**ASPHALT PAVING – CUTBACK**

***a. Source Category Description***

Asphalt paving is the process of applying asphalt concrete to seal or repair the surface of roads, parking lots, driveways, walkways, or airport runways. Asphalt concrete is a composite material comprised of a binder and a mineral aggregate. The binder, referred to as asphalt cement, is a byproduct of petroleum refining and contains the semi-solid residual material left after the more volatile chemical fractions have been distilled off.1

Asphalt cements thinned with petroleum distillates are known as cutback asphalts. The primary uses of cutback asphalt include tack and seal operations, priming roadbeds, and paving operations for pavements up to several inches thick. Cut-back asphalt is produced by thinning the binder in a diluent containing 25 to 45 percent petroleum distillates by volume prior to mixing with the aggregate. This reduces the viscosity of the asphalt making it easier to work with the mixture.

Emissions from cutback asphalt result from the evaporation of VOCs and HAPS after the mixture is laid down. Of all asphalt types, cutback asphalt has the highest diluent content and, as a result, emits the highest levels of VOCs per ton used. The timeframe and quantity of VOC and HAP emissions depend on the type and the quantity of organic solvent used as a diluent.

For this source category, the following SCC was assigned:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SCC** | **SCC Level 1** | **SCC Level 2** | **SCC Level 3** | **SCC Level 4** |
| 2461021000 | Solvent Utilization | Miscellaneous Non-industrial: Commercial | Cutback Asphalt | Total: All Solvent Types |

The general approach to calculating emissions from cutback asphalt paving is to multiply the estimated county-level cutback asphalt usage by emission factors for VOCs and HAPs.

***b. Activity Data***

State-level cutback asphalt usage in 2008 was obtained from the Asphalt Institute’s *2008 Asphalt Usage Survey*.2 (the EPA used the same activity values for the 2011 as they did for the 2008 NEI due to limited resources.) State-level data were allocated to county-level according to the fraction of paved road vehicle miles traveled (VMT) in each county.

Total annual VMT estimates by State and roadway class were obtained from the Federal Highway Administration’s (FHWA) annual Highway Statistics report.3 Paved road VMT was calculated by subtracting the State/roadway class unpaved road VMT from total State/roadway class VMT. State-level paved road VMT was spatially allocated to counties according to the fraction of total VMT in each county for the specific roadway class as shown by the following equation:

VMTx,total = ∑VMTST,y \* VMTx,y / VMTST,y

where: VMTx,total = VMT (million miles) in county x on all paved roadways

VMTST,y = paved road VMT for the entire State for roadway class y

VMTx,y = total VMT (million miles) in county x and roadway class y

VMTST,y = total VMT (million miles) in entire State for roadway class y

The county-level total VMT by roadway class used in this calculation was previously developed by E.H. Pechan and Associates, Inc. to support the onroad national emissions inventory.4

***c. Emission Factors***Emission factors for cutback asphalt usage were obtained from the *Technical Report Series* produced by the U.S. EPA’s Emission Inventory Improvement Program and are reported in Table 1 below.1

***d. Emissions***

Emissions were calculated by multiplying the county-level asphalt usage (barrels) by the emission factors listed in Table 1 and then dividing by 2000 to convert pounds to tons.

Emissionsx,y = (Asphalt Usagex \* EFy) / 2000

where: Emissionsx,y = emissions (tons) of pollutant y in county x

Asphalt Usagex = cutback asphalt (barrels) used in county x

EFy = emission factor for pollutant y

To convert tons of asphalt reported in the *2008 Asphalt Usage Survey* to barrels, it was assumed that the density of asphalt is similar to that of water, 8.34 lbs/gal, and that one barrel equals 42 gallons.

Barrels of Asphalt = (tons of asphalt \* 2000 lbs / 8.34 lbs/gal) / 42 gal/barrel

Note that one barrel of asphalt weights approximately 350 pounds.

***e. Sample Calculation***

VOC emissions from cutback asphalt usage in Autauga County, Alabama:

From the *2008 Asphalt Usage Survey*, the state of Alabama used 1,728 tons of cutback asphalt in 2008. The fraction of paved road VMT traveled in Autauga County is 497 million miles divided by 53,633 million miles which equals 0.0093.

Asphalt UsageAutauga = ((1,728 tons \* 2000 lbs / 8.34 lbs/gal) / 42 gal/barrel) \* 0.0093

Asphalt UsageAutauga = 91.41 barrels

VOC EmissionsAutauga = (91.41 barrels \* 88 lbs/barrel) / 2000 lbs/ton

VOC EmissionsAutauga = 4.022 tons

**Table 1. Criteria and HAP Emission Factors for Cutback Asphalt Paving**

|  |  |  |  |
| --- | --- | --- | --- |
| **Pollutant Description** | **Pollutant Code** | **Emission Factor (LBS/BARREL)** | **Emission Factor**  **Reference** |
| VOLATILE ORGANIC COMPOUNDS | VOC | 88.00 | 1 |
| ETHYL BENZENE | 100414 | 2.02 | 1 |
| TOLUENE | 108883 | 5.63 | 1 |
| XYLENES (MIXTURE OF O, M, AND P ISOMERS) | 1330207 | 10.74 | 1 |

***f. References***

1. U.S. Environmental Protection Agency, [Emissions Inventory Improvement Program](https://www.epa.gov/air-emissions-inventories), *Technical Report Series*, Volume III – Area Sources, Chapter 17, “Asphalt Paving,” prepared by Eastern Research Group, Inc. for EPA, Research Triangle Park, NC, 2001.
2. [Asphalt Institute](http://www.asphaltinstitute.org/), *2008 Asphalt Usage Survey for the United States and Canada*.
3. U.S. Department of Transportation, Federal Highway Administration, [*Highway Statistics 2007*](https://www.fhwa.dot.gov/policyinformation/statistics/2007/)*,* Office of Highway Policy Information, Washington, DC, 2008.
4. E.H. Pechan & Associates, Inc. “Documentation for the Onroad National Emission Inventory (NEI) for Base Years 1970 - 2002,” report prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. January 2004.