Hot Mix Asphalt Plant

Air Emission Inventory Guidance

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Background

In the 2000 air emission inventory there were 123 asphalt plants reporting under SIC 2951 (Asphalt paving and mixtures) and 51 asphalt plants reporting under SIC 1611 (Highway and street construction) across all five DNR regions. It is air management's air emission inventory goal to have air emissions reported consistently for Hot Mix Asphalt (HMAs) plants across the state. This document has been written so that air management can achieve this consistency by defining base level equipment and air emission sources common to all HMAs.

This document is a revision of three previous documents. The first HMA document was written in 1996 after discussions with the HMA industry. In 1998, the original document was updated to include summary tables for the HMA source and emission factor information. This 2001 document addresses the 50% sulfur dioxide control issue directed at HMAs.

This guidance was developed by the DNR Central Office, South Central Region, and Southeast Region staff. Information for some of this document was obtained from the Wisconsin Asphalt Pavement Association (WAPA).

Document Applicability

This guidance is **only** applicable to the calculation of emissions for the air emission inventory. This guidance is not intended for use on asphalt plant air permits because the focus of air permits tends to be on potential to emit (PTE) and maximum total air emissions (MTE) while the air emission inventory focuses on the calculation of actual air emissions. This guidance furnishes information on the emission factors and information for calculating air emissions from each hot mix asphalt plant.

DNR Database Needs

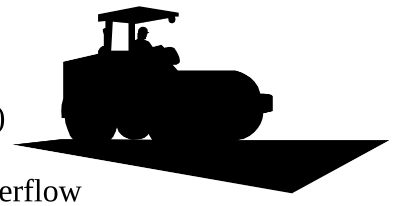
The Air Emissions Management System (AEMS) is the air management computer system used to calculate air emissions from point sources. AEMS requires the identification of the device (i.e. the piece of equipment), the process (i.e., the type of fuel burned or material processed), and an eight digit source classification code (SCC) associated with the process. The database assigns a default emission factor unless some other data is manually placed into the database.

The default emission factors for calculating hot mix asphalt plant air emission sources are taken from four sections of the United States Environmental Protection Agency (USEPA) reference document, **Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources**, AP-42, 1/95 version. These four sections are 11.1 Hot Mix Asphalt Plants, 1.3 Fuel Oil Combustion, 1.4 Natural Gas Combustion and 1.5 Liquefied Petroleum Gas Combustion. Section 11.1 Hot Mix Asphalt Plants was revised in December 2000 by USEPA and information from that revision is used in this document.

This emission inventory reference document is commonly referred to by its USEPA publication number, AP42 and is available from USEPA at no cost at the *http://www.epa.gov/ttn/chief* web-site.

USEPA HMA Descriptions

[Note: This section taken from AP-42 Section 11.1 Hot Mix Asphalt Plants. Tables 1, 2, and 3 were developed from diagrams of the HMA plants in this section.]



There are different types of hot mix asphalt (HMA) set-ups. HMA paving materials can be manufactured by: (1) batch mix plants, (2) continuous mix (mix outside drum plants), (3) parallel flow drum plants and (4) counterflow drum mix plants. According to AP-42 Section 11.1 Hot Mix Asphalt Plants of the total amount of asphalt plants in the United States, 64% are batch plants, 28% are parallel flow drum mix, and 8% are counterflow drum mix. Continuous mix plants are rare and were considered insignificant (and thus not considered) in Section 11.1. If a company has a continuous mix plant please notify the DNR Air Management staff in Madison and they will determine the typical emission sources after discussions with the facility and the HMA industry. AP42 Section 11.1 lists the emission sources for the three types of HMA plants.

Batch Mix HMA

Processing begins as the aggregate is hauled from the storage piles and is placed in the appropriate hoppers of the cold feed unit. The material is metered from the hoppers onto a conveyor belt and is transported into a rotary dryer (typically gas or oil fired). Dryers are equipped with flights designed to shower the aggregate inside the drum to promote drying efficiency.

As the hot aggregate leaves the dryer, it drops into a bucket elevator and is transferred to a set of vibrating screens where it is classified into as many as four different grades (sizes), and is dropped into individual “hot” bins according to size. To control aggregate size distribution in the final batch mix, the operator opens various hot bins over a weigh hopper until the desired mix and weight are obtained. Reclaimed asphalt pavement may be added at this point, also. Concurrent with the aggregate being weighed, liquid asphalt cement is pumped from a heated storage tank to an asphalt bucket, where it is weighed to achieve the desired aggregate-to-asphalt cement ratio in the final mix.

The aggregate from the weigh hopper is dropped into the mixer (pug mill) and dry-mixed for 6 to 10 seconds. The liquid asphalt is then dropped into the pug mill where it is mixed for an additional period of time. Total mixing time is less than 60 seconds. Then the hot mix is conveyed to a hot storage silo or is dropped directly into a truck and hauled to the job site.

As with most facilities in the mineral products industry, batch mix HMA plants have two major categories of emissions: ducted sources (those vented to the atmosphere through some type of stack, vent, or pipe), and fugitive sources (those not confined to ducts or vents but emitted directly into the ambient air). Ducted emissions are usually collected and transported by an industrial ventilation system having one or more fans or air movers, eventually to be emitted to the atmosphere through some type of stack. Fugitive emissions result from process and open sources and consist of a combination of gaseous pollutants and particulate matter (PM).

The most significant source of ducted emissions from batch mix HMA plants is the rotary drum dryer. Emissions from the dryer consist of water as steam evaporated from the aggregate, PM and small amounts of volatile organic compounds (VOC) of various species.

Other potential process sources include the hot-side conveying, classifying, and mixing equipment, which are vented to either the primary dust collector (along with the dryer gas) or to a separate dust collection system. The vents and enclosures that collect emissions from these sources are commonly called “fugitive air” or “scavenger” systems. The scavenger system may or may not have its own separate air mover device, depending on the particular facility. The emissions captured and transported by the scavenger system are mostly aggregate dust, but they may also contain gaseous VOCs and a fine aerosol of condensed liquid particles. This liquid aerosol is created by the condensation of gas into particles during cooling of organic vapors volatilized from the asphalt cement in the mixer (pug mill). The amount of liquid aerosol produced depends to a large extent on the temperature of the asphalt cement and aggregate entering the pub mill. Organic vapor and its associated aerosol are also emitted directly to the atmosphere as process fugitives during truck loadout, from the bed of the truck itself during transport to the job site, and from the asphalt storage tank. In addition to low molecular weight VOCs, these organic emission streams may contain small amounts of polycyclic compounds. The ducted emissions from the heated asphalt storage tanks may include VOCs and combustion products from the tank heater.

There are also a number of fugitive dust sources associated with batch mix HMA plants, including vehicular traffic generating fugitive dust on paved and unpaved roads, aggregate material handling and other aggregate processing operations. Fugitive dust may range from 0.1 μm to more than 300 μm in aerodynamic diameter. On average, 5 percent of cold aggregate feed is less than 74 μm (minus 200 mesh). Fugitive dust that may escape collection before primary control generally consists of PM with 50 to 70 percent of the total mass less than 74 μm.

Table 1 Batch Mix HMA Emission Sources AP-42, 1/95 Figure 11.1.1	
Emission Source	***Source Classification Code***
Hot screens	3-05-002-02
Hot bins	3-05-002-02
Mixer	3-05-002-02
Elevator	3-05-002-02
Rotary Dryer	3-05-002-01
Cold Aggregate Bins	3-05-002-04
Asphalt Cement Storage Heater	3-05-002-06 3-05-002-07 3-05-002-08
Loader	3-05-002-04
Fine Aggregate Storage Pile	3-05-002-03
Coarse Aggregate Storage Pile	3-05-002-03
Conveyor from Rotary Dryer	3-05-020-06
Conveyor to Cold Aggregate Bins	3-05-020-06
RAP Bin Conveyor	3-05-020-06
Primary Collector	
Secondary Collector	
Unpaved Haul road Or Paved Haul Road	3-05-020-33 (proposed) 3-05-020-34 (proposed)

Table 1 lists the possible air emission sources and their associated Source Classification Code (SCC). An SCC is an eight digit code assigned to specific air emission factors for a particular process. [Note: SCCs 3-05-020-33 and 3-05-020-34 have been proposed by DNR as additions to the USEPA SCC list.]

Parallel Flow Drum Mix Plant

This process is a continuous mixing type process, using proportioning cold feed controls for the process materials. The major difference between this process and the batch process is that the dryer is used not only to dry the material but also to mix the heated and dry aggregates with the liquid asphalt cement. Aggregate, which has been proportioned by size gradations, is introduced to the drum at the burner end. As the drum rotates, the aggregates, as well as the combustion products, move toward the other end of the drum in parallel. Liquid asphalt cement flow is controlled by a variable flow pump electronically linked to the new (virgin) aggregate and RAP weigh scales. The asphalt cement is introduced in the mixing zone midway down the drum in a lower temperature zone, along with any recycled asphalt pavement (RAP) and PM from collectors.

The mixture is discharged at the end of the drum and is conveyed to either a surge bin or HMA storage silos. The exhaust gases also exit the end of the drum and pass on to the collection system.

Parallel flow drum mixers have an advantage, in that mixing in the discharge end of the drum captures a substantial portion of the aggregate dust, therefore lowering the load on the downstream collection equipment. For this reason, most parallel flow drum mixers are followed only by primary collection equipment (usually a baghouse or Venturi scrubber). However, because the mixing of aggregate and liquid asphalt cement occurs in the hot combustion product flow, organic emissions (gaseous and liquid aerosol) may be greater than in other processes.

The most significant ducted source of emissions is the rotary drum dryer. Emissions from the drum consist of water as steam evaporated from the aggregate, PM, and small amounts of VOCs of various species derived from combustion exhaust gases, liquid asphalt cement, and RAP, if utilized. The VOCs result from the incomplete combustion and from the heating and mixing of liquid asphalt cement inside the drum. The processing of RAP materials may increase VOC emissions because of an increase in mixing zone temperature during processing.

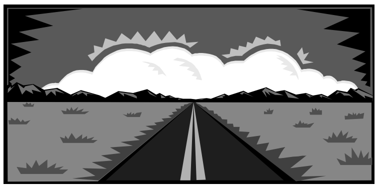
Process fugitive emissions associated with batch plant hot screens, elevators, and the mixer (pug mill) are not present in the drum mix process. However, there may be slight fugitive VOC emissions from transport and handling of the hot mix from the drum mixer to the storage silo and also from the load-out operations to the delivery trucks. Since the drum process is continuous, these plants must have surge bins or storage silos. The fugitive dust sources associated with drum mix plants are similar to those of batch mix plants with regard to truck traffic and to aggregate material feed and handling operations.

Table 2
Parallel Flow HMA
Emission Sources
AP-42, 1/95 Figure 11.1.2

Emission Source	***Source Classification Code***
Parallel Flow Drum Mixer	3-05-002-05
Cold Aggregate Bins	3-05-002-04
Asphalt Cement Storage Heater	3-05-002-06 3-05-002-07 3-05-002-08
Loader	3-05-002-04
Fine Aggregate Storage Pile	3-05-002-03
Coarse Aggregate Storage Pile	3-05-002-03
Conveyor from Parallel Flow Drum Mixer to scalping screen	3-05-020-06
Conveyor from scalping screen to Cold Aggregate Bins	3-05-020-06
Conveyor from RAP Bin to Parallel Flow Drum Mixer	3-05-020-06
Primary Collector	
Secondary Collector	
Unpaved Haul road Or Paved Haul Road	3-05-020-33 (proposed) 3-05-020-34 (proposed)

Table 2 lists the possible air emission sources from parallel flow HMAs along with their corresponding SCC. [Note: SCCs 3-05-020-33 and 3-05-020-34 have been proposed by DNR as additions to the USEPA SCC list.]

Counterflow Drum Mix Plant



In this type of plant, the material flow in the drum is opposite, or counterflow, to the direction of exhaust gases. In addition, the liquid asphalt cement mixing zone is located behind the burner flame so as to remove the materials from direct contact with hot exhaust gases.

Liquid asphalt cement flow is controlled by a variable flow pump, which is electronically limited to the virgin aggregate and RAP weigh scales. It is injected into the mixing zone along with any RAP and particulate matter from primary and secondary collectors.

Because the liquid asphalt cement, virgin aggregate, and RAP are mixed in a zone removed from the exhaust gas stream, counterflow drum mix plants are will likely have organic emissions (gaseous and liquid aerosol) that are lower than parallel flow drum mix plants. A counterflow drum mix plant can normally process RAP at ratios up to 50 percent with little or no observed effect upon emissions.

The most significant ducted source of emissions is the rotary drum dryer in a counterflow drum mix plant. Emissions from the drum consist of water as steam evaporated from the aggregate, PM, and small amounts of VOCs of various species derived from combustion exhaust gases, liquid asphalt cement, and RAP, if used.

Because liquid asphalt cement, aggregate, and sometimes RAP, are mixed in a zone not in contact with the hot exhaust gas stream, counterflow drum mix plants will likely have lower VOC emissions tan parallel flow drum mix plants. The organic compounds that are emitted from counterflow drum mix plants are likely to be products of a slight inefficient combustion.

Process fugitive emissions associated with batch plant hot screens, elevators, and the mixer (pug mill) are not present in the drum mix process. However, there may be slight fugitive VOC emissions from transport and handling of the hot mix from the drum mixer to the storage silo and also from the load-out operations to the delivery trucks. Since the drum process is continuous, these plants must have surge bins or storage silos. The fugitive dust sources associated with drum mix plants are similar to those of batch mix plants with regard to truck traffic and to aggregate material feed and handling operations.

Table 3 Counter Flow HMA Emission Sources AP-42, 1/95 Figure 11.1.3	
Emission Source	***Source Classification Code***
Counter Flow Drum Mixer	3-05-002-05
Cold Aggregate Bins	3-05-002-04
Asphalt Cement Storage Heater	3-05-002-06 3-05-002-07 3-05-002-08
Loader	3-05-002-04
Fine Aggregate Storage Pile	3-05-002-03
Coarse Aggregate Storage Pile	3-05-002-03
Conveyor from Counter Flow Drum Mixer to scalping screen	3-05-020-06
Conveyor from scalping screen to Cold Aggregate Bins	3-05-020-06
Conveyor from RAP Bin to Counter Flow Drum Mixer	3-05-020-06
Primary Collector	
Secondary Collector	
Unpaved Haul road Or Paved Haul Road	3-05-020-33 (proposed) 3-05-020-34 (proposed)

Table 3 lists the possible air emissions sources for counter flow HMAs. [Note: SCCs 3-05-020-33 and 3-05-020-34 have been proposed by DNR as additions to the USEPA SCC list.]

DNR Information on HMAs

DNR has experience with asphalt plants specific to their operations in Wisconsin. .The following is a list of DNR observations regarding HMAs.

Emissions from Processes

Processes are those sources ducted to a vent or to a piece of control equipment. For the most part air emissions from these processes are assumed to be gaseous. Particulate matter air emissions are assumed to be emitted from fugitive sources.

1. **Particulate Matter Sources**

   The PM and PM_{10} emissions associated with ducted or vented processes at HMA plants are assumed to be negligible.

2. **Sulfur dioxide (SO_2), nitrous oxides (NO_x), reactive organic gasses (ROG), lead (Pb), carbon monoxide (CO)**

The discharge of theses criteria pollutants should be linked to the fuel burned at either the batch mix or drum mix asphalt plants. Information from AP-42 Sections 1.3 and 1.4 are used in calculating these emissions because these emission factors are supported through higher quality data (AP-42 gives them an A rating) as compared to the emissions for these pollutants in AP-42 Section 11.1 which have a D or E rating. [Note: USEPA assesses a quality rating of A (the best) to E (the worst) based on data compiled to support these emission factors.] These criteria emissions vary based on fuel burned.

A. Natural Gas

Information from AP-42 Section 1.4 using SCC code 1-02-006-02 for small industrial boilers for burners with a heat input rating of less than100 MMBtu/hr are used in the calculation of criteria pollutant from natural gas burning. SCC code 1-02-006-01 is used for burners with a heat input rate greater than 100 MMBtu/hr.

B. Fuel Oils

1) Description

a. Distillate Fuel Oil

Information from AP-42 Section 1.3 using SCC code 1-03-005-02 for boilers using distillate fuel oil. The criteria pollutant from distillate fuel oil should be calculated. Please note that distillate fuel oils are #1, #2, #3, commercial heating oil, light cycle oil and #4 (if made up solely of heavy distillate fuel oil). #1 and #2 distillate fuel oils have a maximum sulfur content of 0.5% by weight. #3 commercial heating oil and light cycle oil are basically #2 oil however they do not meet the #2 specification for sulfur content, color or ctane (heat content).

This determination does not apply to engines or heaters burning distillate fuel oil used by the hot mix asphalt plant.

b. Residual Fuel Oil

This product is the residue from the crude oil after the light oils are extracted at normal temperature and pressure. Residual fuel oils have a wide variation in viscosity and have a higher heat content than distillate oil. Number 4 can be classified as a distillate and residual oil. Number 5 and number 6 are classified as residual.

fuels. The sulfur content from residual fuel oil can range from 0.25% to 3.6% by weight.

This determination does not apply to engines or heaters burning residual fuel oil used by the hot mix asphalt plant.

c. Waste Fuel Oil

Waste fuel oil, sometimes called reprocessed oil or number 3 oil, is any oil refined from crude or synthetic oil that becomes altered during use. It includes engine oil, gear oil, lubricating oil, hydraulic oil, cutting oil, transformer fluids and tempering or quenching oils. Waste fuel oil is divided into three categories: specification, off-specification and hazardous waste. Air permits for Hot Mix Asphalt plants do not allow for the burning of a fuel classified as a hazardous waste.

Waste fuel oil can be mixed with either distillate or residual fuel oils to obtain a required viscosity.

As a default, the department assumes that number 3 waste fuel oil emission factor(s) are the same as distillate fuel oil emission factors, provided the number 3 oil is made up of either distillate fuel oil or meets the specifications of number 1 or number 2 distillate fuel oils. Because of the assumption, the department will use the same SCC code of 1-02-005-02 for the number 3 waste fuel oil meeting the above criteria. The default sulfur content assumption is 0.25% by weight.

2) Emissions Calculations

The department will base emission calculations for NO_x, ROG, Pb, and CO on information contained in AP-42.

3) Asphalt Producer Reporting For Emission Calculations

The emission inventory reporting for the SO_2 emissions from asphalt plants requires the asphalt plant owner or operator supply the number of gallons of oil burned and the corresponding sulfur content of that oil

The asphalt plant owner or operator should track the number of gallons of fuel oil burned (distillate, waste, or residual) and the percent sulfur of fuel burned at the asphalt plant while the asphalt plant is generating product. This information will then be used in calculating air emissions from the asphalt plant.

DNR developed an Excel spreadsheet for this reporting. The Excel spreadsheet allows the owner or operator to record the number of gallons of fuel burned and the percent sulfur of the fuel for each day of operation. The Excel spreadsheet calculates a yearly weighted average sulfur content for the hot mix asphalt plant that can be used for emission inventory reporting. This spreadsheet is available by writing Ralph Patterson, WDNR, P.O. Box 7921, Madison, WI 53707 or contacting him through E-MAIL at patter@dnr.state.wi.us.

Appendix A supplies forms that allow the manual calculation of the yearly weighted average sulfur content by use of a calculator. Appendix A has 13 sheets. The first 12 sheets are for calculating the total sulfur for each month of the year by day. At the end of the year the amount for each month is transferred to the 13th sheet and then the total sulfur is divided by the total amount produced.

Sulfur dioxide emissions from the burning of oil are calculated based on a derived emission factor. This emission factor assumes that all fuel oil is the same density of 7.44 pounds per gallon and that the asphalt plant burns 1.8 gallons of fuel oil for each ton of asphalt produced.

EMF = Constant x % Sulfur (weighted average)

The constant is:

1.8 gallon fuel oil/ton product x 7.44 lbs of fuel oil/gallon of fuel oil x 2 lbs SO2/lb S = 26.784 lbs SO2/ton product

Note: AP-42 Section 11.1, December 2000, recognized that the asphalt product captured 50% of the sulfur dioxide emitted during the asphalt making process. DNR will assign a 50% fugitive control efficiency to asphalt producing sources at the asphalt plant. The percent sulfur will be divided by 100. For example, a 0.46% sulfur weighted average will be calculated as 0.0046. This approach will be used to calculate SO_2 air emissions for the following SCCs:

1. ***3-05-002-46***
2. ***3-05-002-47***
3. ***3-05-002-58***
4. ***3-05-002-59***
5. ***3-05-002-60***
6. ***3-05-002-61***
7. ***3-05-002-62***
8. ***3-05-002-63***

C. Liquified Petroleum Gas

The criteria pollutant emissions from Liquified Petroleum Gas Combustion should be calculated using information from AP-42 Section 1.5 using SCC code 1-02-010-02 for industrial boilers. You will need to know the amount of Liquified Petroleum Gas burned at the HMA in 1000 gallons in order to calculate these emissions.

Fugitive Emissions

1. Asphalt Heaters

Asphalt heaters are used to heat the liquid asphalt cement. These units are typically fired with fuel oil. Again the combustion emissions factors from AP-42 Section 1.4 (natural gas fired) and 1.3 (fuel oil fired) could be applied to the heaters, as appropriate to fuel burned.

2. Fuel Oil Tank Heaters

Fuel oil tank heaters are used to heat the waste oil/residual fuel oil. These units are typically fired with fuel oil. Again the combustion emissions factors from AP-42 Section 1.4 (natural gas fired) and 1.3 (fuel oil fired) could be applied to the heaters, as appropriate to fuel burned. Generally, the emissions from fuel oil tank heaters are small or insignificant.

3. Roadways

Asphalt plants may have paved or unpaved roadways, depending on their location and whether they are permanent or portable units. The same emissions factors and fugitive dust control efficiencies applied to roadways in quarries and sand and gravel operations under the current nonmetallic mining guidance document should be used to characterize these emissions.

4. Stockpiles

Asphalt plants will have several stockpiles of different types of stone, sand and ground recycled asphalt (RAP). The same emissions factors and fugitive dust control efficiencies applied to roadways in quarries and sand and gravel operations under the current nonmetallic mining guidance document should be used to characterize these emissions.

5. Diesel/Gas Generators

Portable asphalt plants generally use diesel/gas generators in remote areas to supply power for the asphalt plant equipment. The same emissions factors applied to diesel/gas generators in crusher plants. The combustion emissions factors from AP-42 for Reciprocating engines (diesel fuel) 2-02-001-02 and (gas) 2-02-003-01 could be applied to the diesel/gas generators, as appropriate to fuel burned.

6. Hauling/Loading to Bins

Asphalt plants generally will have several bins that a loader operator is required to keep full by traveling between the storage piles and dumping into the bins. The same emissions factor and fugitive dust control efficiency applied to portable crusher operations can be applied to asphalt plants. The hauling emission factor (developed for crushers) is listed in the **Nonmetallic Air Emissions Guidance** document applicable to the calendar year the emission was reported. The SCC code applicable to this fugitive emission is 3-05-020-11.

7. Screening

Asphalt plants generally will have screen(s) that separate out over sized materials before it enters the mix. The same emissions factor and fugitive dust control efficiency applied to portable crusher operations can be applied to asphalt plants. The SCC Code applicable to screening is 3-05-020-04.

8. Soil Remediation

Asphalt plants that remediate soil discharge ROG and benzene emissions. These emissions are calculated and recorded according to their permit requirements and can be entered into AEMS under a separate process number. The SCC code associated with asphalt plants should be entered. The emission factor for ROG should reflect the units of reporting.

Typical HMA Plant

There are similarities and differences between (1) batch mix plants, (2) parallel flow drum and (3) counterflow drum mix plants. Each HMA plant in AEMS should begin with similar devices and proceses and have the specific HMA tailored using the devices and processes specific to the type of HMA. Table 4 lists the HMA sources identified by DNR and USEPA. The table then lists whether these HMA sources should be part of the base emission configuration or can be added to make the HMA specific to the type of HMA.

Table 4
HMA Emission Sources
Base or Optional

Emission Source	SCC	Base or optional	Comment
Rotary Dryer or Parallel Flow, Counter Flow Drum Mixer	3-05-002-01 or 3-05-002-05	Base	Emission factors for SO2, NOx, ROG, and CO should be removed for asphalt mix process with SCC 3-05-002-05
Hot screens	3-05-002-02	Optional	
Hot bins	3-05-002-02	Optional	
Mixer	3-05-002-02	Optional	
Elevator	3-05-002-02	Optional	
Cold Aggregate Bins	3-05-002-04	Optional	SO2, NOx, ROG, and CO should be removed for asphalt mix process with SCC 3-05-002-04
Asphalt Cement Storage Heater	3-05-002-06 3-05-002-07 3-05-002-08	Base	
Loader	3-05-020-11 (unpaved) or 3-05-020-37 (paved)	Base	Assign 50%, 75%, or greater than 90% control efficiency
Fine aggregate storage pile	3-05-002-03	Optional	
Coarse aggregate storage pile	3-05-002-03	Optional	
Conveyor	3-05-020-06	Base	Assign 50%, 75%, or greater than 90% control efficiency
Primary collector		Base	Assume baghouse of 95% control
Secondary collector		Optional	
Unpaved Haul Road or Paved Haul Road	3-05-020-33 (proposed) 3-05-020-34 (proposed)	Base	Assign 50%, 75%, or greater than 90% control efficiency
Screen	3-05-020-04	Base	
Combustion tank heaters	1-03-005-02 oil 1-02-006-03 natural gas	Optional	Emission factors for PM and PM10 for natural gas should be switched off
Diesel/Gas Generators (Gensets)	2-02-001-02-diesel 2-02-003-01-gas	Base	
Soil Remediation	3-06-22-001 Underground Storage Remediation and Other Remediation	Optional	
	3-06-22-002 Underground Storage and Other Remediation: Soil: Residual Oil		
	30622003 Underground Storage and Other Remediation: Soil: Natural Gas		
	30622004 Underground Storage and Other Remediation: Soil: Distillate Oil		
	30622005 Underground Storage and Other Remediation: Soil: LPG		
	30622006 Underground Storage and Other Remediation: Soil: Waste Oil		

Summary

Air Management wants to consistently characterize HMA emissions for HMA plants throughout Wisconsin. USEPA and DNR information were reviewed to determine what sources should be part of a base emission characterization for HMAs and which sources could be optional. This document will be used to calculate emissions for all hot mix asphalt plants operating in Wisconsin.

Appendix A

Weighted Percent Sulfur Calculation

January Production-Sheet 1 of 13				
Column A	*Column B*	*Column C*	*Column D*	*Column E*
				Total Sulfur
Month	Day	Gallons Used	% Sulfur	(gallons)
January	*1*			
January	*2*			
January	*3*			
January	*4*			
January	*5*			
January	*6*			
January	*7*			
January	*8*			
January	*9*			
January	*10*			
January	*11*			
January	*12*			
January	*13*			
January	*14*			
January	*15*			
January	*16*			
January	*17*			
January	*18*			
January	*19*			
January	*20*			
January	*21*			
January	*22*			
January	*23*			
January	*24*			
January	*25*			
January	*26*			
January	*27*			
January	*28*			
January	*29*			
January	*30*			
January	*31*			
	Total			

Spreadsheet Use Instructions

For each day of the month enter the number of gallons of oil burned in column C and the percent sulfur in Column D. Multiply the oil burned by the percent sulfur and place the value of these quantities in Column E. At the end of the month total all values in Columns Cand E and transfer these values to Sheet 13.

February Production-Sheet 2 of 13				
Column A	*Column B*	*Column C*	*Column D*	*Column E*
Month	**Day**	**Gallons Used**	**% Sulfur**	**Total Sulfur (gallons)**
February	*1*			
February	*2*			
February	*3*			
February	*4*			
February	*5*			
February	*6*			
February	*7*			
February	*8*			
February	*9*			
February	*10*			
February	*11*			
February	*12*			
February	*13*			
February	*14*			
February	*15*			
February	*16*			
February	*17*			
February	*18*			
February	*19*			
February	*20*			
February	*21*			
February	*22*			
February	*23*			
February	*24*			
February	*25*			
February	*26*			
February	*27*			
February	*28*			
February	*29*			
	Total			

Spreadsheet Use Instructions

For each day of the month enter the number of gallons of oil burned in column C and the percent sulfur in Column D. Multiply the oil burned by the percent sulfur and place the value of these quantities in Column E. At the end of the month total all values in Columns Cand E and transfer these values to Sheet 13.

March Production-Sheet 3 of 13				
Column A	*Column B*	*Column C*	*Column D*	*Column E*
Month	Day	Gallons Used	% Sulfur	Total Sulfur (gallons)
March	*1*			
March	*2*			
March	*3*			
March	*4*			
March	*5*			
March	*6*			
March	*7*			
March	*8*			
March	*9*			
March	*10*			
March	*11*			
March	*12*			
March	*13*			
March	*14*			
March	*15*			
March	*16*			
March	*17*			
March	*18*			
March	*19*			
March	*20*			
March	*21*			
March	*22*			
March	*23*			
March	*24*			
March	*25*			
March	*26*			
March	*27*			
March	*28*			
March	*29*			
March	*30*			
March	*31*			
	Total			

Spreadsheet Use Instructions

For each day of the month enter the number of gallons of oil burned in column C and the percent sulfur in Column D. Multiply the oil burned by the percent sulfur and place the value of these quantities in Column E. At the end of the month total all values in Columns Cand E and transfer these values to Sheet 13.

April Production-Sheet 1 of 13				
Column A	*Column B*	*Column C*	*Column D*	*Column E*
Month	Day	Gallons Used	% Sulfur	Total Sulfur (gallons)
April	*1*			
April	*2*			
April	*3*			
April	*4*			
April	*5*			
April	*6*			
April	*7*			
April	*8*			
April	*9*			
April	*10*			
April	*11*			
April	*12*			
April	*13*			
April	*14*			
April	*15*			
April	*16*			
April	*17*			
April	*18*			
April	*19*			
April	*20*			
April	*21*			
April	*22*			
April	*23*			
April	*24*			
April	*25*			
April	*26*			
April	*27*			
April	*28*			
April	*29*			
April	*30*			
	Total			

Spreadsheet Use Instructions

For each day of the month enter the number of gallons of oil burned in column C and the percent sulfur in Column D. Multiply the oil burned by the percent sulfur and place the value of these quantities in Column E. At the end of the month total all values in Columns Cand E and transfer these values to Sheet 13.

May Production-Sheet 5 of 13				
Column A	*Column B*	*Column C*	*Column D*	*Column E*
				Total Sulfur
Month	Day	Gallons Used	% Sulfur	(gallons)
May	*1*			
May	*2*			
May	*3*			
May	*4*			
May	*5*			
May	*6*			
May	*7*			
May	*8*			
May	*9*			
May	*10*			
May	*11*			
May	*12*			
May	*13*			
May	*14*			
May	*15*			
May	*16*			
May	*17*			
May	*18*			
May	*19*			
May	*20*			
May	*21*			
May	*22*			
May	*23*			
May	*24*			
May	*25*			
May	*26*			
May	*27*			
May	*28*			
May	*29*			
May	*30*			
May	*31*			
	Total			

Spreadsheet Use Instructions

For each day of the month enter the number of gallons of oil burned in column C and the percent sulfur in Column D. Multiply the oil burned by the percent sulfur and place the value of these quantities in Column E. At the end of the month total all values in Columns Cand E and transfer these values to Sheet 13.

June Production-Sheet 6 of 13				
Column A	*Column B*	*Column C*	*Column D*	*Column E*
Month	Day	Gallons Used	% Sulfur	Total Sulfur (gallons)
June	*1*			
June	*2*			
June	*3*			
June	*4*			
June	*5*			
June	*6*			
June	*7*			
June	*8*			
June	*9*			
June	*10*			
June	*11*			
June	*12*			
June	*13*			
June	*14*			
June	*15*			
June	*16*			
June	*17*			
June	*18*			
June	*19*			
June	*20*			
June	*21*			
June	*22*			
June	*23*			
June	*24*			
June	*25*			
June	*26*			
June	*27*			
June	*28*			
June	*29*			
June	*30*			
	Total			

Spreadsheet Use Instructions

For each day of the month enter the number of gallons of oil burned in column C and the percent sulfur in Column D. Multiply the oil burned by the percent sulfur and place the value of these quantities in Column E. At the end of the month total all values in Columns Cand E and transfer these values to Sheet 13.

July Production-Sheet 7 of 13				
Column A	*Column B*	*Column C*	*Column D*	*Column E*
Month	Day	Gallons Used	% Sulfur	Total Sulfur (gallons)
July	*1*			
July	*2*			
July	*3*			
July	*4*			
July	*5*			
July	*6*			
July	*7*			
July	*8*			
July	*9*			
July	*10*			
July	*11*			
July	*12*			
July	*13*			
July	*14*			
July	*15*			
July	*16*			
July	*17*			
July	*18*			
July	*19*			
July	*20*			
July	*21*			
July	*22*			
July	*23*			
July	*24*			
July	*25*			
July	*26*			
July	*27*			
July	*28*			
July	*29*			
July	*30*			
July	*31*			
	Total			

Spreadsheet Use Instructions

For each day of the month enter the number of gallons of oil burned in column C and the percent sulfur in Column D. Multiply the oil burned by the percent sulfur and place the value of these quantities in Column E. At the end of the month total all values in Columns Cand E and transfer these values to Sheet 13.

August Production-Sheet 8 of 13				
Column A	*Column B*	*Column C*	*Column D*	*Column E*
Month	Day	Gallons Used	% Sulfur	Total Sulfur (gallons)
August	*1*			
August	*2*			
August	*3*			
August	*4*			
August	*5*			
August	*6*			
August	*7*			
August	*8*			
August	*9*			
August	*10*			
August	*11*			
August	*12*			
August	*13*			
August	*14*			
August	*15*			
August	*16*			
August	*17*			
August	*18*			
August	*19*			
August	*20*			
August	*21*			
August	*22*			
August	*23*			
August	*24*			
August	*25*			
August	*26*			
August	*27*			
August	*28*			
August	*29*			
August	*30*			
August	*31*			
	Total			

Spreadsheet Use Instructions

For each day of the month enter the number of gallons of oil burned in column C and the percent sulfur in Column D. Multiply the oil burned by the percent sulfur and place the value of these quantities in Column E. At the end of the month total all values in Columns Cand E and transfer these values to Sheet 13.

September Production-Sheet 9 of 13				
Column A	*Column B*	*Column C*	*Column D*	*Column E*
Month	Day	Gallons Used	% Sulfur	Total Sulfur (gallons)
September	*1*			
September	*2*			
September	*3*			
September	*4*			
September	*5*			
September	*6*			
September	*7*			
September	*8*			
September	*9*			
September	*10*			
September	*11*			
September	*12*			
September	*13*			
September	*14*			
September	*15*			
September	*16*			
September	*17*			
September	*18*			
September	*19*			
September	*20*			
September	*21*			
September	*22*			
September	*23*			
September	*24*			
September	*25*			
September	*26*			
September	*27*			
September	*28*			
September	*29*			
September	*30*			
	Total			

Spreadsheet Use Instructions

For each day of the month enter the number of gallons of oil burned in column C and the percent sulfur in Column D. Multiply the oil burned by the percent sulfur and place the value of these quantities in Column E. At the end of the month total all values in Columns Cand E and transfer these values to Sheet 13.

October Production-Sheet 10 of 13				
Column A	*Column B*	*Column C*	*Column D*	*Column E*
Month	Day	Gallons Used	% Sulfur	Total Sulfur (gallons)
October	*1*			
October	*2*			
October	*3*			
October	*4*			
October	*5*			
October	*6*			
October	*7*			
October	*8*			
October	*9*			
October	*10*			
October	*11*			
October	*12*			
October	*13*			
October	*14*			
October	*15*			
October	*16*			
October	*17*			
October	*18*			
October	*19*			
October	*20*			
October	*21*			
October	*22*			
October	*23*			
October	*24*			
October	*25*			
October	*26*			
October	*27*			
October	*28*			
October	*29*			
October	*30*			
October	*31*			
	Total			

Spreadsheet Use Instructions

For each day of the month enter the number of gallons of oil burned in column C and the percent sulfur in Column D. Multiply the oil burned by the percent sulfur and place the value of these quantities in Column E. At the end of the month total all values in Columns Cand E and transfer these values to Sheet 13.

November Production-Sheet 11 of 13				
Column A	*Column B*	*Column C*	*Column D*	*Column E*
Month	Day	Gallons Used	% Sulfur	Total Sulfur (gallons)
November	*1*			
November	*2*			
November	*3*			
November	*4*			
November	*5*			
November	*6*			
November	*7*			
November	*8*			
November	*9*			
November	*10*			
November	*11*			
November	*12*			
November	*13*			
November	*14*			
November	*15*			
November	*16*			
November	*17*			
November	*18*			
November	*19*			
November	*20*			
November	*21*			
November	*22*			
November	*23*			
November	*24*			
November	*25*			
November	*26*			
November	*27*			
November	*28*			
November	*29*			
November	*30*			
	Total			

Spreadsheet Use Instructions

For each day of the month enter the number of gallons of oil burned in column C and the percent sulfur in Column D. Multiply the oil burned by the percent sulfur and place the value of these quantities in Column E. At the end of the month total all values in Columns Cand E and transfer these values to Sheet 13.

December Production-Sheet 12 of 13

Column A	*Column B*	*Column C*	*Column D*	*Column E*
Month	Day	Gallons Used	% Sulfur	Total Sulfur (gallons)
December	*1*			
December	*2*			
December	*3*			
December	*4*			
December	*5*			
December	*6*			
December	*7*			
December	*8*			
December	*9*			
December	*10*			
December	*11*			
December	*12*			
December	*13*			
December	*14*			
December	*15*			
December	*16*			
December	*17*			
December	*18*			
December	*19*			
December	*20*			
December	*21*			
December	*22*			
December	*23*			
December	*24*			
December	*25*			
December	*26*			
December	*27*			
December	*28*			
December	*29*			
December	*30*			
December	*31*			
	Total			

Spreadsheet Use Instructions

For each day of the month enter the number of gallons of oil burned in column C and the percent sulfur in Column D. Multiply the oil burned by the percent sulfur and place the value of these quantities in Column E. At the end of the month total all values in Columns Cand E and transfer these values to Sheet 13.

Total For Year - Sheet 13 of 13

Column A	*Column B*	*Column C*	*Column D*	*Column E*	
		Fuel		Sulfur	
Month		(gallons)		(gallons)	
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					
	Total				
Weighted Per Cent Sulfur	*Total E/Total C*		x 100 =		Percent
For Year					

Weighted Percent Sulfur Answer

Spreadsheet Use Instructions

Enter information in Column C and Column 3 from Sheets 1 to 12. Add total for all months for Columns C and E. Divide total in Column E by total in Column C to calculate Weighted Per Cent Sulfur for year.