC: 2461022000) is a separate cold application process that utilizes water-based solvents and an emulsifying agent. The result is a stable liquid suspension with asphalt globules. Following application, the additives evaporate and leave the asphalt in place. In contrast to cutback asphalts, emulsified asphalts have become more common in recent years and ~10% of liquid asphalt is now used in these applications.

Liquid asphalt can also be applied heated, which both lowers the viscosity of the material and minimizes the need for added solvents. Hot-mix asphalt application (SCC: 2461025100), which is the traditional method for asphalt pavement production, involves combining the liquid asphalt with aggregate at a hot-mix plant and heating the mixture to +150 °C. The mixture is then hauled to the usage site heated, where it is placed, compacted, and ambiently cooled. This process does not require any solvent additions. Warm-mix asphalt application (SCC: 2461025200) is a more recent technology that enables asphalt pavement production to occur at 20 – 40 °C cooler temperatures than hot-mix asphalt application. Warm-mix asphalt applications at reduced temperatures now constitute ~18% of asphalt paving applications [ref 2]. These lower production temperatures promote energy savings through reductions in fuel use and lower emissions at the hot-mix plant. To reduce the viscosity of the liquid asphalt in warm-mix applications, water, water-bearing minerals, chemicals, waxes, organic additives, or a combination of technologies must be added [ref 3].

While heated applications processes represent most liquid asphalt paving applications, it has historically been assumed that emissions were sparse due to the removal of the more volatile organics during distillation. Recent research has demonstrated that less volatile organic vapors from liquid asphalt do evaporate at temperatures associated with hot-mix application (~140 °C), warm-mix application (120 °C), and post-application, or “in-use” temperatures [ref 4]. Emission during the “in-use” period diffuse from the pavement over time following application.

Table 2.1: Point source reporting thresholds, as potential to emit, for CAPs in the AERR. Note that the potential to emit is shown in tons per year, as defined in 40 CFR part 70, with the exception of lead.

Pollutant	Type B Source Thresholds	Thresholds within Nonattainment Areas
(1) SO2	≥100	≥100
(2) VOC	≥100	O3 (moderate) ≥ 100
(2) VOC	≥100	O3(serious) ≥ 50
(2) VOC	≥100	O3 (severe) ≥ 25
(2) VOC	≥100	O3(extreme) ≥ 10
(3) NOx	≥100	≥100
(4) CO	≥1000	O3 (all areas) ≥ 100
(4) CO	≥1000	CO (all areas) ≥ 100
(5) Lead	≥0.5 (actual)	≥0.5 (actual)
(6) Primary PM10	≥100	PM10 (moderate) ≥100
(6) Primary PM10	≥100	PM10 (serious) ≥70
(7) Primary PM2.5	≥100	≥100
(8) NH3	≥100	≥100

Roofing asphalts include asphalt cements and emulsions used in the manufacturing of asphalt shingles, asphalt sealant, and roof tar. In 2020, manufacturing of these products consumed ~1.95 million short tons of asphalt, which is ~9% of all asphalt generated in the United States. These materials are predominantly applied in ambient conditions (i.e., as asphalt shingles). Roof tar, which is applied hot and at temperatures like hot-mix road asphalt (+150 °C), comprises ~5% of roofing asphalt usage. In addition, all forms of roofing asphalt are exposed to both high temperatures and solar radiation throughout the duration of their life cycles, which have the potential of generating enhancements of emissions.

The table below notes all SCCs covered in this source category and the SCCs for which the EPA generates default emissions.

2.2 EPA-developed estimates

Usage of liquid asphalt at the state-level for each process is calculated and subsequently allocated to the county-level using estimated vehicle miles traveled on paved roads and construction expenditure statistics for roofing processes. Emission factors consider both application and in-use processes. Net county-level emissions are quantified by multiplying the SCC-specific liquid asphalt usage by SCC-specific emission factors. The sources of data, calculation of state-level, SCC-specific usage results, allocation of state-level usage to the county-level, emission factors, and emission estimates are all discussed in subsequent sections.

2.2.1 Activity Data

Activity data for these sources are the amount of liquid asphalt used in each process. This includes cutback, emulsified, hot mix, warm mix, and roofing. Each year, the Asphalt Institute releases an asphalt usage survey for the Unites States and Canada that reflects usage among their membership [ref 1]. The Asphalt Institute estimates that their membership captures 90% of the United States market and the survey includes usage for cutback, emulsified, a summation of heated application processes, and roofing asphalt at the level of Petroleum Administration for Defense Districts (PADD) and sub-PADD levels. PADDs are geographic aggregations of the 50 states and the District of