20.11.41 NMAC "AUTHORITY-TO-CONSTRUCT" AIR QUALITY PERMIT APPLICATION FOR BLACK ROCK HP-2 HMA PLANT

Albuquerque, New Mexico

PREPARED FOR
BLACK ROCK SERVICES, LLC

OCTOBER 2021

Prepared by

Montrose Air Quality Services, LLC

MONTROSE ENVIRONMENTAL

Introduction

This 20.11.41.2 permit application is for a new 400 tph hot mix asphalt (HMA) plant for Black Rock Services, LLC (Black Rock). Black Rock has retained Montrose Air Quality Services, LLC (Montrose) to assist with the new 20.2.41 NMAC "Authority to Construct" permit application. The plant will be identified as Black Rock Services HP-2 and will be located at the northwest corner of Carmony Ln NE and Alexander Blvd NE. The UTM coordinates of the proposed HMA plant will be; 352,000 meters E, 3,888,500 meters N, Zone 13, NAD 83.

The facility will produce hot mix asphalt used for road and highway projects. The HMA plant will consist of aggregate storage piles, recycled asphalt pavement (RAP) storage pile, a cold aggregate feed bins (5), cold aggregate scalping screen, RAP feed bins (2), RAP scalping screen, RAP crusher, mineral filler silo, mineral filler silo baghouse, drum dryer/mixer, drum dryer/mixer baghouse, asphalt drag conveyor, asphalt storage silos (6), asphalt cement storage tanks (3), asphalt cement oil heater, and multiple conveyors. The HMA plant will be powered by commercial line power. As an alternative to mineral fillers in the asphalt concrete mix, the plant will also use Evotherm. Evotherm promotes adhesion by acting as both a liquid antistrip and a warm mix asphalt (WMA). Evotherm is an easy-to-handle, pumpable liquid that contains no regulated HAPs or TAPs components. Evotherm and mineral filler will not be used in the mix concurrently.

As part of the operation of the facility, Black Rock will take limits on daily throughput and hours of operation.

Table 1 presents the daily limits for hot mix asphalt production.

Table 1: Daily Production Rates

Month	Tons Per Day
January	4000
February	4000
March	4800
April	6000
May	6000
June	6000
July	6000
August	6000
September	4800
October	4000
November	4000
December	4000

The following hours of operation in Table 2 will applies to the HMA Plant.

TABLE 2: HMA Asphalt Production Hours of Operation (MST)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
12:00 AM	0	0	1	1	1	1	1	1	1	0	0	0
1:00 AM	0	0	1	1	1	1	1	1	1	0	0	0
2:00 AM	0	0	1	1	1	1	1	1	1	0	0	0
3:00 AM	0	0	1	1	1	1	1	1	1	0	0	0
4:00 AM	0	0	1	1	1	1	1	1	1	0	0	0
5:00 AM	0	1	1	1	1	1	1	1	1	1	1	0
6:00 AM	0	1	1	1	1	1	1	1	1	1	1	0
7:00 AM	1	1	1	1	1	1	1	1	1	1	1	1
8:00 AM	1	1	1	1	1	1	1	1	1	1	1	1
9:00 AM	1	1	1	1	1	1	1	1	1	1	1	1
10:00 AM	1	1	1	1	1	1	1	1	1	1	1	1
11:00 AM	1	1	1	1	1	1	1	1	1	1	1	1
12:00 PM	1	1	1	1	1	1	1	1	1	1	1	1
1:00 PM	1	1	1	1	1	1	1	1	1	1	1	1
2:00 PM	1	1	1	1	1	1	1	1	1	1	1	1
3:00 PM	1	1	1	1	1	1	1	1	1	1	1	1
4:00 PM	1	1	1	1	1	1	1	1	1	1	1	1
5:00 PM	0.5	1	1	1	1	1	1	1	1	1	1	0
6:00 PM	0	1	1	1	1	1	1	1	1	1	1	0
7:00 PM	0	1	1	1	1	1	1	1	1	1	1	0
8:00 PM	0	1	1	1	1	1	1	1	1	1	1	0
9:00 PM	0	1	1	1	1	1	1	1	1	1	1	0
10:00 PM	0	0	1	1	1	1	1	1	1	0	0	0
11:00 PM	0	0	1	1	1	1	1	1	1	0	0	0
Total	10.5	17	24	24	24	24	24	24	24	17	17	10

Virgin aggregate/RAP/Mineral Filler/Asphalt cement ratios used in estimating material handling particulate emission rates is equal to 57.5/35.0/1.5/6.0. If no RAP is allowed in a mix, the Virgin aggregate/RAP/Mineral Filler/Asphalt cement ratios used in estimating material handling particulate emission rates is equal to 92.5/0.0/1.5/6.0. The maximum plant input for aggregate/RAP is 370 tons per hour at any time. This allows a range for aggregate and RAP to be 230 to 370 tons for aggregate and 140 to 0 for RAP. Particulate emission rates were calculated using maximum aggregate (370 tons per hour) and RAP (140 tons per hour) inputs. These ratios are estimated to produce the highest particulate emission rates for use in the dispersion modeling analysis, but ratios may change with mix requirements, these are not requested permit conditions

Annual particulate emissions for this facility will be controlled primarily by limiting annual production. The facility will also utilize baghouses for the mineral filler silo and drum dryer/mixer to reduce the amount of particulate emitted from the plant. Furthermore, the use of moisture (water sprays) in material handling procedures and pavement on roadways will be utilized as controls for particulate emissions. Asphalt fumes, organic PM, carbon monoxide, and VOC ("Blue Smoke") generated as the hot mix asphalt concrete is unloaded from the drum mixer to the asphalt storage silos by way of the drag conveyor (Unit 17) will be controlled by installation of a recirculation system that captures these emissions and recirculates the captured gases back to the drum dryer for additional destruction.

No startup/shutdown emission rates are expected to be greater than what is proposed for normal operations of the plant. All controls will be operating and functioning correctly prior to the start of production.

HMA Plant
Operational Plan to Mitigate Emissions and Plan of Work Practices

Startup

Prior to the production of asphalt, the drum dryer/mixer dust collector will be operational and functioning correctly per applicable permit conditions. This includes operation of the recirculation system functioning correctly per applicable permit conditions to reduce blue smoke generation. Prior to loading the mineral filler, the baghouse dust collector will be operational and functioning correctly per applicable permit conditions

Upon visual inspection, all paved haul roads will be cleaned to minimize fugitive dust as required under applicable permit conditions.

Shutdown

All required control equipment will operate until all asphalt production ceases.

Maintenance

The asphalt drum mixer/dryer, and drum mixer/dryer dust collector will be maintained to prevent excess emissions during startup or shutdown. The mineral filler baghouse dust collector will be maintained to prevent excess emissions during startup or shutdown. This facility will not have excess emissions during any maintenance procedures.

Malfunction

Upon malfunction where excess particulate emissions are observed from the asphalt drum mixer/dryer, and drum mixer/dryer dust collector, all asphalt production will cease until repairs to control equipment are made. Upon malfunction where excess particulate emissions are observed from the mineral filler baghouse dust collector, mineral filler silo loading will cease until repairs to control equipment are made.

If you have any questions regarding this permit application please call Paul Wade of Montrose at (505) 830-9680 x6 or Robert Caldwell of Black Rock at (505) 206-1101.

The contents of this application packet include:

20.11.41 NMAC Permit Fee Review
20.11.41 NMAC Permit Application Checklist
20.11.41 NMAC Permit Application Forms
Attachment A: Figure A-1: Black Rock's HP-2 HMA Process Flow
Figure A-2: Black Rock's Broadway HP-2 HMA Plant Layout
Attachment B: Emission Calculations
Attachment C: Emission Calculations Support Documents
Attachment D: Figure D-1: Aerial Map
Attachment E: Facility Description
Attachment F: Regulatory Applicability Determination
Attachment G: Dispersion Modeling Summary and Report
Attachment H: Public Notice Documents

City of Albuquerque

Environmental Health Department
Air Quality Program

Permit Application Review Fee Checklist Effective January 1 - December 31, 2021

Please completely fill out the information in each section. Incompleteness of this checklist may result in the Albuquerque Environmental Health Department not accepting the application review fees. If you should have any questions concerning this checklist, please call 768-1972.

I. COMPANY INFORMATION:

Company Name	Black Rock Services, LLC		
Company Address	1040 Bosque Farms Blvd, Bosque Farms, NM 87068		
Facility Name	HP-2		
Facility Address	Northwest corner of Carmony Ln NE and Alexander Blvd NE		
Contact Person	Robert Caldwell		
Contact Person Phone Number	(505) 206-1101		
Are these application review fees for an existing permitted source located within the City of Albuquerque or Bernalillo County?		**Yes**	**No**
If yes, what is the permit number associated with this modification?		**Permit #**	
Is this application review fee for a Qualified Small Business as defined in 20.11.2 NMAC? (See Definition of Qualified Small Business on Page 4)		**Yes**	**No**

II. STATIONARY SOURCE APPLICATION REVIEW FEES:

If the application is for a new stationary source facility, please check all that apply. If this application is for a modification to an existing permit please see Section III.

Check All That Apply	Stationary Sources	Review Fee	Program Element
	Air Quality Notifications		
	AQN New Application	$581.00	2801
	AQN Technical Amendment	$318.00	2802
	AQN Transfer of a Prior Authorization	$318.00	2803
X	*Not Applicable*	*See Sections Below*	
	Stationary Source Review Fees (Not Based on Proposed Allowable Emission Rate)		
	Source Registration required by 20.11.40 NMAC	$ 592.00	2401
	A Stationary Source that requires a permit pursuant to 20.11.41 NMAC or other board regulations and are not subject to the below proposed allowable emission rates	$ 1,185.00	2301
X	*Not Applicable*	*See Sections Below*	
	Stationary Source Review Fees (Based on the Proposed Allowable Emission Rate for the single highest fee pollutant)		
	Proposed Allowable Emission Rate Equal to or greater than 1 tpy and less than 5 tpy	$ 889.00	2302
	Proposed Allowable Emission Rate Equal to or greater than 5 tpy and less than 25 tpy	$1,777.00	2303
	Proposed Allowable Emission Rate Equal to or greater than 25 tpy and less than 50 tpy	$3,554.00	2304
	Proposed Allowable Emission Rate Equal to or greater than 50 tpy and less than 75 tpy	$5,331.00	2305
X	Proposed Allowable Emission Rate Equal to or greater than 75 tpy and less than 100 tpy	$7,108.00	2306
	Proposed Allowable Emission Rate Equal to or greater than 100 tpy	$8,885.00	2307
	Not Applicable	*See Section Above*	

Federal Program Review Fees (In addition to the Stationary Source Application Review Fees above)			
X	40 CFR 60 - "New Source Performance Standards" (NSPS)	$1,185.00	2308
	40 CFR 61 - "Emission Standards for Hazardous Air Pollutants (NESHAPs)	$1,185.00	2309
	40 CFR 63 - (NESHAPs) Promulgated Standards	$1,185.00	2310
	40 CFR 63 - (NESHAPs) Case-by-Case MACT Review	$11,847.00	2311
	20.11.61 NMAC, Prevention of Significant Deterioration (PSD) Permit	$5,924.00	2312
	20.11.60 NMAC, Non-Attainment Area Permit	$5,924.00	2313
	Not Applicable	*Not Applicable*	

III. MODIFICATION TO EXISTING PERMIT APPLICATION REVIEW FEES:

If the permit application is for a modification to an existing permit, please check all that apply. If this application is for a new stationary source facility, please see Section II.

Check All That Apply	Modifications	Review Fee	Program Element
Modification Application Review Fees (Not Based on Proposed Allowable Emission Rate)			
	Proposed modification to an existing stationary source that requires a permit pursuant to 20.11.41 NMAC or other board regulations and are not subject to the below proposed allowable emission rates	$ 1,185.00	2321
X	*Not Applicable*	*See Sections Below*	
Modification Application Review Fees (Based on the Proposed Allowable Emission Rate for the single highest fee pollutant)			
	Proposed Allowable Emission Rate Equal to or greater than 1 tpy and less than 5 tpy	$889.00	2322
	Proposed Allowable Emission Rate Equal to or greater than 5 tpy and less than 25 tpy	$1,777.00	2323
	Proposed Allowable Emission Rate Equal to or greater than 25 tpy and less than 50 tpy	$3,554.00	2324
	Proposed Allowable Emission Rate Equal to or greater than 50 tpy and less than 75 tpy	$5,331.00	2325
	Proposed Allowable Emission Rate Equal to or greater than 75 tpy and less than 100 tpy	$7,108.00	2326
	Proposed Allowable Emission Rate Equal to or greater than 100 tpy	$8,885.00	2327
X	*Not Applicable*	*See Section Above*	
Major Modifications Review Fees (In addition to the Modification Application Review Fees above)			
	20.11.60 NMAC, Permitting in Non-Attainment Areas	$5,924.00	2333
	20.11.61 NMAC, Prevention of Significant Deterioration	$5,924.00	2334
X	*Not Applicable*	*Not Applicable*	
Federal Program Review Fees (This section applies only if a Federal Program Review is triggered by the proposed modification) (These fees are in addition to the Modification and Major Modification Application Review Fees above)			
	40 CFR 60 - "New Source Performance Standards" (NSPS)	$1,185.00	2328
	40 CFR 61 - "Emission Standards for Hazardous Air Pollutants (NESHAPs)	$1,185.00	2329
	40 CFR 63 - (NESHAPs) Promulgated Standards	$1,185.00	2330
	40 CFR 63 - (NESHAPs) Case-by-Case MACT Review	$11,847.00	2331
	20.11.61 NMAC, Prevention of Significant Deterioration (PSD) Permit	$5,924.00	2332
	20.11.60 NMAC, Non-Attainment Area Permit	$5,924.00	2333
	Not Applicable	*Not Applicable*	

IV. ADMINISTRATIVE AND TECHNICAL REVISION APPLICATION REVIEW FEES:

If the permit application is for an administrative or technical revision of an existing permit issued pursuant to 20.11.41 NMAC, please check one that applies.

Check One	Revision Type	Review Fee	Program Element
	Administrative Revisions	$ 250.00	2340
	Technical Revisions	$ 500.00	2341
X	*Not Applicable*	*See Sections II, III or V*	

V. PORTABLE STATIONARY SOURCE RELOCATION FEES:

If the permit application is for a portable stationary source relocation of an existing permit, please check one that applies.

Check One	Portable Stationary Source Relocation Type	Review Fee	Program Element
	No New Air Dispersion Modeling Required	$ 500.00	2501
	New Air Dispersion Modeling Required	$ 750.00	2502
X	*Not Applicable*	*See Sections II, III or V*	

VI. Please submit a check or money order in the amount shown for the total application review fee.

Section Totals	Review Fee Amount
Section II Total	$8,293
Section III Total	$0
Section IV Total	$0
Section V Total	$0
Total Application Review Fee	**$8,293**

I, the undersigned, a responsible official of the applicant company, certify that to the best of my knowledge, the information stated on this checklist, give a true and complete representation of the permit application review fees which are being submitted. I also understand that an incorrect submittal of permit application reviews may cause an incompleteness determination of the submitted permit application and that the balance of the appropriate permit application review fees shall be paid in full prior to further processing of the application.

Signed this 19th **day of** April **20**21

Robert Caldwell
Print Name

Owner/Operator
Print Title

R. Caldwell
Signature

Definition of Qualified Small Business as defined in 20.11.2 NMAC:
"Qualified small business" means a business that meets all of the following requirements:
(1) a business that has 100 or fewer employees;
(2) a small business concern as defined by the federal Small Business Act;
(3) a source that emits less than 50 tons per year of any individual regulated air pollutant, or less than 75 tons per year of all regulated air pollutants combined; and
(4) a source that is not a major source or major stationary source.

Note: Beginning January 1, 2011, and every January 1 thereafter, an increase based on the consumer price index shall be added to the application review fees. The application review fees established in Subsection A through D of 20.11.2.18 NMAC shall be adjusted by an amount equal to the increase in the consumer price index for the immediately-preceding year. Application review fee adjustments equal to or greater than fifty cents ($0.50) shall be rounded up to the next highest whole dollar. Application review fee adjustments totaling less than fifty cents ($0.50) shall be rounded down to the next lowest whole dollar. The department shall post the application review fees on the city of Albuquerque environmental health department air quality program website.

City of Albuquerque

Environmental Health Department
Air Quality Program

Permit Application Checklist

Any person seeking a permit under 20.11.41 NMAC, Authority-to-Construct Permits, shall do so by filing a written application with the Department. Prior to ruling a submitted application complete each application submitted shall contain the required items listed below. **This checklist must be returned with the application.**

Applications that are ruled incomplete because of missing information will delay any determination or the issuance of the permit. The Department reserves the right to request additional relevant information prior to ruling the application complete in accordance with 20.11.41 NMAC.

All applicants shall:

1. **X** Fill out and submit the *Pre-permit Application Meeting Request* form
   a. **X** Attach a copy to this application

2. **X** Attend the pre-permit application meeting
   a. ☐ Attach a copy of the completed *Pre-permit Application Meeting Checklist* to this application

3. **X** Provide public notice to the appropriate parties
   a. **X** Attach a copy of the completed *Notice of Intent to Construct* form to this form
      i. Neighborhood Association(s):____
      ____
      ii. Coalition(s): ____
   b. ☐ Attach a copy of the completed *Public Sign Notice Guideline* form

4. Fill out and submit the *Permit Application*. All applications shall:

   A. **X** be made on a form provided by the Department. Additional text, tables, calculations or clarifying information may also be attached to the form.

   B. **X** at the time of application, include documentary proof that all applicable permit application review fees have been paid as required by 20 NMAC 11.02. Please refer to the attached permit application worksheet.

   C. **X** contain the applicant's name, address, and the names and addresses of all other owners or operators of the emission sources.

   D. **X** contain the name, address, and phone number of a person to contact regarding questions about the facility.

E. **X** indicate the date the application was completed and submitted

F. **X** contain the company name, which identifies this particular site.

G. **X** contain a written description of the facility and/or modification including all operations affecting air emissions.

H. **X** contain the maximum and standard operating schedules for the source after completion of construction or modification in terms of hours per day, days per week, and weeks per year.

I. **X** provide sufficient information to describe the quantities and nature of any regulated air contaminant (including any amount of a hazardous air pollutant) that the source will emit during:
- Normal operation
- Maximum operation
- Abnormal emissions from malfunction, start-up and shutdown

J. **X** include anticipated operational needs to allow for reasonable operational scenarios to avoid delays from needing additional permitting in the future.

K. **X** contain a map, such as a 7.5-minute USGS topographic quadrangle, showing the exact location of the source; and include physical address of the proposed source.

L. **X** contain an aerial photograph showing the proposed location of each process equipment unit involved in the proposed construction, modification, relocation, or technical revision of the source except for federal agencies or departments involved in national defense or national security as confirmed and agreed to by the department in writing.

M. **X** contain the UTM zone and UTM coordinates.

N. **X** include the four digit Standard Industrialized Code (SIC) and the North American Industrial Classification System (NAICS).

O. **X** contain the types and **potential emission rate** amounts of any regulated air contaminants the new source or modification will emit. Complete appropriate sections of the application; attachments can be used to supplement the application, but not replace it.

P. **X** contain the types and **controlled** amounts of any regulated air contaminants the new source or modification will emit. Complete appropriate sections of the application; attachments can be used to supplement the application, but not replace it.

Q. **X** contain the basis or source for each emission rate (include the manufacturer's specification sheets, AP-42 Section sheets, test data, or other data when used as the source).

R. **X** contain all calculations used to estimate **potential emission rate** and **controlled** emissions.

S. **X** contain the basis for the estimated control efficiencies and sufficient engineering data for verification of the control equipment operation, including if necessary, design drawings, test reports, and factors which affect the normal operation (e.g. limits to normal operation).

T. **X** contain fuel data for each existing and/or proposed piece of fuel burning equipment.

U. **X** contain the anticipated maximum production capacity of the entire facility and the requested production capacity after construction and/or modification.

V. **X** contain the stack and exhaust gas parameters for all existing and proposed emission stacks.

W. **X** provide an ambient impact analysis using a atmospheric dispersion model approved by the US Environmental Protection Agency (EPA), and the Department to demonstrate compliance with the ambient air quality standards for the City of Albuquerque and Bernalillo County (See 20.11.01 NMAC). If you are modifying an existing source, the modeling must include the emissions of the entire source to demonstrate the impact the new or modified source(s) will have on existing plant emissions.

X. **X** contain a preliminary operational plan defining the measures to be taken to mitigate source emissions during malfunction, startup, or shutdown.

Y. **X** contain a process flow sheet, including a material balance, of all components of the facility that would be involved in routine operations. Indicate all emission points, including fugitive points.

Z. **X** contain a full description, including all calculations and the basis for all control efficiencies presented, of the equipment to be used for air pollution control. This shall include a process flow sheet or, if the Department so requires, layout and assembly drawings, design plans, test reports and factors which affect the normal equipment operation, including control and/or process equipment operating limitations.

AA. ☐ contain description of the equipment or methods proposed by the applicant to be used for emission measurement.

BB. **X** be signed under oath or affirmation by a corporate officer, authorized to bind the company into legal agreements, certifying to the best of his or her knowledge the truth of all information submitted.

City of Albuquerque – Environmental Health Department
Air Quality Program

Please mail this application to **P.O. Box 1293, Albuquerque, NM 87103**
or hand deliver between 8:00 am – 5:00 pm Monday-Friday to:
3rd Floor, Suite 3023 – One Civic Plaza NW, Albuquerque, NM 87102
(505) 768-1972 aqd@cabq.gov

Application for Air Pollutant Sources in Bernalillo County
Source Registration (20.11.40 NMAC) and Construction Permits (20.11.41 NMAC)

Submittal Date: **October 26, 2021**

Corporate Information ☐ **Check here and leave this section blank if information is exactly the same as Facility Information below.**

Company Name: **Black Rock Services, LLC**			
Mailing Address: **1040 Bosque Farms Blvd**	City: **Bosque Farms**	State: **NM**	Zip: **87068**
Company Phone: **(505) 206-1101**	Company Contact: **Robert Caldwell**		
Company Contact Title: **Owner/Operator**	Phone: **(505) 206-1101**	E-mail: **rcaldwell@blackrock-services.com**	

Stationary Source (Facility) Information: **Provide a plot plan (legal description/drawing of the facility property) with overlay sketch of facility processes, location of emission points, pollutant type, and distances to property boundaries.**

Facility Name: **Black Rock Services HP-2**			
Facility Physical Address: **Northwest corner of Carmony Ln NE and Alexander Blvd NE**	City: **Albuquerque**	State: **NM**	Zip: **87107**
Facility Mailing Address (if different): **None**	City:	State:	Zip:
Facility Contact: **Robert Caldwell**	Title: **Owner/Operator**		
Phone: **(505) 206-1101**	E-mail: **rcaldwell@blackrock-services.com**		
Authorized Representative Name[1]: **Robert Caldwell**	Authorized Representative Title: **Owner/Operator**		

Billing Information ☒ **Check here if same contact and mailing address as corporate** ☐ **Check here if same as facility**

Billing Company Name:			
Mailing Address:	City:	State:	Zip:
Billing Contact:	Title:		
Phone:	E-mail:		

Preparer/Consultant(s) Information ☐ **Check here and leave section blank if no Consultant used or Preparer is same as Facility Contact.**

Name: **Paul Wade**	Title: **Principal**		
Mailing Address: **3500 Comanche Rd NE Suite G**	City: **Albuquerque**	State: **NM**	Zip: **87107**
Phone: **(505) 830-9680 x6**	Email: **pwade@montrose-env.com**		

1. See 20.11.41.13.E.(13) NMAC.

Application for Air Pollutant Sources in Bernalillo County
Source Registration (20.11.40 NMAC) and Construction Permits (20.11.41 NMAC)

General Operation Information (if any question does not pertain to your facility, type N/A on the line or in the box)

Permitting action being requested (please refer to the definitions in 20.11.40 NMAC or 20.11.41 NMAC):			
☒ New Permit	☐ Permit Modification Current Permit #:	☐ Technical Permit Revision Current Permit #:	☐ Administrative Permit Revision Current Permit #:

UTM Coordinates or Latitude – Longitude of Facility: **352000E; 3888500N; Zone 13; NAD 83**	
Facility Type (description of your facility operations): **Hot Mix Asphalt Plant**	
Standard Industrial Classification (SIC Code #): **2951**	North American Industry Classification System (NAICS Code #): **324121**
Is this facility currently operating in Bernalillo County? **No**	If **YES**, list date of original construction: If **NO**, list date of planned startup: **October 2021**
Is the facility permanent? **Yes**	If **NO**, list dates for requested temporary operation: From Through
Is the application for a physical or operational change, expansion, or reconstruction (altering process, or adding, or replacing process or control equipment, etc.) to an existing facility? **No**	
Provide a description of the requested changes:	
Is the facility operation: ☐ Continuous ☒ Intermittent ☐ Batch	

Estimated percent of production/operation:	Jan-Mar: **10**	Apr-Jun: **40**	Jul-Sep: **40**	Oct-Dec: **10**
Requested operating times of facility:	**24** hours/day	**7** days/week	**4.3** weeks/month	**12** months/year

Will there be special or seasonal operating times other than shown above? This includes monthly- or seasonally-varying hours. **Yes**
If **YES**, please explain: **Asphalt Production - December - January; daylight hours: February, October, and November - 17 hours from 5 am to 10 pm: March - September - 24 hours per day**
List raw materials processed: **Sand, Gravel, Mineral Filler, Asphalt Cement, RAP**
List saleable item(s) produced: **Hot Mix Asphalt**

Regulated Emission Sources Table

(Generator-Crusher-Screen-Conveyor-Boiler-Mixer-Spray Guns-Saws-Sander-Oven-Dryer-Furnace-Incinerator-Haul Road-Storage Pile, etc.)
Match the Units listed on this Table to the same numbered line if also listed on Emissions Tables & Stack Table.

Unit Number and Description[1]		Manufacturer	Model #	Serial #	Manufacture Date	Installation Date	Modification Date[2]	Process Rate or Capacity (Hp, kW, Btu, ft[3], lbs, tons, yd[3], etc.)[3]	Fuel Type
1	**Cold Aggregate Storage Piles**	**N/A**	**N/A**	**N/A**	**N/A**	**TBD**	**N/A**	**230-370 tph / 833,750-1,341,250 tpy**	
2	**Cold Aggregate Feed Bins (5)**	**ALmix**	**UF 400**	**1109**	**2014**	**TBD**	**N/A**	**230-370 tph / 833,750-1,341,250 tpy**	
3	**Cold Aggregate Feed Conveyor**					**TBD**	**N/A**	**230-370 tph / 833,750-1,341,250 tpy**	
4	**Cold Aggregate Scalping Screen**					**TBD**	**N/A**	**230-370 tph / 833,750-1,341,250 tpy**	
5	**Scalping Screen Conveyor**					**TBD**	**N/A**	**230-370 tph / 833,750-1,341,250 tpy**	
6	**Slinger Conveyor**					**TBD**	**N/A**	**230-370 tph / 833,750-1,341,250 tpy**	
7	**RAP Storage Pile**	**N/A**	**N/A**	**N/A**	**N/A**	**TBD**	**N/A**	**0-140 tph / 0-507,500 tpy**	
8	**RAP Feed Bins (2)**	**ALmix**	**UF 400**	**1109**	**2014**	**TBD**	**N/A**	**0-140 tph / 0-507,500 tpy**	
9	**RAP Feed Conveyor**					**TBD**	**N/A**	**0-140 tph / 0-507,500 tpy**	
10	**RAP Scalping Screen**					**TBD**	**N/A**	**0-140 tph / 0-507,500 tpy**	
11	**RAP Recycle Conveyor**					**TBD**	**N/A**	**0-140 tph / 0-507,500 tpy**	
12	**RAP Crusher**					**TBD**	**N/A**	**0-140 tph / 0-507,500 tpy**	
13	**RAP Transfer Conveyor**					**TBD**	**N/A**	**0-140 tph / 0-507,500 tpy**	
14	**RAP Transfer Conveyor**					**TBD**	**N/A**	**0-140 tph / 0-507,500 tpy**	
15	**Mineral Filler Silo**					**TBD**	**N/A**	**25 tph / 21,750 tpy**	
16	**Drum Dryer/Mixer**					**TBD**	**N/A**	**400 tph / 1,450,000 tpy**	**Natural Gas**
17	**Asphalt Drag Conveyor**					**TBD**	**N/A**	**400 tph / 1,450,000 tpy**	
18	**Asphalt Storage Silos (6)**					**TBD**	**N/A**	**400 tph / 1,450,000 tpy**	
19	**Asphalt Storage Tanks (3)**					**TBD**	**N/A**	**45,000 gallons each**	
20	**Asphalt Heater**	**Heatec**	**HCS-175**			**TBD**	**N/A**	**2 MMBtu**	**Natural Gas**

Unit Number and Description[1]		Manufacturer	Model #	Serial #	Manufacture Date	Installation Date	Modification Date[2]	Process Rate or Capacity (Hp, kW, Btu, ft^3, lbs, tons, yd^3, etc.)[3]	Fuel Type
21	**Haul Road Traffic**	**N/A**	**N/A**	**N/A**	**N/A**	**TBD**	**N/A**	**32 truck per hour**	
22	**HMA Yard**	**N/A**	**N/A**	**N/A**	**N/A**	**TBD**	**N/A**	**400 tph / 1,450,000 tpy**	
								/	
								/	
								/	

NOTE: To add extra rows in Word, click anywhere in the last row. A plus (+) sign should appear on the bottom right corner of the row. Click the plus (+) sign to add a row. Repeat as needed.

1. Unit numbers must correspond to unit numbers in the previous permit unless a complete cross reference table of all units in both permits is provided.
2. Have changes been made to the unit that impact emissions or that trigger modification as defined in 20.11.41.7.U NMAC?
3. Basis for Equipment Process Rate or Capacity (Manufacturer's data, Field observation/test, etc.) **Manufaturer's Data**
   Submit information for each unit as an attachment.

Emissions Control Equipment Table

Control Equipment Units listed on this Table should either match up to the same Unit number as listed on the Regulated Emission Sources, Controlled Emissions and Stack Parameters Tables (if the control equipment is integrated with the emission unit) or should have a distinct Control Equipment Unit Number and that number should then also be listed on the Stack Parameters Table.

Control Equipment Unit Number and Description		Controlling Emissions for Unit Number(s)	Manufacturer	Model # | Serial #	Date Installed	Controlled Pollutant(s)	% Control Efficiency[1]	Method Used to Estimate Efficiency	Rated Process Rate or Capacity or Flow
3b	**Additional Moisture Content**	**3**	**TBD**	**TBD | TBD**	**TBD**	**PM10, PM2.5**	**95.82**	**AP-42 11.19.2, PM10**	**230-370 tph**
4b	**Additional Moisture Content**	**4**	**TBD**	**TBD | TBD**	**TBD**	**PM10, PM2.5**	**91.49**	**AP-42 11.19.2, PM10**	**230-370 tph**
5b	**Additional Moisture Content**	**5**	**TBD**	**TBD | TBD**	**TBD**	**PM10, PM2.5**	**95.82**	**AP-42 11.19.2, PM10**	**230-370 tph**
6b	**Additional Moisture Content**	**6**	**TBD**	**TBD | TBD**	**TBD**	**PM10, PM2.5**	**95.82**	**AP-42 11.19.2, PM10**	**230-370 tph**
9b	**Additional Moisture Content**	**9**	**TBD**	**TBD | TBD**	**TBD**	**PM10, PM2.5**	**95.82**	**AP-42 11.19.2, PM10**	**0-140 tph**
10b	**Additional Moisture Content**	**10**	**TBD**	**TBD | TBD**	**TBD**	**PM10, PM2.5**	**91.49**	**AP-42 11.19.2, PM10**	**0-140 tph**
11b	**Additional Moisture Content**	**11**	**TBD**	**TBD | TBD**	**TBD**	**PM10, PM2.5**	**95.82**	**AP-42 11.19.2, PM10**	**0-140 tph**
12b	**Additional Moisture Content**	**12**	**TBD**	**TBD | TBD**	**TBD**	**PM10, PM2.5**	**77.5**	**AP-42 11.19.2, PM10**	**0-140 tph**
13b	**Additional Moisture Content**	**13**	**TBD**	**TBD | TBD**	**TBD**	**PM10, PM2.5**	**95.82**	**AP-42 11.19.2, PM10**	**0-140 tph**
14b	**Additional Moisture Content**	**14**	**TBD**	**TBD | TBD**	**TBD**	**PM10, PM2.5**	**95.82**	**AP-42 11.19.2, PM10**	**0-140 tph**
15b	**Baghouse**	**15**	**ALmix**	**TBD | TBD**	**TBD**	**PM10, PM2.5**	**99.0**	**EPA AP-42 Table B2-3**	**Max. 25 tph, Ave. 6 tph**
16b	**Baghouse**	**16**	**ALmix**	**TBD | TBD**	**TBD**	**PM10, PM2.5**	**99.65**	**AP-42 11.1, PM10**	**400 tph**
17b	**Blue Smoke Collector**	**17**	**ALmix**	**TBD | TBD**	**TBD**	**PM10, PM2.5**	**60.0**	**Engineering Judgement**	**400 tph**

NOTE: To add extra rows in Word, click anywhere in the last row. A plus (+) sign should appear on the bottom right corner of the row. Click the plus (+) sign to add a row. Repeat as needed.

1. Basis for Control Equipment % Efficiency (Manufacturers data, Field Observation/Test, AP-42, etc.). **AP-42, Engineering Judgement**
   Submit information for each unit as an attachment.

Exempted Sources and Exempted Activities Table

See 20.11.41 for exemptions.

Unit Number and Description		Manufacturer	Model #	Serial #	Manufacture Date	Installation Date	Modification Date[1]	Process Rate or Capacity (Hp, kW, Btu, ft^3, lbs, tons, yd^3, etc.)[2]	Fuel Type
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NOTE: To add extra rows in Word, click anywhere in the last row. A plus (+) sign should appear on the bottom right corner of the row. Click the plus (+) sign to add a row. Repeat as needed.

1. Have changes been made to the unit that impact emissions, that trigger modification as defined in 20.11.41.7.U NMAC, or that change the status from exempt to non-exempt?
2. Basis for Equipment Process Rate or Capacity (Manufacturer's data, Field observation/test, etc.) _____
   Submit information for each unit as an attachment.

Uncontrolled Emissions Table - RAP 35% in Mix

(Process potential under physical/operational limitations during a 24 hr/day and 365 day/year = 8760 hrs)

Regulated Emission Units listed on this Table should match up to the same numbered line and Unit as listed on the Regulated Emissions and Controlled Tables. List total HAP values per Emission Unit if overall HAP total for the facility is ≥ 1 ton/yr.

<table>
<tr><th rowspan="2">Unit Number*</th><th colspan="2">Nitrogen Oxides (NO_X)</th><th colspan="2">Carbon Monoxide (CO)</th><th colspan="2">Nonmethane Hydrocarbons/Volatile Organic Compounds (NMHC/VOCs)</th><th colspan="2">Sulfur Dioxide (SO_2)</th><th colspan="2">Particulate Matter ≤ 10 Microns (PM_{10})</th><th colspan="2">Particulate Matter ≤ 2.5 Microns ($PM_{2.5}$)</th><th colspan="2">Hazardous Air Pollutants (HAPs)</th><th rowspan="2">Method(s) used for Determination of Emissions (AP-42, Material Balance, Field Tests, etc.)</th></tr>
<tr><th>lb/hr</th><th>ton/yr</th><th>lb/hr</th><th>ton/yr</th><th>lb/hr</th><th>ton/yr</th><th>lb/hr</th><th>ton/yr</th><th>lb/hr</th><th>ton/yr</th><th>lb/hr</th><th>ton/yr</th><th>lb/hr</th><th>ton/yr</th></tr>
<tr><td>**1**</td><td colspan="8" rowspan="6">**Particulate emission rates for Units 1 through 6 were estimated using the maximum input of aggregate into the plant of 230 tons per hour.**</td><td>0.51</td><td>2.25</td><td>0.078</td><td>0.34</td><td></td><td></td><td>**AP-42 13.2.4**</td></tr>
<tr><td>**2**</td><td>0.51</td><td>2.25</td><td>0.078</td><td>0.34</td><td></td><td></td><td>**AP-42 13.2.4**</td></tr>
<tr><td>**3**</td><td>0.25</td><td>1.11</td><td>0.039</td><td>0.17</td><td></td><td></td><td>**AP-42 11.19.2**</td></tr>
<tr><td>**4**</td><td>2.00</td><td>8.76</td><td>0.30</td><td>1.33</td><td></td><td></td><td>**AP-42 11.19.2**</td></tr>
<tr><td>**5**</td><td>0.25</td><td>1.11</td><td>0.039</td><td>0.17</td><td></td><td></td><td>**AP-42 11.19.2**</td></tr>
<tr><td>**6**</td><td>0.25</td><td>1.11</td><td>0.039</td><td>0.17</td><td></td><td></td><td>**AP-42 11.19.2**</td></tr>
<tr><td>**7**</td><td colspan="8" rowspan="8">**Particulate emission rates for Units 7 through 14 were estimated using the maximum input of RAP into the plant of 140 tons per hour.**</td><td>0.094</td><td>0.41</td><td>0.014</td><td>0.062</td><td></td><td></td><td>**AP-42 13.2.4 and EIIP Volume 2, Chapter 3, Table 3.2-1**</td></tr>
<tr><td>**8**</td><td>0.094</td><td>0.41</td><td>0.014</td><td>0.062</td><td></td><td></td><td>**AP-42 13.2.4 and EIIP Volume 2, Chapter 3, Table 3.2-1**</td></tr>
<tr><td>**9**</td><td>0.15</td><td>0.67</td><td>0.024</td><td>0.10</td><td></td><td></td><td>**AP-42 11.19.2**</td></tr>
<tr><td>**10**</td><td>1.22</td><td>5.33</td><td>0.18</td><td>0.81</td><td></td><td></td><td>**AP-42 11.19.2**</td></tr>
<tr><td>**11**</td><td>0.15</td><td>0.67</td><td>0.024</td><td>0.10</td><td></td><td></td><td>**AP-42 11.19.2**</td></tr>
<tr><td>**12**</td><td>0.34</td><td>1.47</td><td>0.051</td><td>0.22</td><td></td><td></td><td>**AP-42 11.19.2**</td></tr>
<tr><td>**13**</td><td>0.15</td><td>0.67</td><td>0.024</td><td>0.10</td><td></td><td></td><td>**AP-42 11.19.2**</td></tr>
<tr><td>**14**</td><td>0.15</td><td>0.67</td><td>0.024</td><td>0.10</td><td></td><td></td><td>**AP-42 11.19.2**</td></tr>
<tr><td>**15**</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>11.8</td><td>12.4</td><td>2.33</td><td>2.44</td><td></td><td></td><td>**AP-42 11.12**</td></tr>
</table>

Unit Number*	Nitrogen Oxides (NO_X)		Carbon Monoxide (CO)		Nonmethane Hydrocarbons/Volatile Organic Compounds (NMHC/VOCs)		Sulfur Dioxide (SO_2)		Particulate Matter ≤ 10 Microns (PM_{10})		Particulate Matter ≤ 2.5 Microns ($PM_{2.5}$)		Hazardous Air Pollutants (HAPs)		Method(s) used for Determination of Emissions (AP-42, Material Balance, Field Tests, etc.)
	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	
16	10.4	45.6	52.0	227.8	12.8	56.1	1.36	5.96	2600	11388	626	2742	2.15	9.43	**AP-42 11.1**
17			0.47	2.07	4.87	21.35			0.23	1.03	0.23	1.03			**AP-42 11.1**
18			0.17	0.76	0.54	2.35			0.12	0.51	0.12	0.51			**AP-42 11.1**
19					0.071	0.31									**TANKS 4.0.9d**
20	0.26	1.14	0.22	0.96	0.029	0.13	0.0056	0.024	0.020	0.087	0.020	0.087	0.0049	0.021	**AP-42 1.4, SO_2 - Mass Balance**
21	**RAP input of 35%**								0.15	0.67	0.038	0.16			**AP-42 13.1**
22			0.14	0.62	0.44	1.93									**AP-42 11.1**
Totals of Uncontrolled Emissions with RAP input of 140 tph into mix	**10.7**	**46.7**	**53.0**	**232.2**	**18.8**	**82.1**	**1.37**	**5.98**	**2618**	**11430**	**630**	**2750**	**2.16**	**9.45**	

NOTE: To add extra rows in Word, click anywhere in the second-to-last row. A plus (+) sign should appear on the bottom right corner of the row. Click the plus (+) sign to add a row. Repeat as needed.

*A permit is required and this application along with the additional checklist information requested on the Permit Application checklist must be provided if:

(1) any one of these process units or combination of units, has an uncontrolled emission rate greater than or equal to (≥) 10 lbs/hr or 25 tons/yr for any of the above pollutants, excluding HAPs, based on 8,760 hrs of operation; or

(2) any one of these process units or combination of units, has an uncontrolled emission rate ≥ 2 tons/yr for any single HAP or ≥ 5 tons/yr for any combination of HAPs based on 8,760 hours of operation; or

(3) any one of the process units or combination of units is subject to an Air Board or federal emission limit or standard.

* If all of these process units, individually and in combination, have an uncontrolled emission rate less than (<) 10 lbs/hr or 25 tons/yr for all of the above pollutants (based on 8,760 hrs of operation), but > 1 ton/yr for any of the above pollutants, then a source registration is required. A Registration is required, at minimum, for any amount of HAP emissions. Please complete the remainder of this form.

Application for Air Pollutant Sources in Bernalillo County
Source Registration (20.11.40 NMAC) and Construction Permits (20.11.41 NMAC)
Uncontrolled Emissions Table - RAP 0% in Mix

(Process potential under physical/operational limitations during a 24 hr/day and 365 day/year = 8760 hrs)

Regulated Emission Units listed on this Table should match up to the same numbered line and Unit as listed on the Regulated Emissions and Controlled Tables. List total HAP values per Emission Unit if overall HAP total for the facility is ≥ 1 ton/yr.

Unit Number*	Nitrogen Oxides (NO_X)		Carbon Monoxide (CO)		Nonmethane Hydrocarbons/Volatile Organic Compounds (NMHC/VOCs)		Sulfur Dioxide (SO_2)		Particulate Matter ≤ 10 Microns (PM_{10})		Particulate Matter ≤ 2.5 Microns ($PM_{2.5}$)		Hazardous Air Pollutants (HAPs)		Method(s) used for Determination of Emissions (AP-42, Material Balance, Field Tests, etc.)
	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	
1	**Particulate emission rates for Units 1 through 6 were estimated using the maximum input of aggregate into the plant of 370 tons per hour.**								0.83	3.62	0.13	0.55			**AP-42 13.2.4**
2									0.83	3.62	0.13	0.55			**AP-42 13.2.4**
3									0.41	1.78	0.063	0.28			**AP-42 11.19.2**
4									3.22	14.10	0.49	2.14			**AP-42 11.19.2**
5									0.41	1.78	0.063	0.28			**AP-42 11.19.2**
6									0.41	1.78	0.063	0.28			**AP-42 11.19.2**
7	**Particulate emission rates for Units 7 through 14 were estimated using the maximum input of RAP into the plant of 0 tons per hour.**								0.0	0.0	0.0	0.0			**AP-42 13.2.4 and EIIP Volume 2, Chapter 3, Table 3.2-1**
8									0.0	0.0	0.0	0.0			**AP-42 13.2.4 and EIIP Volume 2, Chapter 3, Table 3.2-1**
9									0.0	0.0	0.0	0.0			**AP-42 11.19.2**
10									0.0	0.0	0.0	0.0			**AP-42 11.19.2**
11									0.0	0.0	0.0	0.0			**AP-42 11.19.2**
12									0.0	0.0	0.0	0.0			**AP-42 11.19.2**
13									0.0	0.0	0.0	0.0			**AP-42 11.19.2**
14									0.0	0.0	0.0	0.0			**AP-42 11.19.2**
15									11.8	12.4	2.33	2.44			**AP-42 11.12**

Unit Number*	Nitrogen Oxides (NO_X)		Carbon Monoxide (CO)		Nonmethane Hydrocarbons/Volatile Organic Compounds (NMHC/VOCs)		Sulfur Dioxide (SO_2)		Particulate Matter ≤ 10 Microns (PM_{10})		Particulate Matter ≤ 2.5 Microns ($PM_{2.5}$)		Hazardous Air Pollutants (HAPs)		Method(s) used for Determination of Emissions (AP-42, Material Balance, Field Tests, etc.)
	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	
16	10.4	45.6	52.0	227.8	12.8	56.1	1.36	5.96	2600	11388	626	2742	2.15	9.43	**AP-42 11.1**
17			0.47	2.07	4.87	21.35			0.23	1.03	0.23	1.03			**AP-42 11.1**
18			0.17	0.76	0.54	2.35			0.12	0.51	0.12	0.51			**AP-42 11.1**
19					0.071	0.31									**TANKS 4.0.9d**
20	0.26	1.14	0.22	0.96	0.029	0.13	0.0056	0.024	0.020	0.087	0.020	0.087	0.0049	0.021	**AP-42 1.4, SO_2 - Mass Balance**
21	**RAP input of 0%**								0.15	0.66	0.037	0.16			**AP-42 13.1**
22			0.14	0.62	0.44	1.93									**AP-42 11.1**
Totals of Uncontrolled Emissions with Aggregate input of 370 tph into mix	**10.7**	**46.7**	**53.0**	**232.2**	**18.8**	**82.1**	**1.37**	**5.98**	**2618**	**11429**	**630**	**2750**	**2.16**	**9.45**	

NOTE: To add extra rows in Word, click anywhere in the second-to-last row. A plus (+) sign should appear on the bottom right corner of the row. Click the plus (+) sign to add a row. Repeat as needed.

*A permit is required and this application along with the additional checklist information requested on the Permit Application checklist must be provided if:

(1) any one of these process units <u>or</u> combination of units, has an uncontrolled emission rate greater than or equal to (≥) 10 lbs/hr or 25 tons/yr for any of the above pollutants, excluding HAPs, based on 8,760 hrs of operation; or

(2) any one of these process units <u>or</u> combination of units, has an uncontrolled emission rate ≥ 2 tons/yr for any single HAP or ≥ 5 tons/yr for any combination of HAPs based on 8,760 hours of operation; or

(3) any one of the process units <u>or</u> combination of units is subject to an Air Board or federal emission limit or standard.

* If all of these process units, individually <u>and</u> in combination, have an uncontrolled emission rate less than (<) 10 lbs/hr or 25 tons/yr for all of the above pollutants (based on 8,760 hrs of operation), but > 1 ton/yr for any of the above pollutants, then a source registration is required. <u>A Registration is required, at minimum, for any amount of HAP emissions. Please complete the remainder of this form.</u>

Controlled Emissions Table - RAP 35% in Mix

(Based on current operations with emission controls OR requested operations with emission controls)

Regulated Emission Units listed on this Table should match up to the same numbered line and Unit as listed on the Regulated Emissions and Uncontrolled Tables. List total HAP values per Emission Unit if overall HAP total for the facility is ≥ 1 ton/yr.

Unit Number	Nitrogen Oxides (NO_X)		Carbon Monoxide (CO)		Nonmethane Hydrocarbons/Volatile Organic Compounds (NMHC/VOCs)		Sulfur Dioxide (SO_2)		Particulate Matter ≤ 10 Microns (PM_{10})		Particulate Matter ≤ 2.5 Microns ($PM_{2.5}$)		Hazardous Air Pollutants (HAPs)		Control Method	% Efficiency[1]
	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr		
1	**Particulate emission rates for Units 1 through 6 were estimated using the maximum input of aggregate into the plant of 230 tons per hour.**								0.51	0.93	0.078	0.14				
2									0.51	0.93	0.078	0.14				
3									0.011	0.019	0.0030	0.0054			Additional Moisture Content	95.82
4									0.17	0.31	0.012	0.021			Additional Moisture Content	91.49
5									0.011	0.019	0.0030	0.0054			Additional Moisture Content	95.82
6									0.011	0.019	0.0030	0.0054			Additional Moisture Content	95.82
7	**Particulate emission rates for Units 7 through 14 were estimated using the maximum input of RAP into the plant of 140 tons per hour.**								0.094	0.17	0.014	0.026				
8									0.094	0.17	0.014	0.026				
9									0.0064	0.012	0.0018	0.0033			Additional Moisture Content	95.82
10									0.10	0.19	0.0070	0.013			Additional Moisture Content	91.49
11									0.0064	0.012	0.0018	0.0033			Additional Moisture Content	95.82
12									0.076	0.14	0.014	0.025			Additional Moisture Content	77.5

Unit Number	Nitrogen Oxides (NO_X)		Carbon Monoxide (CO)		Nonmethane Hydrocarbons/Volatile Organic Compounds (NMHC/VOCs)		Sulfur Dioxide (SO_2)		Particulate Matter ≤ 10 Microns (PM_{10})		Particulate Matter ≤ 2.5 Microns ($PM_{2.5}$)		Hazardous Air Pollutants (HAPs)		Control Method	% Efficiency[1]
	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr		
13									0.0064	0.012	0.0018	0.0033			Additional Moisture Content	95.82
14									0.0064	0.012	0.0018	0.0033			Additional Moisture Content	95.82
15									0.12	0.051	0.027	0.012			Baghouse	99.0
16	10.4	18.9	52.0	94.3	12.8	23.2	1.36	2.47	9.20	16.7	9.20	16.7	2.15	3.90	Baghouse	99.65
17			0.19	0.34	1.95	3.53			0.094	0.17	0.094	0.17			Blue Smoke Collector	60.0
18			0.17	0.32	0.54	0.97			0.12	0.21	0.12	0.21				
19					0.071	0.31										
20	0.26	1.14	0.22	0.96	0.029	0.13	0.0056	0.024	0.020	0.087	0.020	0.087	0.0049	0.022		
21	**RAP input of 35%**								0.15	0.27	0.038	0.065				
22			0.14	0.26	0.44	0.80										
Totals of Controlled Emissions with RAP input of 140 tph into mix	**10.7**	**20.0**	**52.7**	**96.1**	**15.8**	**28.9**	**1.37**	**2.49**	**11.3**	**20.4**	**9.73**	**17.6**	**2.16**	**3.92**		

NOTE: To add extra rows in Word, click anywhere in the second-to-last row. A plus (+) sign should appear on the bottom right corner of the row. Click the plus (+) sign to add a row. Repeat as needed.

1. Basis for Control Equipment % Efficiency (Manufacturers data, Field Observation/Test, AP-42, etc.). **AP-42**
   Submit information for each unit as an attachment.

Application for Air Pollutant Sources in Bernalillo County
Source Registration (20.11.40 NMAC) and Construction Permits (20.11.41 NMAC)
Controlled Emissions Table - RAP 0% in Mix

(Based on current operations with emission controls OR requested operations with emission controls)

Regulated Emission Units listed on this Table should match up to the same numbered line and Unit as listed on the Regulated Emissions and Uncontrolled Tables. List total HAP values per Emission Unit if overall HAP total for the facility is ≥ 1 ton/yr.

Unit Number	Nitrogen Oxides (NO_X)		Carbon Monoxide (CO)		Nonmethane Hydrocarbons/Volatile Organic Compounds (NMHC/VOCs)		Sulfur Dioxide (SO_2)		Particulate Matter ≤ 10 Microns (PM_{10})		Particulate Matter ≤ 2.5 Microns ($PM_{2.5}$)		Hazardous Air Pollutants (HAPs)		Control Method	% Efficiency[1]
	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr		
1	**Particulate emission rates for Units 1 through 6 were estimated using the maximum input of aggregate into the plant of 370 tons per hour.**								0.83	1.50	0.13	0.23				
2									0.83	1.50	0.13	0.23				
3									0.017	0.031	0.0048	0.0087			Additional Moisture Content	95.82
4									0.27	0.50	0.019	0.034			Additional Moisture Content	91.49
5									0.017	0.031	0.0048	0.0087			Additional Moisture Content	95.82
6									0.017	0.031	0.0048	0.0087			Additional Moisture Content	95.82
7	**Particulate emission rates for Units 7 through 14 were estimated using the maximum input of RAP into the plant of 0 tons per hour.**								0.0	0.0	0.0	0.0				
8									0.0	0.0	0.0	0.0				
9									0.0	0.0	0.0	0.0			Additional Moisture Content	95.82
10									0.0	0.0	0.0	0.0			Additional Moisture Content	91.49
11									0.0	0.0	0.0	0.0			Additional Moisture Content	95.82
12									0.0	0.0	0.0	0.0			Additional Moisture Content	77.5

Unit Number	Nitrogen Oxides (NO_X)		Carbon Monoxide (CO)		Nonmethane Hydrocarbons/Volatile Organic Compounds (NMHC/VOCs)		Sulfur Dioxide (SO_2)		Particulate Matter ≤ 10 Microns (PM_{10})		Particulate Matter ≤ 2.5 Microns ($PM_{2.5}$)		Hazardous Air Pollutants (HAPs)		Control Method	% Efficiency[1]
	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr		
13									0.0	0.0	0.0	0.0			Additional Moisture Content	95.82
14									0.0	0.0	0.0	0.0			Additional Moisture Content	95.82
15									0.12	0.051	0.027	0.012			Baghouse	99.0
16	10.4	18.9	52.0	94.3	12.8	23.2	1.36	2.47	9.20	16.7	9.20	16.7	2.15	3.90	Baghouse	99.65
17			0.19	0.34	1.95	3.53			0.094	0.17	0.094	0.17			Blue Smoke Collector	60.0
18			0.17	0.32	0.54	0.97			0.12	0.21	0.12	0.21				
19					0.071	0.31										
20	0.26	1.14	0.22	0.96	0.029	0.13	0.0056	0.024	0.020	0.087	0.020	0.087	0.0049	0.022		
21	**RAP input of 0%**								0.15	0.26	0.037	0.064				
22			0.14	0.26	0.44	0.80										
Totals of Controlled Emissions with Aggregate input of 370 tph into mix	**10.7**	**20.0**	**52.7**	**96.1**	**15.8**	**28.9**	**1.37**	**2.49**	**11.7**	**21.0**	**9.78**	**17.7**	**2.16**	**3.92**		

NOTE: To add extra rows in Word, click anywhere in the second-to-last row. A plus (+) sign should appear on the bottom right corner of the row. Click the plus (+) sign to add a row. Repeat as needed.

1. Basis for Control Equipment % Efficiency (Manufacturers data, Field Observation/Test, AP-42, etc.). **AP-42**

Submit information for each unit as an attachment.

Hazardous Air Pollutants (HAPs) Emissions Table

Report the Potential Emission Rate for each HAP from each source on the Regulated Emission Sources Table that emits a given HAP. Report individual HAPs with ≥ 1 ton/yr total emissions for the facility on this table. Otherwise, report total HAP emissions for each source that emits HAPs and report individual HAPs in the accompanying application package in association with emission calculations. If this application is for a Registration solely due to HAP emissions, report the largest HAP emissions on this table and the rest, if any, in the accompanying application package.

Unit Number	Total HAPs		Formaldehyde													
	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr
16	2.15	3.90	1.24	2.25												
20	0.0049	0.021														
Totals of HAPs for all units:	**2.16**	**3.92**	**1.24**	**2.25**												

NOTE: To add extra rows in Word, click anywhere in the second-to-last row. A plus (+) sign should appear on the bottom right corner of the row. Click the plus (+) sign to add a row. Repeat as needed.

Copy and paste the HAPs table here if need to list more individual HAPs.

Purchased Hazardous Air Pollutant Table*

Product Categories (Coatings, Solvents, Thinners, etc.)	Hazardous Air Pollutant (HAP), or Volatile Hazardous Air Pollutant (VHAP) Primary To The Representative As Purchased Product	Chemical Abstract Service Number (CAS) of HAP or VHAP from Representative As Purchased Product	HAP or VHAP Concentration of Representative As Purchased Product (pounds/gallon, or %)	Concentration Determination (CPDS, MSDS, etc.)[1]	Total Product Purchases For Category	(-)	Quantity of Product Recovered & Disposed For Category	(=)	Total Product Usage For Category
1. N/A					lbs/yr gal/yr	(-)	lbs/yr gal/yr	(=)	lbs/yr gal/yr
2.					lbs/yr gal/yr	(-)	lbs/yr gal/yr	(=)	lbs/yr gal/yr
3.					lbs/yr gal/yr	(-)	lbs/yr gal/yr	(=)	lbs/yr gal/yr
4.					lbs/yr gal/yr	(-)	lbs/yr gal/yr	(=)	lbs/yr gal/yr
5.					lbs/yr gal/yr	(-)	lbs/yr gal/yr	(=)	lbs/yr gal/yr
6.					lbs/yr gal/yr	(-)	lbs/yr gal/yr	(=)	lbs/yr gal/yr
7.					lbs/yr gal/yr	(-)	lbs/yr gal/yr	(=)	lbs/yr gal/yr
8.					lbs/yr gal/yr	(-)	lbs/yr gal/yr	(=)	lbs/yr gal/yr
9.					lbs/yr gal/yr	(-)	lbs/yr gal/yr	(=)	lbs/yr gal/yr
.					lbs/yr gal/yr	(-)	lbs/yr gal/yr	(=)	lbs/yr gal/yr
TOTALS					lbs/yr gal/yr	(-)	lbs/yr gal/yr	(=)	lbs/yr gal/yr

NOTE: To add extra rows in Word, click anywhere in the second-to-last row. A plus (+) sign should appear on the bottom right corner of the row. Click the plus (+) sign to add a row. Repeat as needed.

1. Submit, as an attachment, information on one (1) product from each Category listed above which best represents the average of all the products purchased in that Category.

***NOTE: A Registration is required, at minimum, for any amount of HAP or VHAP emission.**
Emissions from purchased HAP usage should be accounted for on previous tables as appropriate.
A permit may be required for these emissions if the source meets the requirements of 20.11.41.

Material and Fuel Storage Table

(Tanks, barrels, silos, stockpiles, etc.)

Storage Equipment		Product Stored	Capacity (bbls, tons, gals, acres, etc.)	Above or Below Ground	Construction (Welded, riveted) & Color	Installation Date	Loading Rate[1]	Offloading Rate[1]	True Vapor Pressure	Control Equipment	Seal Type	% Eff.[2]
1	**Storage Piles**	**Aggregate**	**0.7 Acres**	**Above**	**N/A**	**TBD**	**25 tons/truck**	**230-370 tph**	**N/A**	**N/A**	**N/A**	**N/A**
2	**Storage Pile**	**RAP**	**0.15 Acres**	**Above**	**N/A**	**TBD**	**25 tons/truck**	**0-140 tph**	**N/A**	**N/A**	**N/A**	**N/A**
T1	**Tank**	**Asphalt Cement**	**45,000 Gal**	**Above**	**Welded/Silver**	**TBD**	**8000 gal/truck**	**1735 gal/hr**	**0.035 Psia**	**N/A**	**N/A**	**N/A**
T2	**Tank**	**Asphalt Cement**	**45,000 Gal**	**Above**	**Welded/Silver**	**TBD**	**8000 gal/truck**	**1735 gal/hr**	**0.035 Psia**	**N/A**	**N/A**	**N/A**
T3	**Tank**	**Asphalt Cement**	**45,000 Gal**	**Above**	**Welded/Silver**	**TBD**	**8000 gal/truck**	**1735 gal/hr**	**0.035 Psia**	**N/A**	**N/A**	**N/A**
T4	**Tank**	**Evotherm**	**5,000 Gal**	**Above**	**Welded/White**	**TBD**	**5000 gal/truck**	**96.4 gal/hr Max**	**N/A**	**N/A**	**N/A**	**N/A**
T5	**Tank**	**Water**	**10,000 Gal**	**Above**	**Welded/White**	**TBD**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
T6	**Silo**	**Mineral Filler**	**25 TPH**	**Above**	**N/A**	**TBD**	**25 TPH**	**6 TPH**	**N/A**	**Baghouse**	**N/A**	**99.0**
T7-12	**Silos**	**Asphalt**	**400 TPH**	**Above**	**N/A**	**TBD**	**400 TPH**	**400 TPH**	**N/A**	**N/A**	**N/A**	**N/A**

NOTE: To add extra rows in Word, click anywhere in the last row. A plus (+) sign should appear on the bottom right corner of the row. Click the plus (+) sign to add a row. Repeat as needed.

1. Basis for Loading/Offloading Rate (Manufacturer's data, Field Observation/Test, etc.). **Loading – Delivery Truck Capacity; Offloading – Maximum Plant Throughput**
   Submit information for each unit as an attachment.
2. Basis for Control Equipment % Efficiency (Manufacturer's data, Field Observation/Test, AP-42, etc.). **N/A**
   Submit information for each unit as an attachment.

Stack Parameters Table

If any equipment from the Regulated Emission Sources Table is also listed in this Stack Table, use the same numbered line for the emission unit on both tables to show the association between the Process Equipment and its stack.

Unit Number and Description		Pollutant (CO, NOx, PM10, etc.)	UTM Easting (m)	UTM Northing (m)	Stack Height (ft)	Stack Exit Temp. (°F)	Stack Velocity (fps)	Stack Flow Rate	Stack Inside Diameter (ft)	Stack Type
15	**Mineral Filler Silo**	**PM_{10}, $PM_{2.5}$**	**352006.0**	**3888510.0**	**47.0**	**Ambient**	**42.44**	**500 ACFM**	**0.5**	**Horizontal**
16	**Drum Dryer/Mixer**	**NOx, CO, SO_2, VOC, PM_{10}, $PM_{2.5}$, H_2S, Asphalt Fumes**	**351989.1**	**38885524.4**	**23.19**	**240**	**74.89**	**75000 ACFM**	**4.61**	**Vertical**
19	**Asphalt Cement Storage Tanks (3 total)**	**VOC, Asphalt Fumes**	**352028.9**	**3888493.8**	**61.5**	**350**	**0.001 m/s**		**0.001 m**	**Vertical**
		VOC, Asphalt Fumes	**352033.1**	**3888492.6**	**61.5**	**350**	**0.001 m/s**		**0.001 m**	**Vertical**
		VOC, Asphalt Fumes	**352037.2**	**3888491.3**	**61.5**	**350**	**0.001 m/s**		**0.001 m**	**Vertical**
20	**Asphalt Heater**	**NOx, CO, SO_2, VOC, PM_{10}, $PM_{2.5}$**	**352031.5**	**3888495.7**	**12.0**	**600**	**20.71**	**976 ACFM**	**1.0**	**Rain Cap**
										Select
										Select

NOTE: To add extra rows in Word, click anywhere in the last row. A plus (+) sign should appear on the bottom right corner of the row. Click the plus (+) sign to add a row. Repeat as needed.

I, the undersigned, an authorized representative of the applicant company, certify that to the best of my knowledge, the information stated on this application, together with associated drawings, specifications, and other data, give a true and complete representation of the existing, modified existing, or planned new stationary source with respect to air pollution sources and control equipment. I also understand that any significant omissions, errors, or misrepresentations in these data will be cause for revocation of part or all of the resulting registration or permit.

Signed this 26 day of October, 2021

Robert Caldwell
Print Name

Owner/Operator
Print Title

R. Caldwell
Signature

Attachment A
Facility Process Flow Diagrams and Plot Plan

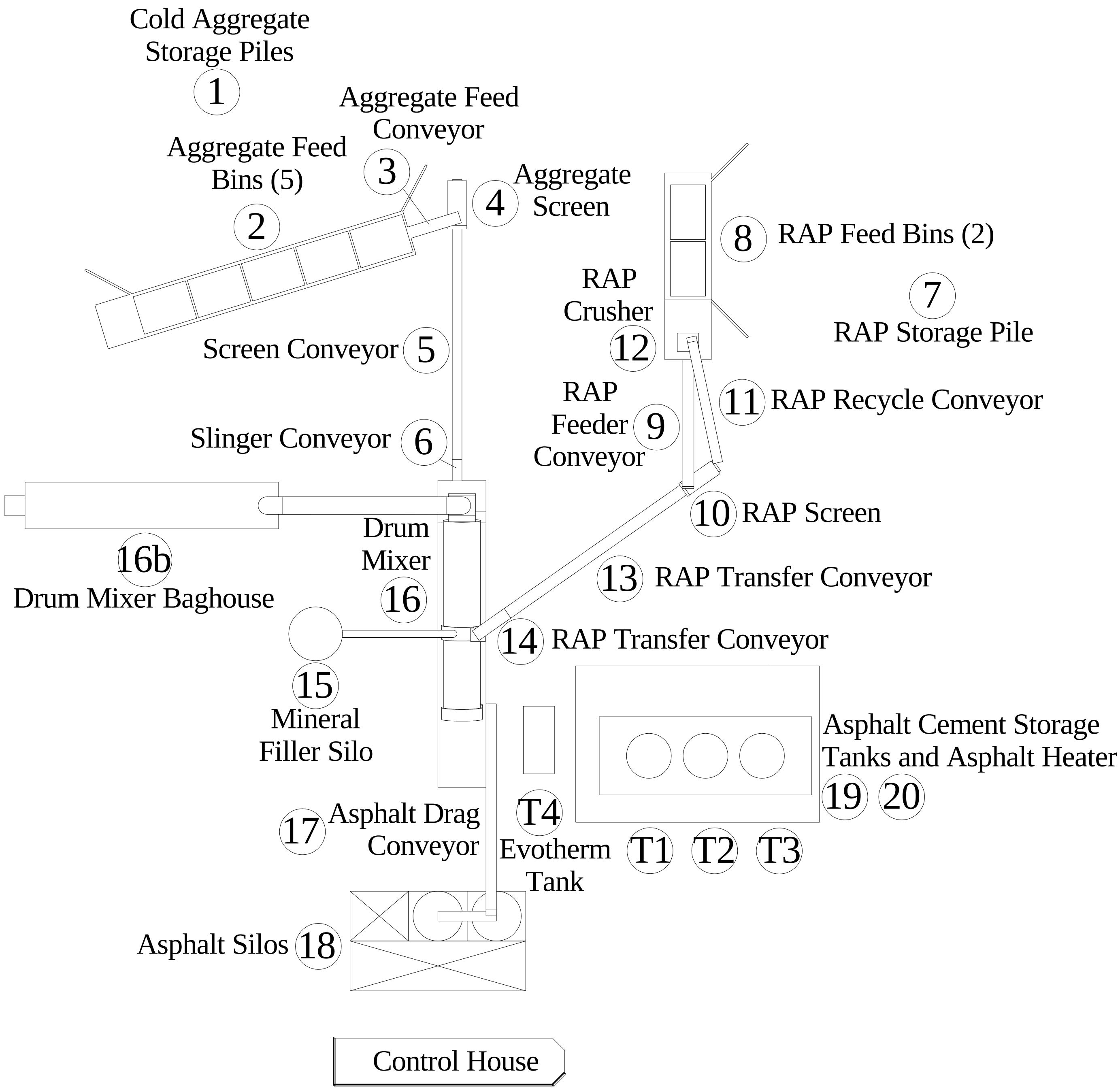

Figure A-1: Black Rock's HP-2 HMA Process Flow

Figure A-2: Black Rock's Broadway HP-2 HMA Plant Layout

Attachment B
Emissions Calculations

Pre-Control Particulate Emission Rates

MATERIAL HANDLING ($PM_{2.5}$, PM_{10}, AND PM)

To estimate material handling pre-control particulate emissions rates for screening, crushing, and conveyor transfer operations, emission factors were obtained from EPA's Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, Aug. 2004, Section 11.19.2, Table 11.19.2-2. To determine missing $PM_{2.5}$ emission factors the ratio of 0.35/0.053 from $PM_{10}/PM_{2.5}$ *k* factors found in AP-42 Section 13.2.4 (11/2006) were used.

To estimate material handling pre-control particulate emission rates for aggregate handling operations (aggregate/RAP piles/ loading cold feed bins/RAP feed bins), an emission equation was obtained from EPA's Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, Fifth Edition, Section 13.2.4 (11/2004), where the k (PM = 0.74, PM_{10} = 0.35, $PM_{2.5}$ = 0.053), wind speed for determining the maximum hourly emission rate is based on the average wind speed for Albuquerque for the years of 1996 through 2006 of 8.5 mph, and the NMED default moisture content of 2 percent. Additionally, for RAP handling the emission factors are reduced further because of the inherent properties of RAP with a coating of asphalt which captures small particles within the material. Based on EPA documents "EIIP – Preferred and Alternative Methods for Estimating Air Emissions from Hot-Mix-Asphalt Plants, Final Report, July 1996, Table 3.2-1 Fugitive Dust – Crushed RAP material" the inherent typical efficiency of the material is 70% (see Attachment C). The equation in AP-42 Section 13.2.4 was multiplied by 0.3 to account for the 70% reduction in emissions due to RAP material properties.

The asphalt may contain 1.5% mineral filler. Pre-control particulate emission rates for mineral filler silo loading was obtained from EPA's Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, Fifth Edition, Section 11.12 (06/06), Table 11.12-2 "Cement Unloading to Elevated Storage Silo". To determine missing $PM_{2.5}$ emission factor, PM_{10} * 0.38/1.92 from $PM_{10}/PM_{2.5}$ uncontrolled emission equations found in AP-42 Section 11.12 (06/06), Table 11.12-4 "Uncontrolled k Factor" was used.

Maximum hourly asphalt production is 400 tons per hours. Uncontrolled annual emissions are based on operating 8760 hours per year. Virgin aggregate/RAP/Mineral Filler/Asphalt cement ratios used in estimating material handling particulate emission rates is equal to 57.5/35.0/1.5/6.0. If no RAP is allowed in a mix, the Virgin aggregate/RAP/Mineral Filler/Asphalt cement ratios used in estimating material handling particulate emission rates is equal to 92.5/0.0/1.5/6.0. This allows a range for aggregate and RAP to be 230 to 370 tons for aggregate and 140 to 0 for RAP. Since the RAP system includes a RAP crusher, maximum emissions for modeling while operating on 35% of RAP input in the mix. Additional dispersion modeling will be run based on RAP input at 0% of the mix for 3 or 4 modeling time scenarios that showed the highest impacts when the model was run based on RAP input at 35% of the mix. These ratios are estimates and ratios may change with mix requirements, these are not requested permit conditions. Table B-1 and B-2 summarizes the uncontrolled emission rates for material handling.

Aggregate Storage Piles and Feed Bin Loading Emission Equation:

Maximum Hour Emission Factor

E (lbs/ton) = k x 0.0032 x $(U/5)^{1.3}$ / $(M/2)^{1.4}$

E_{PM} (lbs/ton) = 0.74 x 0.0032 x $(8.5/5)^{1.3}$ / $(2/2)^{1.4}$

E_{PM10} (lbs/ton) = 0.35 x 0.0032 x $(8.5/5)^{1.3}$ / $(2/2)^{1.4}$

$E_{PM2.5}$ (lbs/ton) = 0.053 x 0.0032 x $(8.5/5)^{1.3}$ / $(2/2)^{1.4}$

E_{PM} (lbs/ton) = 0.00472 lbs/ton;

E_{PM10} (lbs/ton) = 0.00223 lbs/ton

$E_{PM2.5}$ (lbs/ton) = 0.00034 lbs/ton

RAP Storage Piles and RAP Feed Bin Loading Emission Equation (70% Inherent Reduction):

Maximum Hour Emission Factor

E (lbs/ton) = k x 0.0032 x $(U/5)^{1.3}$ / $(M/2)^{1.4}$ * 0.3

E_{PM} (lbs/ton) = 0.74 x 0.0032 x $(8.5/5)^{1.3}$ / $(2/2)^{1.4}$ * 0.3

E_{PM10} (lbs/ton) = 0.35 x 0.0032 x $(8.5/5)^{1.3}$ / $(2/2)^{1.4}$ * 0.3

$E_{PM2.5}$ (lbs/ton) = 0.053 x 0.0032 x $(8.5/5)^{1.3}$ / $(2/2)^{1.4}$ * 0.3

E_{PM} (lbs/ton) = 0.00142 lbs/ton;

E_{PM10} (lbs/ton) = 0.00067 lbs/ton

$E_{PM2.5}$ (lbs/ton) = 0.00010 lbs/ton

AP-42 Emission Factors:

All Bin Unloading and Conveyor Transfers = Uncontrolled Conveyor Transfer Point Emission Factor

Screening = Uncontrolled Screening Emission Factor

Crusher = Uncontrolled Crushing Emission Factor

Material Handling Emission Factors:

Process Unit	PM Emission Factor (lbs/ton)	PM_{10} Emission Factor (lbs/ton)	$PM_{2.5}$ Emission Factor (lbs/ton)
Uncontrolled Screening	0.02500	0.00870	0.00132
Uncontrolled Crushing	0.00540	0.00240	0.00036
Uncontrolled Screen Unloading, Feed Bins Unloading, and Conveyor Transfers	0.00300	0.00110	0.00017
Uncontrolled Aggregate Storage Piles, Cold Aggregate Feeder Loading Max Hourly	0.00472	0.00223	0.00034
Uncontrolled RAP Storage Piles, RAP Feeder Loading Max Hourly	0.00142	0.00067	0.00010

AP-42 Section 11.12 Table 11.12-2 Uncontrolled Emission Factors:

Process Unit	PM Emission Factor (lbs/ton)	PM_{10} Emission Factor (lbs/ton)	$PM_{2.5}$ Emission Factor (lbs/ton)
Mineral Filler Silo Loading	0.73	0.47	0.093

The following equation was used to calculate the hourly emission rate for each process unit:

Emission Rate (lbs/hour) = Process Rate (tons/hour) * Emission Factor (lbs/ton)

The following equation was used to calculate the annual emission rate for each process unit:

$$\text{Emission Rate (tons/year)} = \frac{\text{Emission Rate (lbs/hour)} * 8760 \text{ hrs/year}}{2000 \text{ lbs/ton}}$$

Table B-1 Pre-Controlled Regulated Process Equipment Emission Rates – 35% RAP in Mix

Unit #	Process Unit Description	Process Rate (tph)	PM Emission Rate (lbs/hr)	PM Emission Rate (tons/yr)	PM_{10} Emission Rate (lbs/hr)	PM_{10} Emission Rate (tons/yr)	$PM_{2.5}$ Emission Rate (lbs/hr)	$PM_{2.5}$ Emission Rate (tons/yr)
1	Cold Aggregate Storage Piles	230	1.09	4.76	0.51	2.25	0.078	0.34
2	Feed Bin Loading	230	1.09	4.76	0.51	2.25	0.078	0.34
3	Feed Bin Unloading	230	0.69	3.02	0.25	1.11	0.039	0.17
4	Scalping Screen	230	5.75	25.2	2.00	8.76	0.30	1.33
5	Scalping Screen Unloading	230	0.69	3.02	0.25	1.11	0.039	0.17
6	Conveyor Transfer to Slinger Conveyor	230	0.69	3.02	0.25	1.11	0.039	0.17
7	RAP Storage Pile	140	0.20	0.87	0.094	0.41	0.014	0.062
8	RAP Bin Loading	140	0.20	0.87	0.094	0.41	0.014	0.062
9	RAP Bin Unloading	140	0.42	1.84	0.15	0.67	0.024	0.10
10	RAP Screen	140	3.50	15.3	1.22	5.33	0.18	0.81
11	RAP Screen Recycle Unloading	140	0.42	1.84	0.15	0.67	0.024	0.10
12	RAP Crusher	140	0.76	3.31	0.34	1.47	0.051	0.22
13	RAP Screen Unloading	140	0.42	1.84	0.15	0.67	0.024	0.10
14	RAP Transfer Conveyor	140	0.42	1.84	0.15	0.67	0.024	0.10
15	Mineral Filler Silo	25	18.3	19.2	11.8	12.4	2.33	2.44

Table B-2 Pre-Controlled Regulated Process Equipment Emission Rates – 0% RAP in Mix

Unit #	Process Unit Description	Process Rate (tph)	PM Emission Rate (lbs/hr)	PM Emission Rate (tons/yr)	PM_{10} Emission Rate (lbs/hr)	PM_{10} Emission Rate (tons/yr)	$PM_{2.5}$ Emission Rate (lbs/hr)	$PM_{2.5}$ Emission Rate (tons/yr)
1	Cold Aggregate Storage Piles	370	1.75	7.65	0.83	3.62	0.13	0.55
2	Feed Bin Loading	370	1.75	7.65	0.83	3.62	0.13	0.55
3	Feed Bin Unloading	370	1.11	4.86	0.41	1.78	0.063	0.28
4	Scalping Screen	370	9.25	40.5	3.22	14.10	0.49	2.14
5	Scalping Screen Unloading	370	1.11	4.86	0.41	1.78	0.063	0.28
6	Conveyor Transfer to Slinger Conveyor	370	1.11	4.86	0.41	1.78	0.063	0.28
7	RAP Storage Pile	0	0.0	0.0	0.0	0.0	0.0	0.0
8	RAP Bin Loading	0	0.0	0.0	0.0	0.0	0.0	0.0
9	RAP Bin Unloading	0	0.0	0.0	0.0	0.0	0.0	0.0
10	RAP Screen	0	0.0	0.0	0.0	0.0	0.0	0.0
11	RAP Screen Recycle Unloading	0	0.0	0.0	0.0	0.0	0.0	0.0
12	RAP Crusher	0	0.0	0.0	0.0	0.0	0.0	0.0
13	RAP Screen Unloading	0	0.0	0.0	0.0	0.0	0.0	0.0
14	RAP Transfer Conveyor	0	0.0	0.0	0.0	0.0	0.0	0.0
15	Mineral Filler Silo	25	18.3	19.2	11.8	12.4	2.33	2.44

HMA HAUL TRUCK TRAVEL

Haul truck travel emissions (Unit 21) were estimated using AP-42, Section 13.2.1 (ver.01/11) “Paved Roads” emission equation. Haul trucks will be used to deliver asphalt cement, mineral filler, Evotherm, RAP, aggregate material, and transport asphalt product. Table B-3 summarizes the emission rate for haul truck traffic at 35% RAP input in the mix. Table B-4 summarizes the emission rate for haul truck traffic at 0% RAP input in the mix.

AP-42 13.1 Paved Road (01/11) 35% RAP in Mix

Equation:

E = k(sL)^0.91*(W)^1.02*[1-P/4N] *Annual emissions only include p factor*

k PM	0.011	
k PM10	0.0022	
k PM25	0.00054	
sL	0.6	road surface silt loading (g/m2) Table 13.2.1-2, <500
P = days with precipitation over 0.01 inches	60	AP-42 Figure 13.2.2-1
N = number of days in averaging period	365	

Mineral Filler Truck VMT	190.0	meter/total	25	tons/load	6	tons/hr
Evotherm Truck VMT	227.4	meter/total	25	tons/load	96.4	gal/hr
RAP Truck VMT	227.4	meter/total	25	tons/load	140	tons/hr
Asphalt Cement Truck VMT	227.4	meter/total	25	tons/load	24	tons/hr
Asphalt Truck VMT	163.6	meter/total	25	tons/load	400	tons/hr
Aggregate Truck VMT	103.1	meter/one way	25	tons/load	230	tons/hr

Max. Mineral Filler Trucks/hr	0.2	truck/hr	2102	trucks/yr
Max. Evotherm Trucks/hr	0.02	truck/hr	169	trucks/yr
Max. RAP Trucks/hr	5.6	truck/hr	49056	trucks/yr
Max. Asphalt Cement Trucks/hr	1.0	truck/hr	8410	trucks/yr
Max. Asphalt Truck/hr	16.0	truck/hr	140160	trucks/yr
Max Aggregate Trucks/hr	9.2	truck/hr	80592	trucks/yr
	32.0	truck/hr	280489	trucks/yr

VMT Evotherm/Cement/RAP	0.930	VMT/hr	8143	VMT/yr
VMT Mineral Filler	0.028	VMT/hr	248	VMT/yr
VMT Asphalt	1.627	VMT/hr	14251	VMT/yr
VMT Aggregate	1.178	VMT/hr	10325	VMT/yr
Total	3.763	VMT/hr	32968	VMT/yr

Truck weight 27.5 tons

		PM Uncontrolled		
Max. Truck Emissions Paved Road	0.7642	lbs/hr	3.3472	tons/yr
		PM10 Uncontrolled		
	0.1528	lbs/hr	0.6694	tons/yr
		PM2.5 Uncontrolled		
	0.0375	lbs/hr	0.1643	tons/yr

Table B-3: Uncontrolled Haul Road Fugitive Dust Emission Rates – 35% RAP in Mix

Process Unit Description	Process Rate	PM Emission Rate (lbs/hr)	PM Emission Rate (tons/yr)	PM_{10} Emission Rate (lbs/hr)	PM_{10} Emission Rate (tons/yr)	$PM_{2.5}$ Emission Rate (lbs/hr)	$PM_{2.5}$ Emission Rate (tons/yr)
Paved Road Truck Emissions Unit 21	3.763 miles/hr; 32968 miles/yr	0.76	3.35	0.15	0.67	0.038	0.16

AP-42 13.1 Paved Road (01/11) 0% RAP in Mix

Equation:

E = k(sL)^0.91*(W)^1.02*[1-P/4N] *Annual emissions only include p factor*

k PM	0.011	
k PM10	0.0022	
k PM25	0.00054	
sL	0.6	road surface silt loading (g/m2) Table 13.2.1-2, <500
P = days with precipitation over 0.01 inches	60	AP-42 Figure 13.2.2-1
N = number of days in averaging period	365	

Mineral Filler Truck VMT	190.0	meter/total	25	tons/load	6	tons/hr
Evotherm Truck VMT	227.4	meter/total	25	tons/load	96.4	gal/hr
RAP Truck VMT	227.4	meter/total	25	tons/load	0	tons/hr
Asphalt Cement Truck VMT	227.4	meter/total	25	tons/load	24	tons/hr
Asphalt Truck VMT	163.6	meter/total	25	tons/load	400	tons/hr
Aggregate Truck VMT	103.1	meter/one way	25	tons/load	370	tons/hr

Max. Mineral Filler Trucks/hr	0.2	truck/hr	2102	trucks/yr
Max. Evotherm Trucks/hr	0.02	truck/hr	169	trucks/yr
Max. RAP Trucks/hr	0.0	truck/hr	0	trucks/yr
Max. Asphalt Cement Trucks/hr	1.0	truck/hr	8410	trucks/yr
Max. Asphalt Truck/hr	16.0	truck/hr	140160	trucks/yr
Max Aggregate Trucks/hr	14.8	truck/hr	129648	trucks/yr
	32.0	truck/hr	280489	trucks/yr

VMT Evotherm/Cement/RAP	0.138	VMT/hr	1212	VMT/yr
VMT Mineral Filler	0.028	VMT/hr	248	VMT/yr
VMT Asphalt	1.627	VMT/hr	14250	VMT/yr
VMT Aggregate	1.897	VMT/hr	16616	VMT/yr
Total	3.690	VMT/hr	32327	VMT/yr

Truck weight	27.5	tons

	PM Uncontrolled			
Max. Truck Emissions Paved Road	0.7494	lbs/hr	3.2822	tons/yr
	PM10 Uncontrolled			
	0.1499	lbs/hr	0.6564	tons/yr
	PM2.5 Uncontrolled			
	0.0368	lbs/hr	0.1611	tons/yr

Table B-4: Uncontrolled Haul Road Fugitive Dust Emission Rates – 0% RAP in Mix

Process Unit Description	Process Rate	PM Emission Rate (lbs/hr)	PM Emission Rate (tons/yr)	PM_{10} Emission Rate (lbs/hr)	PM_{10} Emission Rate (tons/yr)	$PM_{2.5}$ Emission Rate (lbs/hr)	$PM_{2.5}$ Emission Rate (tons/yr)
Paved Road Truck Emissions Unit 21	3.690 miles/hr; 32327 miles/yr	0.75	3.28	0.15	0.66	0.037	0.16

DRUM MIX HOT MIX ASPHALT PLANT – PRE-CONTROLLED

Drum mix hot mix asphalt plant pre-controlled emissions were estimated using AP-42, Section 11.1 "Hot Mix Asphalt Plants" (revised 03/04), tables 11.1.3, 4, 7, 8 and 14 emission equations. The drum dryer will be permitted to combust natural gas. Hourly emission rates are based on maximum hourly asphalt production (400 tph) and maximum annual emission rates are based on operating 8760 hours per year. To determine missing $PM_{2.5}$ emission factor the sum of uncontrolled filterable from Table 11.1-4 plus uncontrolled organic and inorganic condensable in Table 11.1-3 was used. Yard emissions were found in AP-42 Section 11.1.2.5. TOC emission equation is 0.0011 lbs/ton of asphalt produced and CO is equal to the TOC emission rate times 0.32. For silo loading and plant load-out, AP-42 Section 1.1, Table 11.1-14 was used. Silo filling emission factors were calculated using the default value of –0.5 for asphalt volatility and an asphalt mix temperature of 325˚ F for HMA mix temperature. Plant asphalt truck loading emission factors were calculated using the default value of –0.5 for asphalt volatility and an asphalt silo heater temperature setting of 280˚ F for HMA mix temperature.

Pollutant	AP-42 Table 11.1-14, Equation
Drum mix plant load-out (Silo Unloading)	
CO	$EF = 0.00558(-V)e^{((0.0251)(T + 460) - 20.43)}$
TOC	$EF = 0.0172(-V)e^{((0.0251)(T + 460) - 20.43)}$
Total PM	$EF = 0.000181 + 0.00141(-V)e^{((0.0251)(T + 460) - 20.43)}$
Silo filling (Drum Unloading)	
CO	$EF = 0.00488(-V)e^{((0.0251)(T + 460) - 20.43)}$
TOC	$EF = 0.0504(-V)e^{((0.0251)(T + 460) - 20.43)}$
Total PM	$EF = 0.000332 + 0.00105(-V)e^{((0.0251)(T + 460) - 20.43)}$

Emissions of VOCs (TOCs) from the asphalt cement storage tanks were determined with EPA's TANK 4.0.9d program and the procedures found in EPA's "Emission Factor Documentation for AP-42 Section 11.1 (12/2000) Section 4.4.5" for input to the TANK program.

AP-42 Section 11.1 Table 11.1-3, 4, 7, 8, and 14 Pre-controlled Emission Factors:

Process Unit	Pollutant	Emission Factor (lbs/ton)
Drum Mixer	NO_X	0.026
	CO	0.13
	SO_2	0.0034
	VOC	0.032
	TOC	0.044
	PM	28.0
	PM_{10}	6.5
	$PM_{2.5}$	1.565
Drum Unloading/Silo Loading	CO	0.001179981
	TOC	0.012186685
	PM	0.000585889
	PM_{10}	0.000585889
	$PM_{2.5}$	0.000585889
Plant/Silo Loadout	CO	0.000436067
	TOC	0.001344150
	PM	0.000291189
	PM_{10}	0.000291189
	$PM_{2.5}$	0.000291189
Yard	CO	0.000352
	TOC	0.0011

The following equation was used to calculate the hourly emission rate for each process unit:

Emission Rate (lbs/hour) = Process Rate (tons/hour) * Emission Factor (lbs/ton)

The following equation was used to calculate the annual emission rate for each process unit:

$$\text{Emission Rate (tons/year)} = \frac{\text{Emission Rate (lbs/hour)} * \text{Operating Hour (hrs/year)}}{\text{2000 lbs/ton}}$$

Table B-5: Pre-Controlled Hot Mix Plant Emission Rates

Process Unit Number	Process Unit Description	Pollutant	Average Hourly Process Rate (tons/hour)	Emission Rate (lbs/hr)	Emission Rate (tons/yr)
16	Asphalt Drum Dryer	NO_X	400	10.4	45.6
		CO	400	52.0	227.8
		SO_2	400	1.36	5.96
		VOC	400	12.8	56.1
		PM	400	11200	49056
		PM_{10}	400	2600	11388
		$PM_{2.5}$	400	626	2742
17	Drum Mixer Unloading	CO	400	0.47	2.07
		TOC	400	4.87	21.35
		PM	400	0.23	1.03
		PM_{10}	400	0.23	1.03
		$PM_{2.5}$	400	0.23	1.03
18	Asphalt Silo Unloading	CO	400	0.17	0.76
		TOC	400	0.54	2.35
		PM	400	0.12	0.51
		PM_{10}	400	0.12	0.51
		$PM_{2.5}$	400	0.12	0.51
19	Asphalt Cement Storage Tanks (3)	TOC	400	0.071	0.31
22	YARD	CO	400	0.14	0.62
		TOC	400	0.44	1.93

Controlled Particulate Emission Rates

No controls or emission reductions for combustion emissions (NO_X, CO, SO_2, or VOC) are proposed for the drum dryer (Unit 16). No controls or emission reductions for emissions from asphalt silo unload (Unit 18), asphalt heater (Unit 20), and haul road traffic (Unit 21) with the exception of limiting annual production rates for production equipment.

CONTROLLED MATERIAL HANDLING ($PM_{2.5}$, PM_{10}, AND PM)

No fugitive dust controls or emission reductions are proposed for the aggregate/RAP storage piles (Units 1, 7) or loading of the cold aggregate/RAP feed bins (Units 2, 8) with the exception of limiting annual production rates.

Fugitive dust control for unloading the cold aggregate feed bins onto the cold aggregate feed bin conveyor (Unit 3) will be controlled, as needed, with enclosures and/or water sprays at the exit of the feed bins. Fugitive dust control for unloading the RAP feed bins onto the RAP feed bin conveyor (Unit 9) will be controlled, as needed, with enclosures and/or water sprays at the exit of the RAP feed bins. It is estimated that these methods will control to a PM_{10} efficiency of 95.82 percent per AP42 Section 11.19.2, Table 11.19.2-2. Additional emission reductions include limiting annual production rates.

Fugitive dust control for the scalping screen (Unit 4), and RAP screen (Unit 10) will be controlled, as needed, with enclosures and/or water sprays. It is estimated that these methods will control to an PM_{10} efficiency of 91.49 percent for screening operations per AP42 Section 11.19.2, Table 11.19.2-2. Additional emission reductions include limiting annual production rates.

Fugitive dust control for the RAP crusher (Unit 12) will be controlled, as needed, with enclosures and/or water sprays. It is estimated that these methods will control to an PM_{10} efficiency of 77.5 percent for crushing operations per AP42 Section 11.19.2, Table 11.19.2-2. Additional emission reductions include limiting annual production rates.

Fugitive dust control for the conveyor transfer to the cold aggregate transfer conveyors (Units 5, 6) and RAP transfer conveyors (Units 11, 13, 14) will be controlled with material moisture content and/or enclosure. It is estimated that this method will control to an PM_{10} efficiency of 95.82 percent per AP42 Section 11.19.2, Table 11.19.2-2. Additional emission reductions include limiting annual production rates.

Particulate emissions from loading the mineral filler silo (Unit 15) will be controlled with a baghouse dust collector (Unit 15b) on the exhaust vent. The dust collector consists of filter bags. It functions only when material is loaded into the silo. The filter bags are cleaned by air pulses at set intervals. Baghouse fines are dropped back into the silo. It is estimated that this method will control to an efficiency of 99 percent or greater based on information from EPA AP-42 Table B.2-3 low end. Additional emission reductions include limiting annual production rates. To determine missing $PM_{2.5}$ emission factors the ratio of 0.03/0.13 from $PM_{2.5}/PM_{10}$ and the controlled PM_{10} emission factor found in AP-42 Section 11.12 (06/06), Table 11.12-4 “Controlled k Factor” was used. Hourly loading rate is approximately 25 tons per hour.

Particulate emissions from the drum dryer/mixer (Unit 16) will be controlled with a baghouse dust collector (Unit 16b) on the exhaust vent. It is estimated that this method will control to a PM_{10} efficiency of 99.65 percent per AP42 Section 11.1, Table 11.1-3 “controlled PM_{10} emission factor vs. uncontrolled PM_{10} emission factor”. Baghouse fines are returned to the drum dryer/mixer via a closed loop system. Additional emission reductions include limiting annual production rates.

To estimate material handling control particulate emissions rates for screening, crushing, and conveyor transfer operations, emission factors were obtained from EPA’s Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, Aug. 2004, Section 11.19.2, Table 11.19.2-2.

To estimate material handling uncontrolled particulate emission rates for aggregate handling operations (aggregate storage piles/RAP storage piles/cold aggregate loading feed bins/RAP feed bins), an emission equation was obtained from EPA’s Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, Fifth Edition, Section 13.2.4 (11/2004), where the k (PM = 0.74, PM_{10} = 0.35, $PM_{2.5}$ = 0.053), wind speed for determining the maximum hourly emission rate is based on the average wind speed for Albuquerque for the years of 1996 through 2006 of 8.5 mph, and the NMED default moisture content of 2 percent. Additionally, the emission factors are reduced further because of the inherent properties of RAP with a coating of asphalt which captures small particles within the material. Based on EPA documents “EIIP – Preferred and Alternative Methods for Estimating Air Emissions from Hot-Mix-Asphalt Plants, Final Report, July 1996, Table 3.2-1 Fugitive Dust – Crushed RAP material” the inherent typical efficiency of the material is 70% (see Attachment C). The equation in AP-42 Section 13.2.4 was multiplied by 0.3 to account for the 70% reduction in emissions due to RAP material properties.

Maximum hourly asphalt production is 400 tons per hours. Virgin aggregate/RAP/Mineral Filler/Asphalt cement ratios used in estimating material handling particulate emission rates is equal to 57.5/35.0/1.5/6.0. If no RAP is allowed in a mix, the Virgin aggregate/RAP/Mineral Filler/Asphalt cement ratios used in estimating material handling particulate emission rates is equal to 92.5/0.0/1.5/6.0. This allows a range for aggregate and RAP to be 230 to 370 tons for aggregate and 140 to 0 for RAP. These ratios are estimates and ratios may change with mix requirements, these are not requested permit conditions. Annual emissions in tons per year (tpy) were calculated assuming an annual production throughput of 1,450,000 tons of asphalt per year. Table B-6 shows the emission rates for a mix including 35% RAP. Table B-7 shows the emission rate for a mix including 0% RAP.

Aggregate Storage Piles and Feed Bin Loading Emission Equation:

Maximum Hour Emission Factor

E (lbs/ton) = k x 0.0032 x $(U/5)^{1.3}$ / $(M/2)^{1.4}$

E_{PM} (lbs/ton) = 0.74 x 0.0032 x $(8.5/5)^{1.3}$ / $(2/2)^{1.4}$

E_{PM10} (lbs/ton) = 0.35 x 0.0032 x $(8.5/5)^{1.3}$ / $(2/2)^{1.4}$

$E_{PM2.5}$ (lbs/ton) = 0.053 x 0.0032 x $(8.5/5)^{1.3}$ / $(2/2)^{1.4}$

E_{PM} (lbs/ton) = 0.00472 lbs/ton;

E_{PM10} (lbs/ton) = 0.00223 lbs/ton

$E_{PM2.5}$ (lbs/ton) = 0.00034 lbs/ton

RAP Storage Piles and RAP Feed Bin Loading Emission Equation (70% Inherent Reduction):

Maximum Hour Emission Factor

E (lbs/ton) = k x 0.0032 x $(U/5)^{1.3}$ / $(M/2)^{1.4}$ * 0.3

E_{PM} (lbs/ton) = 0.74 x 0.0032 x $(8.5/5)^{1.3}$ / $(2/2)^{1.4}$ * 0.3

E_{PM10} (lbs/ton) = 0.35 x 0.0032 x $(8.5/5)^{1.3}$ / $(2/2)^{1.4}$ * 0.3

$E_{PM2.5}$ (lbs/ton) = 0.053 x 0.0032 x $(8.5/5)^{1.3}$ / $(2/2)^{1.4}$ * 0.3

E_{PM} (lbs/ton) = 0.00142 lbs/ton;

E_{PM10} (lbs/ton) = 0.00067 lbs/ton

$E_{PM2.5}$ (lbs/ton) = 0.00010 lbs/ton

AP-42 Emission Factors:

Aggregate/RAP Feed Bin Unloading = Controlled Conveyor Transfer Point Emission Factor

Aggregate/RAP Screen = Controlled Screening Emission Factor

Aggregate/RAP Crusher = Controlled Crusher Emission Factor

Aggregate/RAP Transfer Conveyor = Controlled Conveyor Transfer Point Emission Factor

Aggregate/RAP Scalping Screen Conveyor = Controlled Conveyor Transfer Point Emission Factor

Material Handling Emission Factors:

Process Unit	PM Emission Factor (lbs/ton)	PM_{10} Emission Factor (lbs/ton)	$PM_{2.5}$ Emission Factor (lbs/ton)
Aggregate/RAP Feed Bin Unloading	0.00014	0.000046	0.000013
Controlled Aggregate/RAP Screening	0.00220	0.00074	0.00005
Controlled RAP Crusher	0.00120	0.00054	0.00010
Controlled Aggregate/RAP Transfer Conveyor	0.00014	0.000046	0.000013
Controlled Aggregate/RAP Screen Unloading	0.00014	0.000046	0.000013
Uncontrolled Aggregate Storage Piles, Cold Aggregate Feeder Loading Max Hourly	0.00472	0.00223	0.00034
Uncontrolled RAP Storage Piles, RAP Feeder Loading Max Hourly	0.00142	0.00067	0.00010

AP-42 Section 11.12 Table 11.12-2 Controlled Emission Factors with 99% CE:

Process Unit	PM Emission Factor (lbs/ton)	PM_{10} Emission Factor (lbs/ton)	$PM_{2.5}$ Emission Factor (lbs/ton)
Mineral Filler Silo Loading	0.0073	0.0047	0.0011

The following equation was used to calculate the hourly emission rate for each process unit:

Emission Rate (lbs/hour) = Process Rate (tons/hour) * Emission Factor (lbs/ton)

The following equation was used to calculate the annual emission rate for each process unit:

$$\text{Emission Rate (tons/year)} = \frac{\text{Emission Factor (lbs/ton)} * \text{Annual Throughput (tons/year)}}{\text{2000 lbs/ton}}$$

Table B-6 Controlled Material Handling Emission Rates with 35% RAP in Mix

Unit #	Process Unit Description	Process Rate (tph)	PM Emission Rate (lbs/hr)	PM Emission Rate (tons/yr)	PM_{10} Emission Rate (lbs/hr)	PM_{10} Emission Rate (tons/yr)	$PM_{2.5}$ Emission Rate (lbs/hr)	$PM_{2.5}$ Emission Rate (tons/yr)
1	Cold Aggregate Storage Piles	230 tph 833750 tpy	1.09	1.97	0.51	0.93	0.078	0.14
2	Feed Bin Loading	230 tph 833750 tpy	1.09	1.97	0.51	0.93	0.078	0.14
3	Feed Bin Unloading	230 tph 833750 tpy	0.032	0.058	0.011	0.019	0.0030	0.0054
4	Scalping Screen	230 tph 833750 tpy	0.51	0.92	0.17	0.31	0.012	0.021
5	Scalping Screen Unloading	230 tph 833750 tpy	0.032	0.058	0.011	0.019	0.0030	0.0054
6	Conveyor Transfer to Slinger Conveyor	230 tph 833750 tpy	0.032	0.058	0.011	0.019	0.0030	0.0054
7	RAP Storage Pile	140 tph 507500 tpy	0.20	0.36	0.094	0.17	0.014	0.026
8	RAP Bin Loading	140 tph 507500 tpy	0.20	0.36	0.094	0.17	0.014	0.026
9	RAP Bin Unloading	140 tph 507500 tpy	0.020	0.036	0.0064	0.012	0.0018	0.0033
10	RAP Screen	140 tph 507500 tpy	0.31	0.56	0.10	0.19	0.0070	0.013
11	RAP Screen Recycle Unloading	140 tph 507500 tpy	0.020	0.036	0.0064	0.012	0.0018	0.0033
12	RAP Crusher	140 tph 507500 tpy	0.17	0.30	0.076	0.137	0.014	0.025
13	RAP Screen Unloading	140 tph 507500 tpy	0.020	0.036	0.0064	0.012	0.0018	0.0033
14	RAP Transfer Conveyor	140 tph 507500 tpy	0.020	0.036	0.0064	0.012	0.0018	0.0033
15	Mineral Filler Silo	25 tph 21750 tpy	0.18	0.079	0.12	0.051	0.027	0.012

Table B-7 Controlled Material Handling Emission Rates with 0% RAP in Mix

Unit #	Process Unit Description	Process Rate (tph)	PM Emission Rate (lbs/hr)	PM Emission Rate (tons/yr)	PM_{10} Emission Rate (lbs/hr)	PM_{10} Emission Rate (tons/yr)	$PM_{2.5}$ Emission Rate (lbs/hr)	$PM_{2.5}$ Emission Rate (tons/yr)
1	Cold Aggregate Storage Piles	370 tph 1341250 tpy	1.75	3.17	0.83	1.50	0.13	0.23
2	Feed Bin Loading	370 tph 1341250 tpy	1.75	3.17	0.83	1.50	0.13	0.23
3	Feed Bin Unloading	370 tph 1341250 tpy	0.052	0.094	0.017	0.031	0.0048	0.0087
4	Scalping Screen	370 tph 1341250 tpy	0.81	1.48	0.27	0.50	0.019	0.034
5	Scalping Screen Unloading	370 tph 1341250 tpy	0.052	0.094	0.017	0.031	0.0048	0.0087
6	Conveyor Transfer to Slinger Conveyor	370 tph 1341250 tpy	0.052	0.094	0.017	0.031	0.0048	0.0087
7	RAP Storage Pile	0 tph 0 tpy	0.0	0.0	0.0	0.0	0.0	0.0
8	RAP Bin Loading	0 tph 0 tpy	0.0	0.0	0.0	0.0	0.0	0.0
9	RAP Bin Unloading	0 tph 0 tpy	0.0	0.0	0.0	0.0	0.0	0.0
10	RAP Screen	0 tph 0 tpy	0.0	0.0	0.0	0.0	0.0	0.0
11	RAP Screen Recycle Unloading	0 tph 0 tpy	0.0	0.0	0.0	0.0	0.0	0.0
12	RAP Crusher	0 tph 0 tpy	0.0	0.0	0.0	0.0	0.0	0.0
13	RAP Screen Unloading	0 tph 0 tpy	0.0	0.0	0.0	0.0	0.0	0.0
14	RAP Transfer Conveyor	0 tph 0 tpy	0.0	0.0	0.0	0.0	0.0	0.0
15	Mineral Filler Silo	25 tph 21750 tpy	0.18	0.079	0.12	0.051	0.027	0.012

HMA Haul Truck Travel

Haul truck travel emissions were estimated using AP-42, Section 13.2.1 (ver.01/11) "Paved Roads" emission equation. Haul trucks will be used to deliver asphalt cement, mineral filler, Evotherm, RAP, aggregate material, and transport asphalt product. Table B-8 summarizes the emission rate for haul truck travel with a RAP mix ratio of 35%. Table B-9 summarizes the emission rate for haul truck travel with a RAP mix ratio of 0%.

AP-42 13.1 Paved Road (01/11) 35% RAP in Mix

Equation:

E = k(sL)^0.91*(W)^1.02*[1-P/4N] *Annual emissions only include p factor*

k PM	0.011	
k PM10	0.0022	
k PM25	0.00054	
sL	0.6	road surface silt loading (g/m2) Table 13.2.1-2, <500
P = days with precipitation over 0.01 inches	60	AP-42 Figure 13.2.2-1
N = number of days in averaging period	365	

Mineral Filler Truck VMT	190.0	meter/total	25	tons/load	6	tons/hr
Evotherm Truck VMT	227.4	meter/total	25	tons/load	96.4	gal/hr
RAP Truck VMT	227.4	meter/total	25	tons/load	140	tons/hr
Asphalt Cement Truck VMT	227.4	meter/total	25	tons/load	24	tons/hr
Asphalt Truck VMT	163.6	meter/total	25	tons/load	400	tons/hr
Aggregate Truck VMT	103.1	meter/one way	25	tons/load	230	tons/hr

Max. Mineral Filler Trucks/hr	0.2	truck/hr	870	trucks/yr
Max. Evotherm Trucks/hr	0.02	truck/hr	70	trucks/yr
Max. RAP Trucks/hr	5.6	truck/hr	20300	trucks/yr
Max. Asphalt Cement Trucks/hr	1.0	truck/hr	3480	trucks/yr
Max. Asphalt Truck/hr	16.0	truck/hr	58000	trucks/yr
Max Aggregate Trucks/hr	9.2	truck/hr	33350	trucks/yr
	32.0	truck/hr	116070	trucks/yr

VMT Evotherm/Cement/RAP	0.930	VMT/hr	3370	VMT/yr
VMT Mineral Filler	0.028	VMT/hr	103	VMT/yr
VMT Asphalt	1.627	VMT/hr	5897	VMT/yr
VMT Aggregate	1.178	VMT/hr	4273	VMT/yr
Total	3.763	VMT/hr	13642	VMT/yr

Truck weight 27.5 tons

	PM Uncontrolled			
Max. Truck Emissions Paved Road	0.7642	lbs/hr	1.3282	tons/yr
	PM10 Uncontrolled			
	0.1528	lbs/hr	0.2656	tons/yr
	PM2.5 Uncontrolled			
	0.0375	lbs/hr	0.0652	tons/yr

Table B-8: Controlled Haul Road Fugitive Dust Emission Rates with 35% RAP in Mix

Process Unit Description	Process Rate	PM Emission Rate (lbs/hr)	PM Emission Rate (tons/yr)	PM_{10} Emission Rate (lbs/hr)	PM_{10} Emission Rate (tons/yr)	$PM_{2.5}$ Emission Rate (lbs/hr)	$PM_{2.5}$ Emission Rate (tons/yr)
Paved Road Truck Emissions Unit 21	3.763 miles/hr; 13642 miles/yr	0.76	1.33	0.15	0.27	0.038	0.065

AP-42 13.1 Paved Road (01/11) 0% RAP in Mix

Equation:

E = k(sL)^0.91*(W)^1.02*[1-P/4N] *Annual emissions only include p factor*

k PM	0.011	
k PM10	0.0022	
k PM25	0.00054	
sL	0.6	road surface silt loading (g/m2) Table 13.2.1-2, <500
P = days with precipitation over 0.01 inches	60	AP-42 Figure 13.2.2-1
N = number of days in averaging period	365	

Mineral Filler Truck VMT	190.0	meter/total	25	tons/load	6	tons/hr
Evotherm Truck VMT	227.4	meter/total	25	tons/load	96.4	gal/hr
RAP Truck VMT	227.4	meter/total	25	tons/load	0	tons/hr
Asphalt Cement Truck VMT	227.4	meter/total	25	tons/load	24	tons/hr
Asphalt Truck VMT	163.6	meter/total	25	tons/load	400	tons/hr
Aggregate Truck VMT	103.1	meter/one way	25	tons/load	370	tons/hr

Max. Mineral Filler Trucks/hr	0.2	truck/hr	870	trucks/yr
Max. Evotherm Trucks/hr	0.02	truck/hr	70	trucks/yr
Max. RAP Trucks/hr	0.0	truck/hr	0	trucks/yr
Max. Asphalt Cement Trucks/hr	1.0	truck/hr	3480	trucks/yr
Max. Asphalt Truck/hr	16.0	truck/hr	58000	trucks/yr
Max Aggregate Trucks/hr	14.8	truck/hr	53650	trucks/yr
	32.0	truck/hr	116070	trucks/yr

VMT Evotherm/Cement/RAP	0.138	VMT/hr	502	VMT/yr
VMT Mineral Filler	0.028	VMT/hr	103	VMT/yr
VMT Asphalt	1.627	VMT/hr	5897	VMT/yr
VMT Aggregate	1.897	VMT/hr	6876	VMT/yr
Total	3.690	VMT/hr	13377	VMT/yr

Truck weight 27.5 tons

		PM Uncontrolled			
Max. Truck Emissions Paved Road	0.7494	lbs/hr	1.3024	tons/yr	
		PM10 Uncontrolled			
	0.1499	lbs/hr	0.2605	tons/yr	
		PM2.5 Uncontrolled			
	0.0368	lbs/hr	0.0639	tons/yr	

Table B-9: Controlled Haul Road Fugitive Dust Emission Rates with 0% RAP in Mix

Process Unit Description	Process Rate	PM Emission Rate (lbs/hr)	PM Emission Rate (tons/yr)	PM_{10} Emission Rate (lbs/hr)	PM_{10} Emission Rate (tons/yr)	$PM_{2.5}$ Emission Rate (lbs/hr)	$PM_{2.5}$ Emission Rate (tons/yr)
Paved Road Truck Emissions Unit 21	3.690 miles/hr; 13377 miles/yr	0.75	1.30	0.15	0.26	0.037	0.064

DRUM MIX HOT MIX ASPHALT PLANT – CONTROLLED

Particulate emissions from the drum dryer/mixer (Unit 16) will be controlled with a baghouse dust collector (Unit 16b) on the exhaust vent. This dust collector consists of filter bags and a fan that draws all the drum mixer exhaust through the dust collector. It is estimated that this method will control to an efficiency of 99.65 percent per AP42 Section 11.1, Table 11.1-3 (PM_{10}). Additional emission reductions include limiting annual production rates.

Drum mix hot mix asphalt plant-controlled emissions were estimated using AP-42, Section 11.1 "Hot Mix Asphalt Plants" (revised 03/04), tables 11.1.3, 4, 7, 8 and 14 emission equations. The drum dryer will be permitted to combust natural gas. Hourly emission rates are based on maximum hourly asphalt production (400 tph) and maximum annual production rate of 1,450,000 tons per year. To determine $PM_{2.5}$ emissions from the drum mixer it is assumed that $PM_{2.5}$ is equal to PM_{10}. Yard emissions were found in AP-42 Section 11.1.2.5. TOC emission equation is 0.0011 lbs/ton of asphalt produced and CO is equal to the TOC emission rate times 0.32. Silo filling emission factors were calculated using the default value of –0.5 for asphalt volatility and an asphalt mix temperature of 325˚ F for HMA mix temperature. Plant asphalt truck loading emission factors were calculated using the default value of –0.5 for asphalt volatility and a silo heater temperature setting of 280˚ F for HMA mix temperature.

Included in the permit application is pollution control equipment installed on the exit of the drum mixer and asphalt silo loading. The pollution control equipment installed is a recirculation system that captures asphalt fumes, organic PM, carbon monoxide, VOC gases (Blue Smoke), then recirculates the gas back to the drum dryer to be incinerated to reduce these pollutants. It is estimated that the system will reduce these pollutant emissions by 60%. This is based on National Pollutant Inventory "Emission Estimation Technique Manual for Hot Mix Asphalt Manufacturing", Table 1 included in this application (Attachment C). It lists a control efficiency of 37 – 86% for "Dryer and combustion process modification", June 1999. The discussion is for VOCs (Blue Smoke), which is essentially fuel droplets, with the logical method of disposal is incineration. Blue smoke collected between the mixer and silo tops is routed back to the burner. A discussion on this process is found in Astec's "Technical Paper T-143 Hot Mix Blue Smoke Emissions", 2002, that is attached to this permit application (Attachment C). Based on these two papers, a control efficiency of 60% was selected as a conservative value.

Pollutant	AP-42 Table 11.1-14, Equation
Drum mix plant load-out (Silo Unloading)	
CO	$EF = 0.00558(-V)e^{((0.0251)(T + 460) - 20.43)}$
TOC	$EF = 0.0172(-V)e^{((0.0251)(T + 460) - 20.43)}$
Total PM	$EF = 0.000181 + 0.00141(-V)e^{((0.0251)(T + 460) - 20.43)}$
Silo filling with 60% control (Drum Unloading)	
CO	$EF = 0.00488(-V)e^{((0.0251)(T + 460) - 20.43)} * 0.40$
TOC	$EF = 0.0504(-V)e^{((0.0251)(T + 460) - 20.43)} * 0.40$
Total PM	$EF = 0.000332 + 0.00105(-V)e^{((0.0251)(T + 460) - 20.43)} * 0.40$

Emissions of VOCs (TOCs) from the asphalt cement storage tanks were determined with EPA's TANK 4.0.9d program and the procedures found in EPA's "Emission Factor Documentation for AP-42 Section 11.1 (12/2000) Section 4.4.5" for input to the TANK program.

AP-42 Section 11.1 Table 11.1-3, 4, 7, 8, and 14 Controlled Emission Factors:

Process Unit	Pollutant	Emission Factor (lbs/ton)
Drum Mixer	NO_X	0.026
	CO	0.13
	SO_2	0.0034
	VOC	0.032
	TOC	0.044
	PM	0.033
	PM_{10}	0.023
	$PM_{2.5}$	0.023
Drum Unloading/Silo Loading	CO	0.000471992
	TOC	0.004874674
	PM	0.000234356
	PM_{10}	0.000234356
	$PM_{2.5}$	0.000234356
Plant/Silo Loadout	CO	0.000436067
	TOC	0.001344150
	PM	0.000291189
	PM_{10}	0.000291189
	$PM_{2.5}$	0.000291189
Yard	CO	0.000352
	TOC	0.0011

The following equation was used to calculate the hourly emission rate for each process unit:

Emission Rate (lbs/hour) = Process Rate (tons/hour) * Emission Factor (lbs/ton)

The following equation was used to calculate the annual emission rate for each process unit:

$$\text{Emission Rate (tons/year)} = \frac{\text{Emission Rate (lbs/hour)} * \text{Operating Hour (hrs/year)}}{\text{2000 lbs/ton}}$$

Table B-10: Controlled Hot Mix Plant Emission Rates

Process Unit Number	Process Unit Description	Pollutant	Average Hourly Process Rate (tons/hour)	Emission Rate (lbs/hr)	Emission Rate (tons/yr)
16,16b	Asphalt Drum Dryer and Baghouse	NO_X	400	10.40	18.85
		CO	400	52.00	94.25
		SO_2	400	1.36	2.47
		VOC	400	12.80	23.20
		PM	400	13.20	23.93
		PM_{10}	400	9.20	16.68
		$PM_{2.5}$	400	9.20	16.68
17	Drum Mixer Unloading	CO	400	0.19	0.34
		TOC	400	1.95	3.53
		PM	400	0.094	0.17
		PM_{10}	400	0.094	0.17
		$PM_{2.5}$	400	0.094	0.17
18	Asphalt Silo Unloading	CO	400	0.17	0.32
		TOC	400	0.54	0.97
		PM	400	0.12	0.21
		PM_{10}	400	0.12	0.21
		$PM_{2.5}$	400	0.12	0.21
19	Asphalt Cement Storage Tanks (3)	TOC	400	0.071	0.31
22	YARD	CO	400	0.14	0.26
		TOC	400	0.44	0.80

Natural Gas Asphalt Heater

One natural gas asphalt heater (Unit 20) heats the asphalt oil before it is mixed with the aggregate in the drum dryer/mixer. The unit is rated at 2,000,000 Btu/hr. The estimated hourly natural gas fuel usage for the heater is 2600 standard cubic feet (scf) per hour. Emissions of nitrogen dioxide (NO_X), carbon monoxides (CO), hydrocarbons (VOC), and particulate (PM) are estimated using AP-42 Section 1.4 "Natural Gas Combustion" (rev 7/98). Emission of sulfur dioxide (SO_2) are estimated using mass balance. Sulfur content of the natural gas in New Mexico cannot exceed a total sulfur content of 0.75 grain per 100 scf. No controls are proposed for the asphalt heater. Uncontrolled annual emissions in tons per year (tpy) were calculated assuming operation of 8760 hours per year. Controlled annual emissions in tons per year (tpy) were calculated assuming operation of 8760 hours per year. Table B-11 summarizes the uncontrolled emission rates for the asphalt heater. Table B-12 summarizes the controlled emission rates for the asphalt heater.

AP-42 Emission Factors: Section 1.4

Natural Gas Emission Factors

Pollutant	Emission Factor
Nitrogen Oxides	100 lbs/MMscf
Carbon Monoxides	84 lbs/MMscf
Particulate	7.6 lbs/MMscf
Hydrocarbons	11 lbs/MMscf

Sulfur Dioxide Emission Rate Equation

SO2 lb/hr = 2600 scf/hr * 0.75 grains/100 scf / 7000 grains/lb * 2 S/SO_2

0.0056 lb/hr = 2600 scf/hr * 0.75 grains/100 scf / 7000 grains/lb * 2 S/SO_2

Emission Rate (lbs/hr) = EF (lbs/gal-hr) * fuel usage (gal)

The following equation was used to calculate the annual emission rate for each heater pollutant:

$$\text{Emission Rate (tons/year)} = \frac{\text{Emission Rate (lbs/hour)} * \text{Operating Hour (hrs/year)}}{\text{2000 lbs/ton}}$$

Table B-11: Uncontrolled Combustion Emission Rates for Asphalt Heater

Process Unit Number	Pollutant	Fuel Usage	Emission Rate (lbs/hr)	Emission Rate (tons/yr)
20	NO_X	2600 scf/hr	0.26	1.14
	CO	2600 scf/hr	0.22	0.96
	VOC	2600 scf/hr	0.029	0.13
	SO_2	2600 scf/hr	0.0056	0.024
	PM	2600 scf/hr	0.020	0.087

Table B-12: Controlled Combustion Emission Rates for Asphalt Heater

Process Unit Number	Pollutant	Fuel Usage	Emission Rate (lbs/hr)	Emission Rate (tons/yr)
20	NO_X	2600 scf/hr	0.26	1.14
	CO	2600 scf/hr	0.22	0.96
	VOC	2600 scf/hr	0.029	0.13
	SO_2	2600 scf/hr	0.0056	0.024
	PM	2600 scf/hr	0.020	0.087

Tables B-13 and B-14 present the uncontrolled and controlled emission rates, respectively, from the facility operating with 35% RAP in the asphalt mix. Tables B-15 and B-16 present the uncontrolled and controlled emission rates, respectively, from the facility operating with 0% RAP in the asphalt mix.

Table B-13 Summary of Uncontrolled NOx, CO, SO2, and PM Emission Rates with 35% RAP in Mix

Uncontrolled Emission Totals																
Unit #	Description	NOx		CO		SO_2		VOC		PM		PM_{10}		$PM_{2.5}$	
		lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr
1	Cold Aggregate Storage Piles									1.09	4.76	0.51	2.25	0.078	0.34
2	Feed Bin Loading									1.09	4.76	0.51	2.25	0.078	0.34
3	Feed Bin Unloading									0.69	3.02	0.25	1.11	0.039	0.17
4	Scalping Screen									5.75	25.2	2.00	8.76	0.30	1.33
5	Scalping Screen Unloading									0.69	3.02	0.25	1.11	0.039	0.17
6	Conveyor Transfer to Slinger Conveyor									0.69	3.02	0.25	1.11	0.039	0.17
7	RAP Storage Pile									0.20	0.87	0.094	0.41	0.014	0.062
8	RAP Bin Loading									0.20	0.87	0.094	0.41	0.014	0.062
9	RAP Bin Unloading									0.42	1.84	0.15	0.67	0.024	0.10
10	RAP Screen									3.50	15.3	1.22	5.33	0.18	0.81
11	RAP Screen Recycle Unloading									0.42	1.84	0.15	0.67	0.024	0.10
12	RAP Crusher									0.76	3.31	0.34	1.47	0.051	0.22
13	RAP Screen Unloading									0.42	1.84	0.15	0.67	0.024	0.10
14	RAP Transfer Conveyor									0.42	1.84	0.15	0.67	0.024	0.10
15	Mineral Filler Silo									18.3	19.2	11.8	12.4	2.33	2.44
16	Drum Dryer/Mixer	10.4	45.6	52.0	227.8	1.36	5.96	12.8	56.1	11200	49056	2600	11388	626	2742
17	Drum Mixer Unloading			0.47	2.07			4.87	21.35	0.23	1.03	0.23	1.03	0.23	1.03
18	Asphalt Silo Unloading			0.17	0.76			0.54	2.35	0.12	0.51	0.12	0.51	0.12	0.51
19	Asphalt Cement Storage Tanks (3)							0.071	0.31						

Table B-13 Summary of Uncontrolled NOx, CO, SO2, and PM Emission Rates with 35% RAP in Mix

Uncontrolled Emission Totals															
Unit #	Description	NOx		CO		SO_2		VOC		PM		PM_{10}		$PM_{2.5}$	
		lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr
20	Asphalt Heater	0.26	1.14	0.22	0.96	0.0056	0.024	0.029	0.13	0.020	0.087	0.020	0.087	0.020	0.087
21	Haul Road Traffic									0.76	3.32	0.15	0.67	0.038	0.16
22	Yard			0.14	0.62			0.44	1.93						
	Total	**10.7**	**46.7**	**53.0**	**232.2**	**1.37**	**5.98**	**18.8**	**82.1**	**11236**	**49152**	**2618**	**11430**	**630**	**2750**

Table B-14 Summary of Allowable NOx, CO, SO2, and PM Emission Rates with 35% RAP in Mix

Allowable Emission Totals																
Unit #	Description	NOx		CO		SO_2		VOC		PM		PM_{10}		$PM_{2.5}$	
		lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr
1	Cold Aggregate Storage Piles									1.09	1.97	0.51	0.93	0.078	0.14
2	Feed Bin Loading									1.09	1.97	0.51	0.93	0.078	0.14
3	Feed Bin Unloading									0.032	0.058	0.011	0.019	0.0030	0.0054
4	Scalping Screen									0.51	0.92	0.17	0.31	0.012	0.021
5	Scalping Screen Unloading									0.032	0.058	0.011	0.019	0.0030	0.0054
6	Conveyor Transfer to Slinger Conveyor									0.032	0.058	0.011	0.019	0.0030	0.0054
7	RAP Storage Pile									0.20	0.36	0.094	0.17	0.014	0.026
8	RAP Bin Loading									0.20	0.36	0.094	0.17	0.014	0.026
9	RAP Bin Unloading									0.020	0.036	0.0064	0.012	0.0018	0.0033
10	RAP Screen									0.31	0.56	0.10	0.19	0.0070	0.013
11	RAP Screen Recycle Unloading									0.020	0.036	0.0064	0.012	0.0018	0.0033
12	RAP Crusher									0.17	0.30	0.076	0.137	0.014	0.025
13	RAP Screen Unloading									0.020	0.036	0.0064	0.012	0.0018	0.0033
14	RAP Transfer Conveyor									0.020	0.036	0.0064	0.012	0.0018	0.0033
15, 15b	Mineral Filler Silo Baghouse									0.18	0.079	0.12	0.051	0.027	0.012
16, 16b	Drum Dryer/Mixer Baghouse	10.4	18.9	52.0	94.3	1.36	2.47	12.8	23.2	13.2	23.9	9.20	16.7	9.20	16.7
17, 17b	Drum Mixer Unloading			0.19	0.34			1.95	3.53	0.094	0.17	0.094	0.17	0.094	0.17
18	Asphalt Silo Unloading			0.17	0.32			0.54	0.97	0.12	0.21	0.12	0.21	0.12	0.21
19	Asphalt Cement Storage Tanks (3)							0.071	0.31						

Table B-14 Summary of Allowable NOx, CO, SO2, and PM Emission Rates with 35% RAP in Mix

Allowable Emission Totals															
Unit #	Description	NOx		CO		SO_2		VOC		PM		PM_{10}		$PM_{2.5}$	
		lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr
20	Asphalt Heater	0.26	1.14	0.22	0.96	0.0056	0.024	0.029	0.13	0.020	0.087	0.020	0.087	0.020	0.087
21	Haul Road Traffic									0.76	1.33	0.15	0.27	0.038	0.065
22	Yard			0.14	0.26			0.44	0.80						
Total		**10.7**	**20.0**	**52.7**	**96.1**	**1.37**	**2.49**	**15.8**	**28.9**	**18.1**	**32.6**	**11.3**	**20.4**	**9.73**	**17.6**

Table B-15 Summary of Uncontrolled NOx, CO, SO2, and PM Emission Rates with 0% RAP in Mix

Uncontrolled Emission Totals															
Unit #	Description	NOx		CO		SO_2		VOC		PM		PM_{10}		$PM_{2.5}$	
		lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr
1	Cold Aggregate Storage Piles									1.75	7.65	0.83	3.62	0.13	0.55
2	Feed Bin Loading									1.75	7.65	0.83	3.62	0.13	0.55
3	Feed Bin Unloading									1.11	4.86	0.41	1.78	0.063	0.28
4	Scalping Screen									9.25	40.5	3.22	14.10	0.49	2.14
5	Scalping Screen Unloading									1.11	4.86	0.41	1.78	0.063	0.28
6	Conveyor Transfer to Slinger Conveyor									1.11	4.86	0.41	1.78	0.063	0.28
7	RAP Storage Pile									0.0	0.0	0.0	0.0	0.0	0.0
8	RAP Bin Loading									0.0	0.0	0.0	0.0	0.0	0.0
9	RAP Bin Unloading									0.0	0.0	0.0	0.0	0.0	0.0
10	RAP Screen									0.0	0.0	0.0	0.0	0.0	0.0
11	RAP Screen Recycle Unloading									0.0	0.0	0.0	0.0	0.0	0.0
12	RAP Crusher									0.0	0.0	0.0	0.0	0.0	0.0
13	RAP Screen Unloading									0.0	0.0	0.0	0.0	0.0	0.0
14	RAP Transfer Conveyor									0.0	0.0	0.0	0.0	0.0	0.0
15	Mineral Filler Silo									18.3	19.2	11.8	12.4	2.33	2.44
16	Drum Dryer/Mixer	10.4	45.6	52.0	227.8	1.36	5.96	12.8	56.1	11200	49056	2600	11388	626	2742
17	Drum Mixer Unloading			0.47	2.07			4.87	21.35	0.23	1.03	0.23	1.03	0.23	1.03
18	Asphalt Silo Unloading			0.17	0.76			0.54	2.35	0.12	0.51	0.12	0.51	0.12	0.51
19	Asphalt Cement Storage Tanks (3)							0.071	0.31						

Table B-15 Summary of Uncontrolled NOx, CO, SO2, and PM Emission Rates with 0% RAP in Mix

Uncontrolled Emission Totals															
Unit #	Description	NOx		CO		SO_2		VOC		PM		PM_{10}		$PM_{2.5}$	
		lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr
20	Asphalt Heater	0.26	1.14	0.22	0.96	0.0056	0.024	0.029	0.13	0.020	0.087	0.020	0.087	0.020	0.087
21	Haul Road Traffic									0.75	3.28	0.15	0.66	0.037	0.16
22	Yard			0.14	0.62			0.44	1.93						
	Total	**10.7**	**46.7**	**53.0**	**232.2**	**1.37**	**5.98**	**18.8**	**82.1**	**11235**	**49150**	**2618**	**11429**	**630**	**2750**

Table B-16 Summary of Allowable NOx, CO, SO2, and PM Emission Rates with 0% RAP in Mix

Allowable Emission Totals																
Unit #	Description	NOx		CO		SO_2		VOC		PM		PM_{10}		$PM_{2.5}$	
		lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr
1	Cold Aggregate Storage Piles									1.75	3.17	0.83	1.50	0.13	0.23
2	Feed Bin Loading									1.75	3.17	0.83	1.50	0.13	0.23
3	Feed Bin Unloading									0.052	0.094	0.017	0.031	0.0048	0.0087
4	Scalping Screen									0.81	1.48	0.27	0.50	0.019	0.034
5	Scalping Screen Unloading									0.052	0.094	0.017	0.031	0.0048	0.0087
6	Conveyor Transfer to Slinger Conveyor									0.052	0.094	0.017	0.031	0.0048	0.0087
7	RAP Storage Pile									0.0	0.0	0.0	0.0	0.0	0.0
8	RAP Bin Loading									0.0	0.0	0.0	0.0	0.0	0.0
9	RAP Bin Unloading									0.0	0.0	0.0	0.0	0.0	0.0
10	RAP Screen									0.0	0.0	0.0	0.0	0.0	0.0
11	RAP Screen Recycle Unloading									0.0	0.0	0.0	0.0	0.0	0.0
12	RAP Crusher									0.0	0.0	0.0	0.0	0.0	0.0
13	RAP Screen Unloading									0.0	0.0	0.0	0.0	0.0	0.0
14	RAP Transfer Conveyor									0.0	0.0	0.0	0.0	0.0	0.0
15, 15b	Mineral Filler Silo Baghouse									0.18	0.079	0.12	0.051	0.027	0.012
16, 16b	Drum Dryer/Mixer Baghouse	10.4	18.9	52.0	94.3	1.36	2.47	12.8	23.2	13.2	23.9	9.20	16.7	9.20	16.7
17, 17b	Drum Mixer Unloading			0.19	0.34			1.95	3.53	0.094	0.17	0.094	0.17	0.094	0.17
18	Asphalt Silo Unloading			0.17	0.32			0.54	0.97	0.12	0.21	0.12	0.21	0.12	0.21
19	Asphalt Cement Storage Tanks (3)							0.071	0.31						

Table B-16 Summary of Allowable NOx, CO, SO2, and PM Emission Rates with 0% RAP in Mix

Allowable Emission Totals																
Unit #	Description	NOx		CO		SO_2		VOC		PM		PM_{10}		$PM_{2.5}$	
		lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr
20	Asphalt Heater	0.26	1.14	0.22	0.96	0.0056	0.024	0.029	0.13	0.020	0.087	0.020	0.087	0.020	0.087
21	Haul Road Traffic									0.75	1.30	0.15	0.26	0.037	0.064
22	Yard			0.14	0.26			0.44	0.80						
	Total	**10.7**	**20.0**	**52.7**	**96.1**	**1.37**	**2.49**	**15.8**	**28.9**	**18.8**	**33.9**	**11.7**	**21.0**	**9.78**	**17.7**

Estimates for Hydrogen Sulfide Pollutants

The Hot Mix Asphalt Plant (HMA) drum dryer/mixer, asphalt silo loading, and asphalt silo unloading are sources of hydrogen sulfide (H_2S) listed as a state regulated ambient air quality standard. Emission factors of H_2S from the drum dryer/mixer, asphalt silo loading, and asphalt silo unloading are based on a 2001 study performed by the North Carolina Division of Air Quality and the city of Salisbury, NC. Emission calculations are based on a production of 400 tph and 1,450,000 tons per year. From the study the H_2S emission factors from these sources are:

Process Unit Number	Process Unit Description	H_2S Emission Factor
16,16b	Asphalt Drum Dryer and Baghouse	0.0000518 lbs/ton
17	Drum Mixer Unloading	0.000001460 lbs/ton
18	Asphalt Silo Unloading	0.000001460 lbs/ton

Table B-17: Controlled Hot Mix Plant Emission Rates

Process Unit Number	Process Unit Description	Pollutant	Average Hourly Process Rate (tons/hour)	Emission Rate (lbs/hr)	Emission Rate (tons/yr)
16,16b	Asphalt Drum Dryer and Baghouse	H_2S	400	0.021	0.038
17	Drum Mixer Unloading	H_2S	400	0.00058	0.0011
18	Asphalt Silo Unloading	H_2S	400	0.00058	0.0011

Estimates for State Toxic Air Pollutants (Asphalt Fumes)

The Hot Mix Asphalt Plant (HMA) drum dryer/mixer, asphalt silo loading, asphalt silo unloading, yard emissions, and heated asphalt cement storage tank are sources of asphalt fumes listed in the NMED's 20.2.72 NMAC, 502 "Toxic Air Pollutants and Emissions", Table A. Emissions of asphalt fumes from the drum dryer/mixer are based on PM organic condensable emission factors found in AP-42 Section 11.1, Table 11.1-3 (0.012 pounds per ton x 400 tons/hr) from the drum dryer/mixer baghouse stack or 4.80 pounds per hour.

Emissions of asphalt fumes from the asphalt silo filling (Unit 17), asphalt silo (plant) unloading (Unit 18), Yard (asphalt transported in asphalt trucks-Unit 22), and hot oil asphalt storage tanks (Unit 19) were based on the assumption that the emissions of concern from the silo filling, silo unloading, hot oil asphalt storage tanks, and yard asphalt fumes sources are the PAH HAPs plus other semi-volatile HAPs from the particulate (PM) organics and the volatile organic HAPs from the Total Organic Compounds (TOC). These two combined make up asphalt fume emissions from the silo filling, silo unloading, hot oil asphalt storage tanks, and yard sources. Using information found in AP-42 Section 11.1, Tables 11.1-14, 15, and 16 the following emission equations or emission factors were used to estimate asphalt fumes emissions from silo filling, silo unloading, hot oil asphalt storage tanks, and yard.

Asphalt silo filling and asphalt silo unloading emission factors were calculated using the default value of –0.5 for asphalt volatility plus an asphalt mix temperature of 325˚ F for HMA mix for silo loading and an asphalt mix temperature of 280˚ F for HMA mix for plant loadout. Pollution control equipment installed on the exit of the drum mixer and asphalt silo loading is a recirculation system that captures asphalt fumes (Blue Smoke), then recirculates the gas back to the drum dryer to be incinerated to reduce these pollutants. It is estimated that the system will reduce these pollutant emissions by 60%.

<u>Silo Filling Unit 17</u>

Asphalt Fumes $EF = 0.00078(-V)e^{((0.0251)(T+460)-20.43)}$ * 60% control efficiency (0.4 factor)

<u>Plant Loadout Unit 18</u>

Asphalt Fumes $EF = 0.00036(-V)e^{((0.0251)(T+460)-20.43)}$

<u>Asphalt Storage Tanks Unit 19</u>

Asphalt Fumes EF = VOC emissions from TANKs * 1.3%

<u>Yard Unit 22</u>

Asphalt Fumes EF = 0.0000165 lbs/ton of asphalt loaded

Inputting these values into the equations gives you a pound per ton value of 0.000075441 lbs/ton (silo filling) and 0.000028133 lbs/ton (plant loadout) of asphalt produced or asphalt fumes emission rates of 0.030 and 0.011 pounds per hour (400 tph of asphalt production), respectively.

Emissions of asphalt fumes from the Yard were based on 1.5 percent of the TOC emission. Yard (Unit 22) emission factors are found in AP-42 Section 11.1.2.5. TOC emission factor is 0.0011 lbs/ton of asphalt produced. Asphalt fumes emissions are 0.0000165 lbs/ton of asphalt produced or 0.0066 pounds per hour (400 tph of asphalt production).

Emissions of asphalt fumes from the asphalt cement storage tanks (Unit 19) were determined with EPA's TANK 4.0.9d program and the procedures found in EPA's "Emission Factor Documentation for AP-42 Section 11.1 (12/2000) Section 4.4.5" for input to the TANK program. The annual VOC emissions for working and breathing losses from three 45,000-gallon tanks were estimated at 624.66 pounds per year (0.071 pounds per hour). Based on 1.3 percent of the VOC emissions (total 0.071 pounds per hour), the asphalt fumes emission rate is 0.00093 pounds per hour.

Total asphalt fumes from the HMA plant is 4.85 pounds per hour and 8.79 tons per year.

Estimates for Federal HAPs Air Pollutants

The Hot Mix Asphalt Plant (HMA) drum dryer (Unit 16) and asphalt heater (Unit 20), are sources of HAPs as it appears in Section 112 (b) of the 1990 CAAA. Emissions of HAPs were determined for the drum mixer using AP-42 Section 11.1 Tables 11.1-10, 11.1-12. Emissions of HAPs were determined for the asphalt heater using the worst-case emission factors from AP-42 Section 1.4, combusting natural gas.

The following tables summarize the HAPs emission rates from the drum mixer and asphalt heater. Total combined HAPs emissions from the Black Rock HP-2 HMA is 2.16 pounds per hour and 3.92 tons per year.

Table B-18: HAPs Emission Rates from the Drum Dryer/Mixer (Unit 16)

EPA HAPS Emissions Drum Mixer Hot Mix Asphalt Plant with Fabric Filter

Average Hourly Production Rate:	400	tons per hour
Yearly Production Rate:	1450000	tons per year

Type of Fuel:	Natural Gas
Emission Factors	AP-42 Section 11.1 Tables 11.1-10, 11.1-12

Non-PAH HAPS	**CAS#**		**Emission Factor (lbs/ton)**	**Emission Rate (lbs/hr)**	**Emission Rate (ton/yr)**
Benzene	71-43-2		3.9E-04	0.156000	0.282750
Ethylbenzene	100-41-4		2.4E-04	0.096000	0.174000
Formaldehyde	50-00-0		3.1E-03	1.240000	2.247500
Hexane	110-54-3		9.2E-04	0.368000	0.667000
Isooctane (2,2,4-trimethylpentane)	540-84-1		4.0E-05	0.016000	0.029000
Methyl chloroform	71-55-6		4.8E-05	0.019200	0.034800
Toluene	108-88-3		1.5E-04	0.060000	0.108750
Xylene	1330-20-7		2.0E-04	0.080000	0.145000
		Total Non-PAH HAPS	5.1E-03	2.035200	3.688800

PAH HAPS	**CAS#**		**Emission Factor (lbs/ton)**	**Emission Rate (lbs/hr)**	**Emission Rate (ton/yr)**
2-Methylnaphthalene	91-57-6		7.4E-05	0.029600	0.053650
Acenaphthene	83-32-9		1.4E-06	0.000560	0.001015
Acenaphthylene	208-96-8		8.6E-06	0.003440	0.006235
Anthracene	120-12-7		2.2E-07	0.000088	0.000160
Benzo(a)anthracene	56-55-3		2.1E-07	0.000084	0.000152
Benzo(a)pyrene	50-32-8		9.8E-09	0.000004	0.000007
Benzo(b)fluoranthene	205-99-2		1.0E-07	0.000040	0.000073
Benzo(b)pyrene	192-97-2		1.1E-07	0.000044	0.000080
Benzo(g,h,I)perylene	191-24-2		4.0E-08	0.000016	0.000029
Benzo(k)fluoranthene	207-08-9		4.1E-08	0.000016	0.000030
Chrysene	218-01-9		1.8E-07	0.000072	0.000131
Fluoranthene	206-44-0		6.1E-07	0.000244	0.000442
Fluorene	86-73-7		3.8E-06	0.001520	0.002755
Indeno(1,2,3-cd)pyrene	193-39-5		7.0E-09	0.000003	0.000005
Naphthalene	91-20-3		9.0E-05	0.036000	0.065250
Perylene	198-55-0		8.8E-09	0.000004	0.000006
Phenanthrene	85-01-8		7.6E-06	0.003040	0.005510
Pyrene	129-00-0		5.4E-07	0.000216	0.000392
		Total PAH HAPS	1.9E-04	0.074991	0.135921

HAPS Metals		Emission Factor (lbs/ton)	Emission Rate (lbs/hr)	Emission Rate (ton/yr)
Arsenic		5.6E-07	0.000224	0.000406
Beryllium		0.0E+00	0.000000	0.000000
Cadmium		4.1E-07	0.000164	0.000297
Chromium		5.5E-06	0.002200	0.003988
Cobalt		2.6E-08	0.000010	0.000019
Hexavalent Chromium		4.5E-07	0.000180	0.000326
Lead		6.2E-07	0.000248	0.000450
Manganese		7.7E-06	0.003080	0.005583
Mercury		2.4E-07	0.000096	0.000174
Nickel		6.3E-05	0.025200	0.045675
Phosphorus		2.8E-05	0.011200	0.020300
Selenium		3.5E-07	0.000140	0.000254
	Total Metals HAPS	1.1E-04	0.042742	0.077471
	Total HAPS		**2.15**	**3.90**

Table B-19: HAPs Emission Rates from the Asphalt Heater (Unit 20)

Btu Rating	2.000	mmBtu/hr
Fuel Usage Hourly:	2600	cuft/hr
Fuel Usage Annual:	22.776	MMcuft/yr
Yearly Operating Hours:	8760	hours per year

Type of Fuel:	Natural Gas
Emission Factors	AP-42 Section 1.4 Natural Gas

Organic Compounds	**CAS#**		**Emission Factor mm cu. ft. gas**	**Emission Rate (lbs/hr)**	**Emission Rate (ton/yr)**
Benzene	71-43-2		2.10E-03	0.0000055	0.0000239
Formaldehyde	50-00-0		7.50E-02	0.0001950	0.0008541
Hexane	110-54-3		1.80E+00	0.0046800	0.0204984
Naphthalene	91-20-3		6.10E-04	0.0000016	0.0000069
Toluene	108-88-3		3.40E-03	0.0000088	0.0000387
		Total Organic Compounds	6.88E-02	0.0007565	0.0033137

HAPS Metals		**Emission Factor mm cu. ft. gas**	**Emission Rate (lbs/hr)**	**Emission Rate (ton/yr)**
Arsenic		2.00E-04	0.0000005	0.0000023
Beryllium		1.20E-05	0.0000000	0.0000001
Cadmium		1.10E-03	0.0000029	0.0000125
Chromium		1.40E-03	0.0000036	0.0000159
Cobalt		8.40E-05	0.0000002	0.0000010
Lead		5.00E-04	0.0000013	0.0000057
Manganese		3.80E-04	0.0000010	0.0000043
Mercury		2.60E-04	0.0000007	0.0000030
Nickel		2.10E-03	0.0000055	0.0000239
Selenium		2.40E-05	0.0000001	0.0000003
	Total Metals HAPS	6.06E-03	0.0000158	0.0000690
	Total HAPS		**0.00491**	**0.02149**

Attachment C
Emission Calculations Supporting Documents

AP-42 Section 1.4

1.4 Natural Gas Combustion

1.4.1 General[1-2]

Natural gas is one of the major combustion fuels used throughout the country. It is mainly used to generate industrial and utility electric power, produce industrial process steam and heat, and heat residential and commercial space. Natural gas consists of a high percentage of methane (generally above 85 percent) and varying amounts of ethane, propane, butane, and inerts (typically nitrogen, carbon dioxide, and helium). The average gross heating value of natural gas is approximately 1,020 British thermal units per standard cubic foot (Btu/scf), usually varying from 950 to 1,050 Btu/scf.

1.4.2 Firing Practices[3-5]

There are three major types of boilers used for natural gas combustion in commercial, industrial, and utility applications: watertube, firetube, and cast iron. Watertube boilers are designed to pass water through the inside of heat transfer tubes while the outside of the tubes is heated by direct contact with the hot combustion gases and through radiant heat transfer. The watertube design is the most common in utility and large industrial boilers. Watertube boilers are used for a variety of applications, ranging from providing large amounts of process steam, to providing hot water or steam for space heating, to generating high-temperature, high-pressure steam for producing electricity. Furthermore, watertube boilers can be distinguished either as field erected units or packaged units.

Field erected boilers are boilers that are constructed on site and comprise the larger sized watertube boilers. Generally, boilers with heat input levels greater than 100 MMBtu/hr, are field erected. Field erected units usually have multiple burners and, given the customized nature of their construction, also have greater operational flexibility and NO_x control options. Field erected units can also be further categorized as wall-fired or tangential-fired. Wall-fired units are characterized by multiple individual burners located on a single wall or on opposing walls of the furnace while tangential units have several rows of air and fuel nozzles located in each of the four corners of the boiler.

Package units are constructed off-site and shipped to the location where they are needed. While the heat input levels of packaged units may range up to 250 MMBtu/hr, the physical size of these units are constrained by shipping considerations and generally have heat input levels less than 100 MMBtu/hr. Packaged units are always wall-fired units with one or more individual burners. Given the size limitations imposed on packaged boilers, they have limited operational flexibility and cannot feasibly incorporate some NO_x control options.

Firetube boilers are designed such that the hot combustion gases flow through tubes, which heat the water circulating outside of the tubes. These boilers are used primarily for space heating systems, industrial process steam, and portable power boilers. Firetube boilers are almost exclusively packaged units. The two major types of firetube units are Scotch Marine boilers and the older firebox boilers. In cast iron boilers, as in firetube boilers, the hot gases are contained inside the tubes and the water being heated circulates outside the tubes. However, the units are constructed of cast iron rather than steel. Virtually all cast iron boilers are constructed as package boilers. These boilers are used to produce either low-pressure steam or hot water, and are most commonly used in small commercial applications.

Natural gas is also combusted in residential boilers and furnaces. Residential boilers and furnaces generally resemble firetube boilers with flue gas traveling through several channels or tubes with water or air circulated outside the channels or tubes.

1.4.3 Emissions[3-4]

The emissions from natural gas-fired boilers and furnaces include nitrogen oxides (NO_x), carbon monoxide (CO), and carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), volatile organic compounds (VOCs), trace amounts of sulfur dioxide (SO_2), and particulate matter (PM).

Nitrogen Oxides -

Nitrogen oxides formation occurs by three fundamentally different mechanisms. The principal mechanism of NO_x formation in natural gas combustion is thermal NO_x. The thermal NO_x mechanism occurs through the thermal dissociation and subsequent reaction of nitrogen (N_2) and oxygen (O_2) molecules in the combustion air. Most NO_x formed through the thermal NO_x mechanism occurs in the high temperature flame zone near the burners. The formation of thermal NO_x is affected by three furnace-zone factors: (1) oxygen concentration, (2) peak temperature, and (3) time of exposure at peak temperature. As these three factors increase, NO_x emission levels increase. The emission trends due to changes in these factors are fairly consistent for all types of natural gas-fired boilers and furnaces. Emission levels vary considerably with the type and size of combustor and with operating conditions (e.g., combustion air temperature, volumetric heat release rate, load, and excess oxygen level).

The second mechanism of NO_x formation, called prompt NO_x, occurs through early reactions of nitrogen molecules in the combustion air and hydrocarbon radicals from the fuel. Prompt NO_x reactions occur within the flame and are usually negligible when compared to the amount of NO_x formed through the thermal NO_x mechanism. However, prompt NO_x levels may become significant with ultra-low-NO_x burners.

The third mechanism of NO_x formation, called fuel NO_x, stems from the evolution and reaction of fuel-bound nitrogen compounds with oxygen. Due to the characteristically low fuel nitrogen content of natural gas, NO_x formation through the fuel NO_x mechanism is insignificant.

Carbon Monoxide -

The rate of CO emissions from boilers depends on the efficiency of natural gas combustion. Improperly tuned boilers and boilers operating at off-design levels decrease combustion efficiency resulting in increased CO emissions. In some cases, the addition of NO_x control systems such as low NO_x burners and flue gas recirculation (FGR) may also reduce combustion efficiency, resulting in higher CO emissions relative to uncontrolled boilers.

Volatile Organic Compounds -

The rate of VOC emissions from boilers and furnaces also depends on combustion efficiency. VOC emissions are minimized by combustion practices that promote high combustion temperatures, long residence times at those temperatures, and turbulent mixing of fuel and combustion air. Trace amounts of VOC species in the natural gas fuel (e.g., formaldehyde and benzene) may also contribute to VOC emissions if they are not completely combusted in the boiler.

Sulfur Oxides -

Emissions of SO_2 from natural gas-fired boilers are low because pipeline quality natural gas typically has sulfur levels of 2,000 grains per million cubic feet. However, sulfur-containing odorants are added to natural gas for detecting leaks, leading to small amounts of SO_2 emissions. Boilers combusting unprocessed natural gas may have higher SO_2 emissions due to higher levels of sulfur in the natural gas. For these units, a sulfur mass balance should be used to determine SO_2 emissions.

Particulate Matter -

Because natural gas is a gaseous fuel, filterable PM emissions are typically low. Particulate matter from natural gas combustion has been estimated to be less than 1 micrometer in size and has filterable and condensable fractions. Particulate matter in natural gas combustion are usually larger molecular weight hydrocarbons that are not fully combusted. Increased PM emissions may result from poor air/fuel mixing or maintenance problems.

Greenhouse Gases -[6-9]

CO_2, CH_4, and N_2O emissions are all produced during natural gas combustion. In properly tuned boilers, nearly all of the fuel carbon (99.9 percent) in natural gas is converted to CO_2 during the combustion process. This conversion is relatively independent of boiler or combustor type. Fuel carbon not converted to CO_2 results in CH_4, CO, and/or VOC emissions and is due to incomplete combustion. Even in boilers operating with poor combustion efficiency, the amount of CH_4, CO, and VOC produced is insignificant compared to CO_2 levels.

Formation of N_2O during the combustion process is affected by two furnace-zone factors. N_2O emissions are minimized when combustion temperatures are kept high (above 1475°F) and excess oxygen is kept to a minimum (less than 1 percent).

Methane emissions are highest during low-temperature combustion or incomplete combustion, such as the start-up or shut-down cycle for boilers. Typically, conditions that favor formation of N_2O also favor emissions of methane.

1.4.4 Controls[4,10]

NO_x Controls -

Currently, the two most prevalent combustion control techniques used to reduce NO_x emissions from natural gas-fired boilers are flue gas recirculation (FGR) and low NO_x burners. In an FGR system, a portion of the flue gas is recycled from the stack to the burner windbox. Upon entering the windbox, the recirculated gas is mixed with combustion air prior to being fed to the burner. The recycled flue gas consists of combustion products which act as inerts during combustion of the fuel/air mixture. The FGR system reduces NO_x emissions by two mechanisms. Primarily, the recirculated gas acts as a dilutent to reduce combustion temperatures, thus suppressing the thermal NO_x mechanism. To a lesser extent, FGR also reduces NO_x formation by lowering the oxygen concentration in the primary flame zone. The amount of recirculated flue gas is a key operating parameter influencing NO_x emission rates for these systems. An FGR system is normally used in combination with specially designed low NO_x burners capable of sustaining a stable flame with the increased inert gas flow resulting from the use of FGR. When low NO_x burners and FGR are used in combination, these techniques are capable of reducing NO_x emissions by 60 to 90 percent.

Low NO_x burners reduce NO_x by accomplishing the combustion process in stages. Staging partially delays the combustion process, resulting in a cooler flame which suppresses thermal NO_x formation. The two most common types of low NO_x burners being applied to natural gas-fired boilers are staged air burners and staged fuel burners. NO_x emission reductions of 40 to 85 percent (relative to uncontrolled emission levels) have been observed with low NO_x burners.

Other combustion control techniques used to reduce NO_x emissions include staged combustion and gas reburning. In staged combustion (e.g., burners-out-of-service and overfire air), the degree of staging is a key operating parameter influencing NO_x emission rates. Gas reburning is similar to the use of overfire in the use of combustion staging. However, gas reburning injects additional amounts of natural gas in the upper furnace, just before the overfire air ports, to provide increased reduction of NO_x to NO_2.

Two postcombustion technologies that may be applied to natural gas-fired boilers to reduce NO_x emissions are selective noncatalytic reduction (SNCR) and selective catalytic reduction (SCR). The SNCR system injects ammonia (NH_3) or urea into combustion flue gases (in a specific temperature zone) to reduce NO_x emission. The Alternative Control Techniques (ACT) document for NO_x emissions from utility boilers, maximum SNCR performance was estimated to range from 25 to 40 percent for natural gas-fired boilers.[12] Performance data available from several natural gas fired utility boilers with SNCR show a 24 percent reduction in NO_x for applications on wall-fired boilers and a 13 percent reduction in NO_x for applications on tangential-fired boilers.[11] In many situations, a boiler may have an SNCR system installed to trim NO_x emissions to meet permitted levels. In these cases, the SNCR system may not be operated to achieve maximum NO_x reduction. The SCR system involves injecting NH_3 into the flue gas in the presence of a catalyst to reduce NO_x emissions. No data were available on SCR performance on natural gas fired boilers at the time of this publication. However, the ACT Document for utility boilers estimates NO_x reduction efficiencies for SCR control ranging from 80 to 90 percent.[12]

Emission factors for natural gas combustion in boilers and furnaces are presented in Tables 1.4-1, 1.4-2, 1.4-3, and 1.4-4.[11] Tables in this section present emission factors on a volume basis (lb/10^6 scf). To convert to an energy basis (lb/MMBtu), divide by a heating value of 1,020 MMBtu/10^6 scf. For the purposes of developing emission factors, natural gas combustors have been organized into three general categories: large wall-fired boilers with greater than 100 MMBtu/hr of heat input, boilers and residential furnaces with less than 100 MMBtu/hr of heat input, and tangential-fired boilers. Boilers within these categories share the same general design and operating characteristics and hence have similar emission characteristics when combusting natural gas.

Emission factors are rated from A to E to provide the user with an indication of how “good” the factor is, with “A” being excellent and “E” being poor. The criteria that are used to determine a rating for an emission factor can be found in the Emission Factor Documentation for AP-42 Section 1.4 and in the introduction to the AP-42 document.

1.4.5 Updates Since the Fifth Edition

The Fifth Edition was released in January 1995. Revisions to this section are summarized below. For further detail, consult the Emission Factor Documentation for this section. These and other documents can be found on the Emission Factor and Inventory Group (EFIG) home page (http://www.epa.gov/ttn/chief).

Supplement D, March 1998

- Text was revised concerning Firing Practices, Emissions, and Controls.

- All emission factors were updated based on 482 data points taken from 151 source tests. Many new emission factors have been added for speciated organic compounds, including hazardous air pollutants.

July 1998 - minor changes

- Footnote D was added to table 1.4-3 to explain why the sum of individual HAP may exceed VOC or TOC, the web address was updated, and the references were reordered.

Table 1.4-1. EMISSION FACTORS FOR NITROGEN OXIDES (NO_x) AND CARBON MONOXIDE (CO) FROM NATURAL GAS COMBUSTION[a]

Combustor Type (MMBtu/hr Heat Input) [SCC]	NO_x[b]		CO	
	Emission Factor (lb/10^6 scf)	Emission Factor Rating	Emission Factor (lb/10^6 scf)	Emission Factor Rating
Large Wall-Fired Boilers (>100) [1-01-006-01, 1-02-006-01, 1-03-006-01]				
Uncontrolled (Pre-NSPS)[c]	280	A	84	B
Uncontrolled (Post-NSPS)[c]	190	A	84	B
Controlled - Low NO_x burners	140	A	84	B
Controlled - Flue gas recirculation	100	D	84	B
Small Boilers (<100) [1-01-006-02, 1-02-006-02, 1-03-006-02, 1-03-006-03]				
Uncontrolled	100	B	84	B
Controlled - Low NO_x burners	50	D	84	B
Controlled - Low NO_x burners/Flue gas recirculation	32	C	84	B
Tangential-Fired Boilers (All Sizes) [1-01-006-04]				
Uncontrolled	170	A	24	C
Controlled - Flue gas recirculation	76	D	98	D
Residential Furnaces (<0.3) [No SCC]				
Uncontrolled	94	B	40	B

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. To convert from lb/10^6 scf to kg/10^6 m^3, multiply by 16. Emission factors are based on an average natural gas higher heating value of 1,020 Btu/scf. To convert from 1b/10^6 scf to lb/MMBtu, divide by 1,020. The emission factors in this table may be converted to other natural gas heating values by multiplying the given emission factor by the ratio of the specified heating value to this average heating value. SCC = Source Classification Code. ND = no data. NA = not applicable.

[b] Expressed as NO_2. For large and small wall fired boilers with SNCR control, apply a 24 percent reduction to the appropriate NO_X emission factor. For tangential-fired boilers with SNCR control, apply a 13 percent reduction to the appropriate NO_X emission factor.

[c] NSPS=New Source Performance Standard as defined in 40 CFR 60 Subparts D and Db. Post-NSPS units are boilers with greater than 250 MMBtu/hr of heat input that commenced construction modification, or reconstruction after August 17, 1971, and units with heat input capacities between 100 and 250 MMBtu/hr that commenced construction modification, or reconstruction after June 19, 1984.

TABLE 1.4-2. EMISSION FACTORS FOR CRITERIA POLLUTANTS AND GREENHOUSE GASES FROM NATURAL GAS COMBUSTION[a]

Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
CO_2[b]	120,000	A
Lead	0.0005	D
N_2O (Uncontrolled)	2.2	E
N_2O (Controlled-low-NO_X burner)	0.64	E
PM (Total)[c]	7.6	D
PM (Condensable)[c]	5.7	D
PM (Filterable)[c]	1.9	B
SO_2[d]	0.6	A
TOC	11	B
Methane	2.3	B
VOC	5.5	C

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by 16. To convert from $lb/10^6$ scf to 1b/MMBtu, divide by 1,020. The emission factors in this table may be converted to other natural gas heating values by multiplying the given emission factor by the ratio of the specified heating value to this average heating value. TOC = Total Organic Compounds. VOC = Volatile Organic Compounds.

[b] Based on approximately 100% conversion of fuel carbon to CO_2. $CO_2[lb/10^6$ scf$]$ = (3.67) (CON) (C)(D), where CON = fractional conversion of fuel carbon to CO_2, C = carbon content of fuel by weight (0.76), and D = density of fuel, $4.2x10^4$ $lb/10^6$ scf.

[c] All PM (total, condensible, and filterable) is assumed to be less than 1.0 micrometer in diameter. Therefore, the PM emission factors presented here may be used to estimate PM_{10}, $PM_{2.5}$ or PM_1 emissions. Total PM is the sum of the filterable PM and condensible PM. Condensible PM is the particulate matter collected using EPA Method 202 (or equivalent). Filterable PM is the particulate matter collected on, or prior to, the filter of an EPA Method 5 (or equivalent) sampling train.

[d] Based on 100% conversion of fuel sulfur to SO_2.
Assumes sulfur content is natural gas of 2,000 grains/10^6 scf. The SO_2 emission factor in this table can be converted to other natural gas sulfur contents by multiplying the SO_2 emission factor by the ratio of the site-specific sulfur content (grains/10^6 scf) to 2,000 grains/10^6 scf.

TABLE 1.4-3. EMISSION FACTORS FOR SPECIATED ORGANIC COMPOUNDS FROM NATURAL GAS COMBUSTION[a]

CAS No.	Pollutant	Emission Factor (lb/10^6 scf)	Emission Factor Rating
91-57-6	2-Methylnaphthalene[b, c]	2.4E-05	D
56-49-5	3-Methylchloranthrene[b, c]	<1.8E-06	E
	7,12-Dimethylbenz(a)anthracene[b,c]	<1.6E-05	E
83-32-9	Acenaphthene[b,c]	<1.8E-06	E
203-96-8	Acenaphthylene[b,c]	<1.8E-06	E
120-12-7	Anthracene[b,c]	<2.4E-06	E
56-55-3	Benz(a)anthracene[b,c]	<1.8E-06	E
71-43-2	Benzene[b]	2.1E-03	B
50-32-8	Benzo(a)pyrene[b,c]	<1.2E-06	E
205-99-2	Benzo(b)fluoranthene[b,c]	<1.8E-06	E
191-24-2	Benzo(g,h,i)perylene[b,c]	<1.2E-06	E
205-82-3	Benzo(k)fluoranthene[b,c]	<1.8E-06	E
106-97-8	Butane	2.1E+00	E
218-01-9	Chrysene[b,c]	<1.8E-06	E
53-70-3	Dibenzo(a,h)anthracene[b,c]	<1.2E-06	E
25321-22-6	Dichlorobenzene[b]	1.2E-03	E
74-84-0	Ethane	3.1E+00	E
206-44-0	Fluoranthene[b,c]	3.0E-06	E
86-73-7	Fluorene[b,c]	2.8E-06	E
50-00-0	Formaldehyde[b]	7.5E-02	B
110-54-3	Hexane[b]	1.8E+00	E
193-39-5	Indeno(1,2,3-cd)pyrene[b,c]	<1.8E-06	E
91-20-3	Naphthalene[b]	6.1E-04	E
109-66-0	Pentane	2.6E+00	E
85-01-8	Phenanathrene[b,c]	1.7E-05	D

TABLE 1.4-3. EMISSION FACTORS FOR SPECIATED ORGANIC COMPOUNDS FROM NATURAL GAS COMBUSTION (Continued)

CAS No.	Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
74-98-6	Propane	1.6E+00	E
129-00-0	Pyrene[b, c]	5.0E-06	E
108-88-3	Toluene[b]	3.4E-03	C

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. To convert from $lb/10^6$ scf to $kg/10^6\ m^3$, multiply by 16. To convert from $1b/10^6$ scf to lb/MMBtu, divide by 1,020. Emission Factors preceeded with a less-than symbol are based on method detection limits.

[b] Hazardous Air Pollutant (HAP) as defined by Section 112(b) of the Clean Air Act.

[c] HAP because it is Polycyclic Organic Matter (POM). POM is a HAP as defined by Section 112(b) of the Clean Air Act.

[d] The sum of individual organic compounds may exceed the VOC and TOC emission factors due to differences in test methods and the availability of test data for each pollutant.

TABLE 1.4-4. EMISSION FACTORS FOR METALS FROM NATURAL GAS COMBUSTION[a]

CAS No.	Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
7440-38-2	Arsenic[b]	2.0E-04	E
7440-39-3	Barium	4.4E-03	D
7440-41-7	Beryllium[b]	<1.2E-05	E
7440-43-9	Cadmium[b]	1.1E-03	D
7440-47-3	Chromium[b]	1.4E-03	D
7440-48-4	Cobalt[b]	8.4E-05	D
7440-50-8	Copper	8.5E-04	C
7439-96-5	Manganese[b]	3.8E-04	D
7439-97-6	Mercury[b]	2.6E-04	D
7439-98-7	Molybdenum	1.1E-03	D
7440-02-0	Nickel[b]	2.1E-03	C
7782-49-2	Selenium[b]	<2.4E-05	E
7440-62-2	Vanadium	2.3E-03	D
7440-66-6	Zinc	2.9E-02	E

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. Emission factors preceeded by a less-than symbol are based on method detection limits. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by l6. To convert from $lb/10^6$ scf to 1b/MMBtu, divide by 1,020.

[b] Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act.

References For Section 1.4

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12. *Alternate Control Techniques Document -* NO_x *Emissions from Utility Boilers*, EPA-453/R-94-023, U. S. Environmental Protection Agency, Research Triangle Park, NC, March 1994.

AP-42 Section 1.4: Natural Gas Combustion Data Files

The data that supports the emission factors are presented in summary in the background report and are reported more completely in an electronic database. The database is in Microsoft Access 97®. The file is located on the CHIEF web site at http://www.epa.gov/ttn/chief/ap42c1.html.

AP-42 Section 11.1

11.1 Hot Mix Asphalt Plants

11.1.1 General[1-3,23, 392-394]

Hot mix asphalt (HMA) paving materials are a mixture of size-graded, high quality aggregate (which can include reclaimed asphalt pavement [RAP]), and liquid asphalt cement, which is heated and mixed in measured quantities to produce HMA. Aggregate and RAP (if used) constitute over 92 percent by weight of the total mixture. Aside from the amount and grade of asphalt cement used, mix characteristics are determined by the relative amounts and types of aggregate and RAP used. A certain percentage of fine aggregate (less than 74 micrometers [µm] in physical diameter) is required for the production of good quality HMA.

Hot mix asphalt paving materials can be manufactured by: (1) batch mix plants, (2) continuous mix (mix outside dryer drum) plants, (3) parallel flow drum mix plants, and (4) counterflow drum mix plants. This order of listing generally reflects the chronological order of development and use within the HMA industry.

In 1996, approximately 500 million tons of HMA were produced at the 3,600 (estimated) active asphalt plants in the United States. Of these 3,600 plants, approximately 2,300 are batch plants, 1,000 are parallel flow drum mix plants, and 300 are counterflow drum mix plants. The total 1996 HMA production from batch and drum mix plants is estimated at about 240 million tons and 260 million tons, respectively. About 85 percent of plants being manufactured today are of the counterflow drum mix design, while batch plants and parallel flow drum mix plants account for 10 percent and 5 percent respectively. Continuous mix plants represent a very small fraction of the plants in use ($\leq$0.5 percent) and, therefore, are not discussed further.

An HMA plant can be constructed as a permanent plant, a skid-mounted (easily relocated) plant, or a portable plant. All plants can have RAP processing capabilities. Virtually all plants being manufactured today have RAP processing capability. Most plants have the capability to use either gaseous fuels (natural gas) or fuel oil. However, based upon Department of Energy and limited State inventory information, between 70 and 90 percent of the HMA is produced using natural gas as the fuel to dry and heat the aggregate.

11.1.1.1 Batch Mix Plants –

Figure 11.1-1 shows the batch mix HMA production process. Raw aggregate normally is stockpiled near the production unit. The bulk aggregate moisture content typically stabilizes between 3 to 5 percent by weight.

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 conveyer 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. At newer facilities, RAP also may be transferred to a separate heated storage bin. 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. 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.

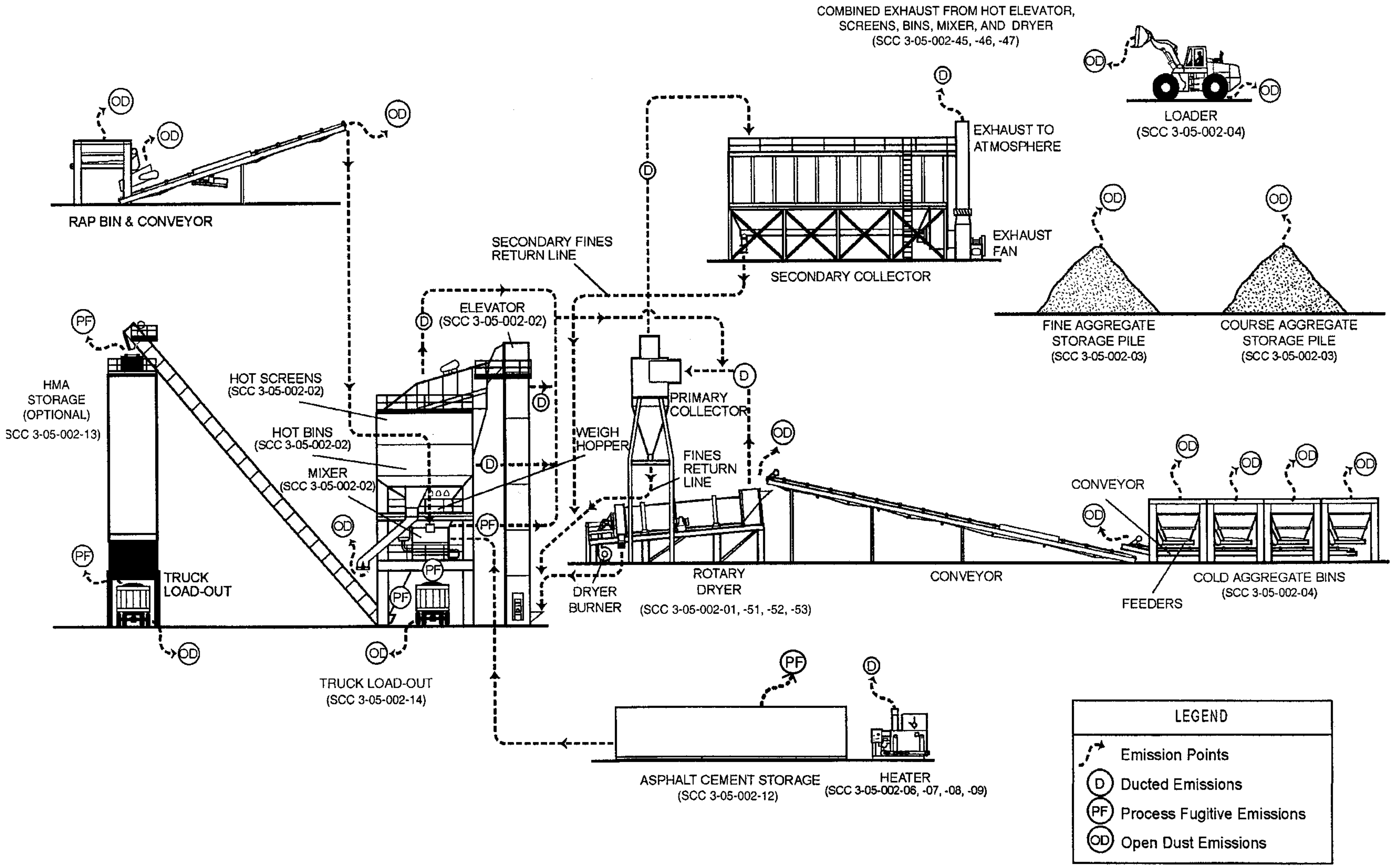

Figure 11.1-1. General process flow diagram for batch mix asphalt plants (source classification codes in parentheses).[3]

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. At older plants, RAP typically is conveyed directly to the pug mill from storage hoppers and combined with the hot aggregate. Total mixing time usually 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.

11.1.1.2 Parallel Flow Drum Mix Plants –

Figure 11.1-2 shows the parallel flow drum mix process. 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 dried 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 RAP and particulate matter (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, where it is loaded into transport trucks. 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 PM 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 asphalt mixing processes. Because data are not available to distinguish significant emissions differences between the two process designs, this effect on emissions cannot be verified.

11.1.1.3 Counterflow Drum Mix Plants –

Figure 11.1-3 shows a 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 zone 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 linked 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 will likely have organic emissions (gaseous and liquid aerosol) that are lower than parallel flow drum mix plants. However, the available data are insufficient to discern any differences in emissions that result from differences in the two processes. A counterflow drum mix plant can normally process RAP at ratios up to 50 percent with little or no observed effect upon emissions.

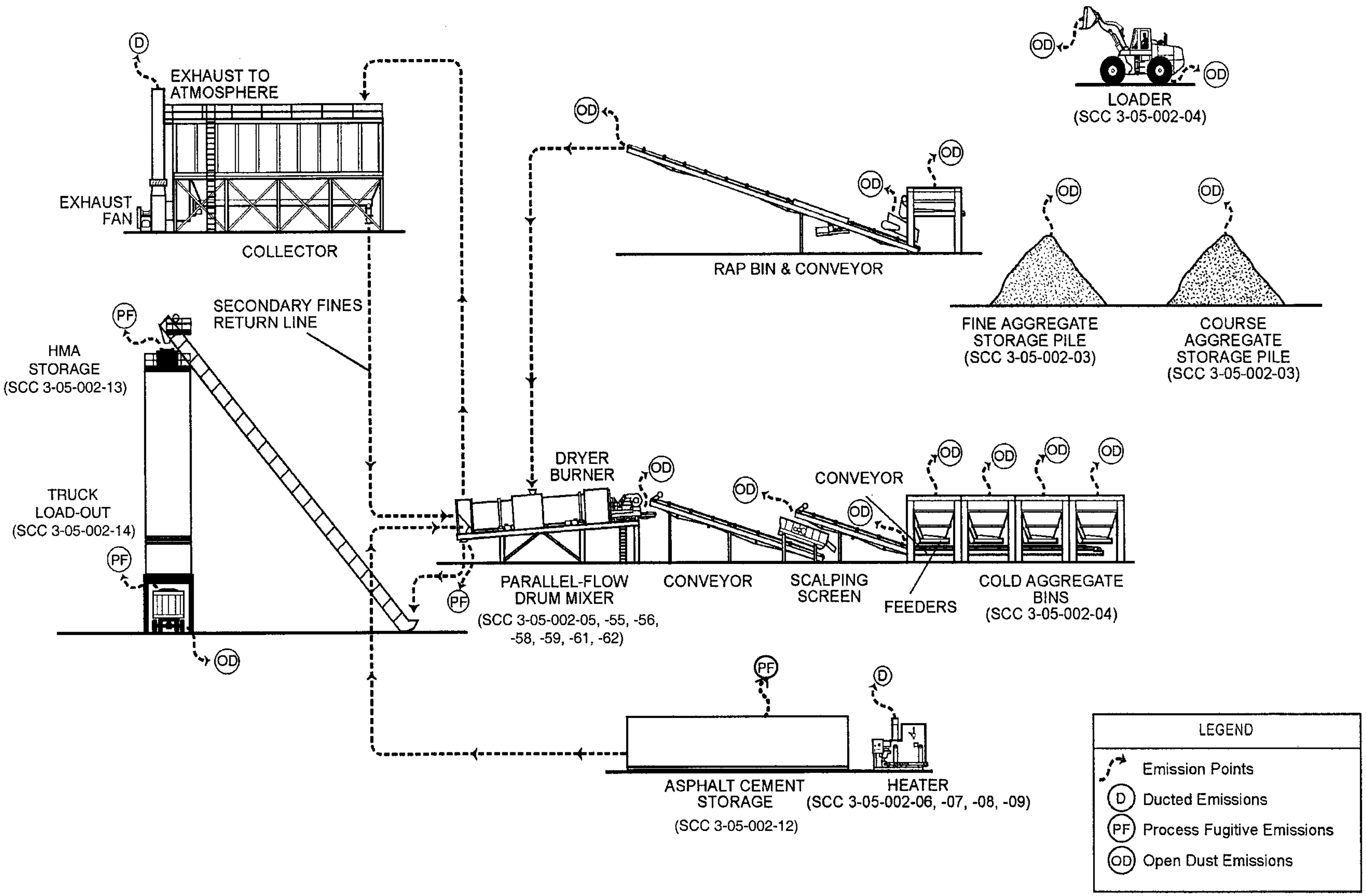

Figure 11.1-2. General process flow diagram for parallel-flow drum mix asphalt plants (source classification codes in parentheses).[3]

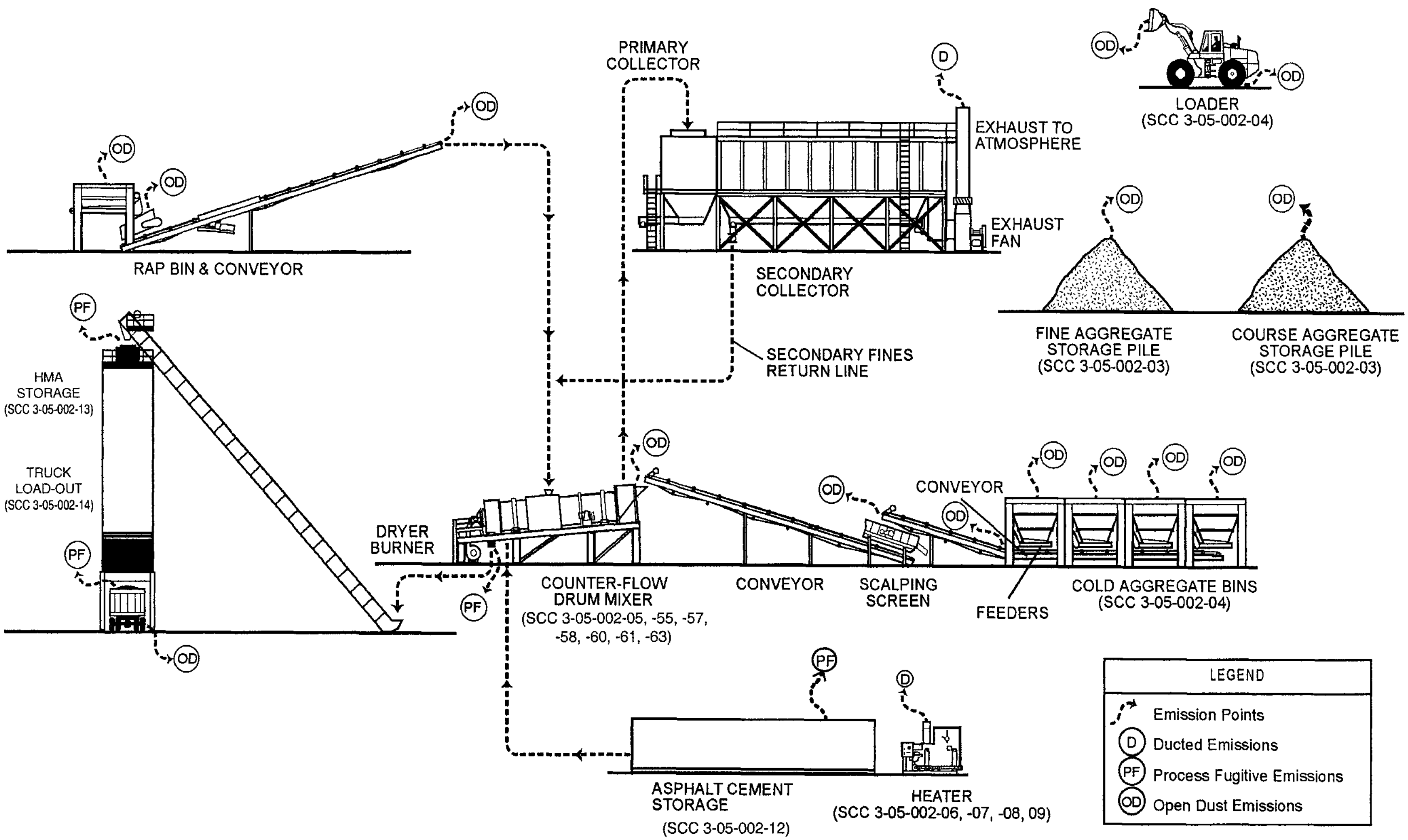

Figure 11.1-3. General process flow diagram for counter-flow drum mix asphalt plants (source classification codes in parentheses).[3]

11.1.1.4 Recycle Processes[393] –

In recent years, the use of RAP has been initiated in the HMA industry. Reclaimed asphalt pavement significantly reduces the amount of virgin rock and asphalt cement needed to produce HMA.

In the reclamation process, old asphalt pavement is removed from the road base. This material is then transported to the plant, and is crushed and screened to the appropriate size for further processing. The paving material is then heated and mixed with new aggregate (if applicable), and the proper amount of new asphalt cement is added to produce HMA that meets the required quality specifications.

11.1.2 Emissions And Controls[2-3,23]

Emissions from HMA plants may be divided into ducted production emissions, pre-production fugitive dust emissions, and other production-related fugitive emissions. Pre-production fugitive dust sources associated with HMA plants include 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. Uncontrolled PM emission factors for various types of fugitive sources in HMA plants are addressed in Sections 11.19.2, "Crushed Stone Processing", 13.2.1, "Paved Roads", 13.2.2, "Unpaved Roads", 13.2.3, "Heavy Construction Operations", and 13.2.4, "Aggregate Handling and Storage Piles." Production-related fugitive emissions and emissions from ducted production operations are discussed below. Emission points discussed below refer to Figure 11.1-1 for batch mix asphalt plants and to Figures 11.1-2 and 11.1-3 for drum mix plants.

11.1.2.1 Batch Mix Plants –

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 and vents but emitted directly from the source to 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 PM.

The most significant ducted source of emissions of most pollutants from batch mix HMA plants is the rotary drum dryer. The dryer emissions consist of water (as steam evaporated from the aggregate); PM; products of combustion (carbon dioxide [CO_2], nitrogen oxides [NO_x], and sulfur oxides [SO_x]); carbon monoxide (CO); and small amounts of organic compounds of various species (including volatile organic compounds [VOC], methane [CH_4], and hazardous air pollutants [HAP]). The CO and organic compound emissions result from incomplete combustion of the fuel. It is estimated that between 70 and 90 percent of the energy used at HMA plants is from the combustion of natural gas.

Other potential process sources include the hot-side conveying, classifying, and mixing equipment, which are vented either to 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 organic compounds and a fine aerosol of condensed organic particles. This organic aerosol is created by the condensation of vapor into particles during cooling of organic vapors volatilized from the asphalt cement in the mixer (pug mill). The amount of organic aerosol produced depends to a large extent on the temperature of the asphalt cement and aggregate entering the pug mill. Organic vapor and its associated aerosol also are emitted directly to the atmosphere as process fugitives during truck load-out, from the bed of the truck itself during transport to the job site, and from the asphalt storage tank. Both the low molecular weight organic compounds and the higher weight organic aerosol contain small amounts of HAP. The ducted emissions from the heated asphalt storage tanks include gaseous and aerosol organic compounds and combustion products from the tank heater.

The choice of applicable emission controls for PM emissions from the dryer and vent line includes dry mechanical collectors, scrubbers, and fabric filters. Attempts to apply electrostatic precipitators have met with little success. Practically all plants use primary dust collection equipment such as large diameter cyclones, skimmers, or settling chambers. These chambers often are used as classifiers to return collected material to the hot elevator and to combine it with the drier aggregate. To capture remaining PM, the primary collector effluent is ducted to a secondary collection device. Most plants use either a fabric filter or a venturi scrubber for secondary emissions control. As with any combustion process, the design, operation, and maintenance of the burner provides opportunities to minimize emissions of NO_x, CO, and organic compounds.

11.1.2.2 Parallel Flow Drum Mix Plants –

The most significant ducted source of emissions from parallel-flow drum mix plants is the rotary drum dryer. Emissions from the drum consist of water (as steam evaporated from the aggregate); PM; products of combustion; CO; and small amounts of organic compounds of various species (including VOC, CH_4, and HAP). The organic compound and CO emissions result from incomplete combustion of the fuel and from heating and mixing of the liquid asphalt cement inside the drum. Although it has been suggested that the processing of RAP materials at these type plants may increase organic compound emissions because of an increase in mixing zone temperature during processing, the data supporting this hypothesis are very weak. Specifically, although the data show a relationship only between RAP content and condensible organic particulate emissions, 89 percent of the variations in the data were the result of other unknown process variables.

Once the organic compounds cool after discharge from the process stack, some condense to form a fine organic aerosol or “blue smoke” plume. A number of process modifications or restrictions have been introduced to reduce blue smoke, including installation of flame shields, rearrangement of flights inside the drum, adjustments of the asphalt injection point, and other design changes.

11.1.2.3 Counterflow Drum Mix Plants –

The most significant ducted source of emissions from counterflow drum mix plants is the rotary drum dryer. Emissions from the drum consist of water (as steam evaporated from the aggregate); PM; products of combustion; CO; and small amounts of organic compounds of various species (including VOC, CH_4, and HAP). The CO and organic compound emissions result primarily from incomplete combustion of the fuel, and can also be released from the heated asphalt. Liquid asphalt cement, aggregate, and sometimes RAP, are mixed in a zone not in contact with the hot exhaust gas stream. As a result, kiln stack emissions of organic compounds from counterflow drum mix plants may be lower than parallel flow drum mix plants. However, variations in the emissions due to other unknown process variables are more significant. As a result, the emission factors for parallel flow and counterflow drum mix plants are the same.

11.1.2.4 Parallel and Counterflow Drum Mix Plants –

Process fugitive emissions associated with batch plant hot screens, elevators, and the mixer (pug mill) are not present in the drum mix processes. However, there are fugitive PM and VOC emissions from transport and handling of the HMA 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 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 11.1-1 presents emission factors for filterable PM and PM-10, condensable PM, and total PM for batch mix HMA plants. Particle size data for batch mix HMA plants, based on the control technology used, are shown in Table 11.1-2. Table 11.1-3 presents filterable PM and PM-10, condensable PM, and total PM emission factors for drum mix HMA plants. Particle size data for drum mix HMA plants, based on the control technology used, are shown in Table 11.1-4. Tables 11.1-5 and -6 present emission factors for CO, CO_2, NO_x, sulfur dioxide (SO_2), total organic compounds (TOC), formaldehyde, CH_4, and VOC from batch mix plants. Tables 11.1-7 and -8 present emission factors for CO, CO_2, NO_x, SO_2, TOC, CH_4, VOC, and hydrochloric acid (HCl) from drum mix plants. The emission factors for CO, NO_x, and organic compounds represent normal plant operations without scrutiny of the burner design, operation, and maintenance. Information provided in Reference 390 indicates that attention to burner design, periodic evaluation of burner operation, and appropriate maintenance can reduce these emissions. Table 11.1-9 presents organic pollutant emission factors for batch mix plants. Table 11.1-10 presents organic pollutant emission factors for drum mix plants. Tables 11.1-11 and -12 present metals emission factors for batch and drum mix plants, respectively. Table 11.1-13 presents organic pollutant emission factors for hot (asphalt) oil systems.

11.1.2.5 Fugitive Emissions from Production Operations –
Emission factors for HMA load-out and silo filling operations can be estimated using the data in Tables 11.1-14, -15, and -16. Table 11.1-14 presents predictive emission factor equations for HMA load-out and silo filling operations. Separate equations are presented for total PM, extractable organic PM (as measured by EPA Method 315), TOC, and CO. For example, to estimate total PM emissions from drum mix or batch mix plant load-out operations using an asphalt loss-on-heating of 0.41 percent and temperature of 290°F, the following calculation is made:

$$
\begin{aligned}
EF &= 0.000181 + 0.00141(-V)e^{((0.0251)(290 + 460) - 20.43)} \\
&= 0.000181 + 0.00141(-(-0.41))e^{((0.0251)(290 + 460) - 20.43)} \\
&= 0.000181 + 0.00141(0.41)e^{(-1.605)} \\
&= 0.000181 + 0.00141(0.41)(0.2009) \\
&= 0.000181 + 0.000116 \\
&= 0.00030 \text{ lb total PM/ton of asphalt loaded}
\end{aligned}
$$

Tables 11.1-15 and -16 present speciation profiles for organic particulate-based and volatile particulate-based compounds, respectively. The speciation profile shown in Table 11.1-15 can be applied to the extractable organic PM emission factors estimated by the equations in Table 11.1-14 to estimate emission factors for specific organic PM compounds. The speciation profile presented in Table 11.1-16 can be applied to the TOC emission factors estimated by the equations in Table 11.1-14 to estimate emission factors for specific volatile organic compounds. The derivations of the predictive emission factor equations and the speciation profiles can be found in Reference 1.

For example, to estimate TOC emissions from drum mix plant load-out operations using an asphalt loss-on-heating of 0.41 percent and temperature of 290°F, the following calculation is made:

$$
\begin{aligned}
EF &= 0.0172(-V)e^{((0.0251)(290 + 460) - 20.43)} \\
&= 0.0172(-(-0.41))e^{((0.0251)(290 + 460) - 20.43)} \\
&= 0.0172(0.41)e^{(-1.605)} \\
&= 0.0172(0.41)(0.2009) \\
&= 0.0014 \text{ lb TOC/ton of asphalt loaded}
\end{aligned}
$$

To estimate the benzene emissions from the same operation, use the TOC emission factor calculated above and apply the benzene fraction for load-out emissions from Table 11.1-16:

$$\begin{aligned} EF &= 0.0014\ (0.00052) \\ &= 7.3 \times 10^{-7} \text{ lb benzene/ton of asphalt loaded} \end{aligned}$$

Emissions from asphalt storage tanks can be estimated using the procedures described in AP-42 Section 7.1, Organic Liquid Storage Tanks, and the TANKS software. Site-specific data should be used for storage tank specifications and operating parameters, such as temperature. If site-specific data for Antoine's constants for an average asphalt binder used by the facility are unavailable, the following values for an average liquid asphalt binder can be used:

A = 75,350.06
B = 9.00346

These values should be inserted into the Antoine's equation in the following form:

$$\log_{10} P = \frac{-0.05223A}{T} + B$$

where:

P = vapor pressure, mm Hg
T = absolute temperature, Kelvin

The assumed average liquid molecular weight associated with these Antoine's constants is 1,000 atomic mass units and the average vapor molecular weight is 105. Emission factors estimated using these default values should be assigned a rating of E. Carbon monoxide emissions can be estimated by multiplying the THC emissions calculated by the TANKS program by 0.097 (the ratio of silo filling CO emissions to silo filling TOC emissions).

Vapors from the HMA loaded into transport trucks continue following load-out operations. The TOC emissions for the 8-minute period immediately following load-out (yard emissions) can be estimated using an emission factor of 0.00055 kg/Mg (0.0011 lb/ton) of asphalt loaded. This factor is assigned a rating of E. The derivation of this emission factor is described in Reference 1. Carbon monoxide emissions can be estimated by multiplying the TOC emissions by 0.32 (the ratio of truck load-out CO emissions to truck load-out THC emissions).

11.2.3 Updates Since the Fifth Edition

The Fifth Edition was released in January 1995. Revisions to this section since that date are summarized below. For further detail, consult the background report for this section. This and other documents can be found on the CHIEF Web Site at http://www.epa.gov/ttn/chief/, or by calling the Info CHIEF Help Desk at (919)541-1000.

December 2000

- All emission factors were revised and new factors were added. For selected pollutant emissions, separate factors were developed for distilate oil, No. 6 oil and waste oil fired dryers. Dioxin and Furan emission factors were developed for oil fired drum mix plants. Particulate, VOC and CO factors were developed for silo filling, truck load out and post truck load out operations at batch plants and drum mix plants. Organic species profiles were developed for silo filling, truck load out and post truck load out operations.

March 2004

- The emission factor for formaldehyde for oil fired hot oil heaters was revised. An emission factor for formaldehyde for gas fired hot oil heaters and emission factors for CO and CO_2 for gas and oil fired hot oil heaters were developed. (Table 11.1-13)

Table 11.1-1. PARTICULATE MATTER EMISSION FACTORS FOR BATCH MIX HOT MIX ASPHALT PLANTS[a]

	Filterable PM				Condensable PM[b]				Total PM			
Process	PM[c]	EMISSION FACTOR RATING	PM-10[d]	EMISSION FACTOR RATING	Inorganic	EMISSION FACTOR RATING	Organic	EMISSION FACTOR RATING	PM[e]	EMISSION FACTOR RATING	PM-10[f]	EMISSION FACTOR RATING
Dryer, hot screens, mixer[g] (SCC 3-05-002-45, -46, -47)												
Uncontrolled	32[h]	E	4.5	E	0.013[j]	E	0.0041[j]	E	32	E	4.5	E
Venturi or wet scrubber	0.12[k]	C	ND	NA	0.013[m]	B	0.0041[n]	B	0.14	C	ND	NA
Fabric filter	0.025[p]	A	0.0098	C	0.013[m]	A	0.0041[n]	A	0.042	B	0.027	C

[a] Factors are lb/ton of product. SCC = Source Classification Code. ND = no data. NA = not applicable. To convert from lb/ton to kg/Mg, multiply by 0.5.

[b] Condensable PM is that PM collected using an EPA Method 202, Method 5 (analysis of "back-half" or impingers), or equivalent sampling train.

[c] Filterable PM is that PM collected on or before the filter of an EPA Method 5 (or equivalent) sampling train.

[d] Particle size data from Reference 23 were used in conjunction with the filterable PM emission factors shown.

[e] Total PM is the sum of filterable PM, condensable inorganic PM, and condensable organic PM.

[f] Total PM-10 is the sum of filterable PM-10, condensable inorganic PM, and condensable organic PM.

[g] Batch mix dryer fired with natural gas, propane, fuel oil, waste oil, and coal. The data indicate that fuel type does not significantly effect PM emissions.

[h] Reference 5.

[j] Although no data are available for uncontrolled condensable PM, values are assumed to be equal to the controlled value measured.

[k] Reference 1, Table 4-19. Average of data from 16 facilities. Range: 0.047 to 0.40 lb/ton. Median: 0.049 lb/ton. Standard deviation: 0.11 lb/ton.

[m] Reference 1, Table 4-19. Average of data from 35 facilities. Range: 0.00073 to 0.12 lb/ton. Median: 0.0042 lb/ton. Standard deviation: 0.024 lb/ton.

[n] Reference 1, Table 4-19. Average of data from 24 facilities. Range: 0.000012 to 0.018 lb/ton. Median: 0.0026 lb/ton. Standard deviation: 0.0042 lb/ton.

[p] Reference 1, Table 4-19. Average of data from 89 facilities. Range: 0.0023 to 0.18 lb/ton. Median: 0.012 lb/ton. Standard deviation: 0.033 lb/ton.

Table 11.1-2. SUMMARY OF PARTICLE SIZE DISTRIBUTION FOR BATCH MIX DRYERS, HOT SCREENS, AND MIXERS[a]

EMISSION FACTOR RATING: E

Particle Size, µm[b]	Cumulative Mass Less Than or Equal to Stated Size (%)[c]		Emission Factors, lb/ton	
	Uncontrolled[d]	Fabric Filter	Uncontrolled[d]	Fabric Filter
1.0	ND	30[e]	ND	0.0075[e]
2.5	0.83	33[e]	0.27	0.0083[e]
5.0	3.5	36[e]	1.1	0.0090[e]
10.0	14	39[f]	4.5	0.0098[f]
15.0	23	47[e]	7.4	0.012[e]

[a] Emission factor units are lb/ton of HMA provided. Rounded to two significant figures. SCC 3-05-002-45, -46, -47. ND = no data available. To convert from lb/ton to kg/Mg, multiply by 0.5.

[b] Aerodynamic diameter.

[c] Applies only to the mass of filterable PM.

[d] References 23, Table 3-36. The emission factors are calculated using the particle size data from this reference in conjunction with the filterable PM emission factor shown in Table 11.1-1.

[e] References 23, Page J-61. The emission factors are calculated using the particle size data from this reference in conjunction with the filterable PM emission factor shown in Table 11.1-1.

[f] References 23-24. The emission factors are calculated using the particle size data from these references in conjunction with the filterable PM emission factor shown in Table 11.1-1.

Table 11.1-3. PARTICULATE MATTER EMISSION FACTORS FOR DRUM MIX HOT MIX ASPHALT PLANTS[a]

Process	Filterable PM				Condensable PM[b]				Total PM			
	PM[c]	EMISSION FACTOR RATING	PM-10[d]	EMISSION FACTOR RATING	Inorganic	EMISSION FACTOR RATING	Organic	EMISSION FACTOR RATING	PM[e]	EMISSION FACTOR RATING	PM-10[f]	EMISSION FACTOR RATING
Dryer[g] (SCC 3-05-002-05,-55 to -63)												
Uncontrolled	28[h]	D	6.4	D	0.0074[j]	E	0.058[k]	E	28	D	6.5	D
Venturi or wet scrubber	0.026[m]	A	ND	NA	0.0074[n]	A	0.012[p]	A	0.045	A	ND	NA
Fabric filter	0.014[q]	A	0.0039	C	0.0074[n]	A	0.012[p]	A	0.033	A	0.023	C

[a] Factors are lb/ton of product. SCC = Source Classification Code. ND = no data. NA = not applicable. To convert from lb/ton to kg/Mg, multiply by 0.5.
[b] Condensable PM is that PM collected using an EPA Method 202, Method 5 (analysis of "back-half" or impingers), or equivalent sampling train.
[c] Filterable PM is that PM collected on or before the filter of an EPA Method 5 (or equivalent) sampling train.
[d] Particle size data from Reference 23 were used in conjunction with the filterable PM emission factors shown.
[e] Total PM is the sum of filterable PM, condensable inorganic PM, and condensable organic PM.
[f] Total PM-10 is the sum of filterable PM-10, condensable inorganic PM, and condensable organic PM.
[g] Drum mix dryer fired with natural gas, propane, fuel oil, and waste oil. The data indicate that fuel type does not significantly effect PM emissions.
[h] References 31, 36-38, 340.
[j] Because no data are available for uncontrolled condensable inorganic PM, the emission factor is assumed to be equal to the maximum controlled condensable inorganic PM emission factor.
[k] References 36-37.
[m] Reference 1, Table 4-14. Average of data from 36 facilities. Range: 0.0036 to 0.097 lb/ton. Median: 0.020 lb/ton. Standard deviation: 0.022 lb/ton.
[n] Reference 1, Table 4-14. Average of data from 30 facilities. Range: 0.0012 to 0.027 lb/ton. Median: 0.0051 lb/ton. Standard deviation: 0.0063 lb/ton.
[p] Reference 1, Table 4-14. Average of data from 41 facilities. Range: 0.00035 to 0.074 lb/ton. Median: 0.0046 lb/ton. Standard deviation: 0.016 lb/ton.
[q] Reference 1, Table 4-14. Average of data from 155 facilities. Range: 0.00089 to 0.14 lb/ton. Median: 0.010 lb/ton. Standard deviation: 0.017 lb/ton.

Table 11.1-4. SUMMARY OF PARTICLE SIZE DISTRIBUTION FOR DRUM MIX DRYERS[a]

EMISSION FACTOR RATING: E

Particle Size, µm[b]	Cumulative Mass Less Than or Equal to Stated Size (%)[c]		Emission Factors, lb/ton	
	Uncontrolled[d]	Fabric Filter	Uncontrolled[d]	Fabric Filter
1.0	ND	15[e]	ND	0.0021[e]
2.5	5.5	21[f]	1.5	0.0029[f]
10.0	23	30[g]	6.4	0.0042[g]
15.0	27	35[d]	7.6	0.0049[d]

[a] Emission factor units are lb/ton of HMA produced. Rounded to two significant figures. SCC 3-05-002-05, and 3-05-002-55 to -63. ND = no data available. To convert from lb/ton to kg/Mg, multiply by 0.5.
[b] Aerodynamic diameter.
[c] Applies only to the mass of filterable PM.
[d] Reference 23, Table 3-35. The emission factors are calculated using the particle size data from this reference in conjunction with the filterable PM emission factor shown in Table 11.1-3.
[e] References 214, 229. The emission factors are calculated using the particle size data from these references in conjunction with the filterable PM emission factor shown in Table 11.1-3.
[f] References 23, 214, 229. The emission factors are calculated using the particle size data from these references in conjunction with the filterable PM emission factor shown in Table 11.1-3.
[g] Reference 23, 25, 229. The emission factors are calculated using the particle size data from these references in conjunction with the filterable PM emission factor shown in Table 11.1-3. EMISSION FACTOR RATING: D.

Table 11.1-5. EMISSION FACTORS FOR CO, CO_2, NO_x, AND SO_2 FROM BATCH MIX HOT MIX ASPHALT PLANTS[a]

Process	CO[b]	EMISSION FACTOR RATING	CO_2[c]	EMISSION FACTOR RATING	NO_x	EMISSION FACTOR RATING	SO_2[c]	EMISSION FACTOR RATING
Natural gas-fired dryer, hot screens, and mixer (SCC 3-05-002-45)	0.40	C	37[d]	A	0.025[e]	D	0.0046[f]	E
No. 2 fuel oil-fired dryer, hot screens, and mixer (SCC 3-05-002-46)	0.40	C	37[d]	A	0.12[g]	E	0.088[h]	E
Waste oil-fired dryer, hot screens, and mixer (SCC 3-05-002-47)	0.40	C	37[d]	A	0.12[g]	E	0.088[h]	E
Coal-fired dryer, hot screens, and mixer[j] (SCC 3-05-002-98)	ND	NA	37[d]	A	ND	NA	0.043[k]	E

[a] Emission factor units are lb per ton of HMA produced. SCC = Source Classification Code. ND = no data available. NA = not applicable. To convert from lb/ton to kg/Mg, multiply by 0.5.

[b] References 24, 34, 46-47, 49, 161, 204, 215-217, 282, 370, 378, 381. The CO emission factors represent normal plant operations without scrutiny of the burner design, operation, and maintenance. Information is available that indicates that attention to burner design, periodic evaluation of burner operation, and appropriate maintenance can reduce CO emissions. Data for dryers firing natural gas, No. 2 fuel oil, and No. 6 fuel oil were combined to develop a single emission factor because the magnitude of emissions was similar for dryers fired with these fuels.

[c] Emissions of CO_2 and SO_2 can also be estimated based on fuel usage and the fuel combustion emission factors (for the appropriate fuel) presented in AP-42 Chapter 1. The CO_2 emission factors are an average of all available data, regardless of the dryer fuel (emissions were similar from dryers firing any of the various fuels). Based on data for drum mix facilities, 50 percent of the fuel-bound sulfur, up to a maximum (as SO_2) of 0.1 lb/ton of product, is expected to be retained in the product, with the remainder emitted as SO_2.

[d] Reference 1, Table 4-20. Average of data from 115 facilities. Range: 6.9 to 160 lb/ton. Median: 32 lb/ton. Standard deviation: 22 lb/ton.

[e] References 24, 34, 46-47.

[f] References 46-47.

[g] References 49, 226.

[h] References 49, 226, 228, 385.

[j] Dryer fired with coal and supplemental natural gas or fuel oil.

[k] Reference 126.

Table 11.1-6. EMISSION FACTORS FOR TOC, METHANE, AND VOC FROM BATCH MIX HOT MIX ASPHALT PLANTS[a]

Process	TOC[b]	EMISSION FACTOR RATING	CH_4[c]	EMISSION FACTOR RATING	VOC[d]	EMISSION FACTOR RATING
Natural gas-fired dryer, hot screens, and mixer (SCC 3-05-002-45)	0.015[e]	D	0.0074	D	0.0082	D
No. 2 fuel oil-fired dryer, hot screens, and mixer (SCC 3-05-002-46)	0.015[e]	D	0.0074	D	0.0082	D
No. 6 fuel oil-fired dryer, hot screens, and mixer (SCC 3-05-002-47)	0.043[f]	E	0.0074	D	0.036	E

[a] Emission factor units are lb per ton of HMA produced. SCC = Source Classification Code. ND = no data available. NA = not applicable. To convert from lb/ton to kg/Mg, multiply by 0.5.

[b] TOC equals total hydrocarbons as propane, as measured with an EPA Method 25A or equivalent sampling train plus formaldehyde.

[c] References 24, 46-47, 49. Factor includes data from natural gas- and No. 6 fuel oil-fired dryers. Methane measured with an EPA Method 18 or equivalent sampling train.

[d] The VOC emission factors are equal to the TOC factors minus the methane emission factors; differences in values reported are due to rounding.

[e] References 24, 46-47, 155.

[f] Reference 49.

Table 11.1-7. EMISSION FACTORS FOR CO, CO_2, NO_x, AND SO_2 FROM DRUM MIX HOT MIX ASPHALT PLANTS[a]

Process	CO[b]	EMISSION FACTOR RATING	CO_2[c]	EMISSION FACTOR RATING	NO_x	EMISSION FACTOR RATING	SO_2[c]	EMISSION FACTOR RATING
Natural gas-fired dryer (SCC 3-05-002-55,-56,-57)	0.13	B	33[d]	A	0.026[e]	D	0.0034[f]	D
No. 2 fuel oil-fired dryer (SCC 3-05-002-58,-59,-60)	0.13	B	33[d]	A	0.055[g]	C	0.011[h]	E
Waste oil-fired dryer (SCC 3-05-002-61,-62,-63)	0.13	B	33[d]	A	0.055[g]	C	0.058[j]	B
Coal-fired dryer[k] (SCC 3-05-002-98)	ND	NA	33[d]	A	ND	NA	0.19[m]	E

[a] Emission factor units are lb per ton of HMA produced. SCC = Source Classification Code. ND = no data available. NA = not applicable. To convert from lb/ton to kg/Mg, multiply by 0.5.

[b] References 25, 44, 48, 50, 149, 154, 197, 214, 229, 254, 339-342, 344, 346, 347, 390. The CO emission factors represent normal plant operations without scrutiny of the burner design, operation, and maintenance. Information is available that indicates that attention to burner design, periodic evaluation of burner operation, and appropriate maintenance can reduce CO emissions. Data for dryers firing natural gas, No. 2 fuel oil, and No. 6 fuel oil were combined to develop a single emission factor because the magnitude of emissions was similar for dryers fired with these fuels.

[c] Emissions of CO_2 and SO_2 can also be estimated based on fuel usage and the fuel combustion emission factors (for the appropriate fuel) presented in AP-42 Chapter 1. The CO_2 emission factors are an average of all available data, regardless of the dryer fuel (emissions were similar from dryers firing any of the various fuels). Fifty percent of the fuel-bound sulfur, up to a maximum (as SO_2) of 0.1 lb/ton of product, is expected to be retained in the product, with the remainder emitted as SO_2.

[d] Reference 1, Table 4-15. Average of data from 180 facilities. Range: 2.6 to 96 lb/ton. Median: 31 lb/ton. Standard deviation: 13 lb/ton.

[e] References 44-45, 48, 209, 341, 342.

[f] References 44-45, 48.

[g] References 25, 50, 153, 214, 229, 344, 346, 347, 352-354.

[h] References 50, 119, 255, 340

[j] References 25, 299, 300, 339, 345, 351, 371-377, 379, 380, 386-388.

[k] Dryer fired with coal and supplemental natural gas or fuel oil.

[m] References 88, 108, 189-190.

Table 11.1-8. EMISSION FACTORS FOR TOC, METHANE, VOC, AND HCl FROM DRUM MIX HOT MIX ASPHALT PLANTS[a]

Process	TOC[b]	EMISSION FACTOR RATING	CH_4[c]	EMISSION FACTOR RATING	VOC[d]	EMISSION FACTOR RATING	HCl[e]	EMISSION FACTOR RATING
Natural gas-fired dryer (SCC 3-05-002-55, -56,-57)	0.044[f]	B	0.012	C	0.032	C	ND	NA
No. 2 fuel oil-fired dryer (SCC 3-05-002-58, -59,-60)	0.044[f]	B	0.012	C	0.032	C	ND	NA
Waste oil-fired dryer (SCC 3-05-002-61, -62,-63)	0.044[f]	E	0.012	C	0.032	E	0.00021	D

[a] Emission factor units are lb per ton of HMA produced. SCC = Source Classification Code. ND = no data available. NA = not applicable. To convert from lb/ton to kg/Mg, multiply by 0.5.
[b] TOC equals total hydrocarbons as propane as measured with an EPA Method 25A or equivalent sampling train plus formaldehyde.
[c] References 25, 44-45, 48, 50, 339-340, 355. Factor includes data from natural gas-, No. 2 fuel oil, and waste oil-fired dryers. Methane measured with an EPA Method 18 or equivalent sampling train.
[d] The VOC emission factors are equal to the TOC factors minus the sum of the methane emission factors and the emission factors for compounds with negligible photochemical reactivity shown in Table 11.1-10; differences in values reported are due to rounding.
[e] References 348, 374, 376, 379, 380.
[f] References 25, 44-45, 48, 50, 149, 153-154, 209-212, 214, 241, 242, 339-340, 355.

Table 11.1-9. EMISSION FACTORS FOR ORGANIC POLLUTANT EMISSIONS FROM BATCH MIX HOT MIX ASPHALT PLANTS[a]

Process	Pollutant		Emission Factor, lb/ton	Emission Factor Rating	Ref. Nos.
	CASRN	Name			
Natural gas- or No. 2 fuel oil-fired dryer, hot screens, and mixer with fabric filter (SCC 3-05-002-45,-46)	Non-PAH Hazardous Air Pollutants[b]				
	75-07-0	Acetaldehyde	0.00032	E	24,34
	71-43-2	Benzene	0.00028	D	24,34,46, 382
	100-41-4	Ethylbenzene	0.0022	D	24,46,47,49
	50-00-0	Formaldehyde	0.00074	D	24,34,46,47,49,226,382
	106-51-4	Quinone	0.00027	E	24
	108-88-3	Toluene	0.0010	D	24,34,46,47
	1330-20-7	Xylene	0.0027	D	24,46,47,49
		Total non-PAH HAPs	0.0075		
	PAH HAPs				
	91-57-6	2-Methylnaphthalene[c]	7.1×10^{-5}	D	24,47,49
	83-32-9	Acenaphthene[c]	9.0×10^{-7}	D	34,46,226
	208-96-8	Acenaphthylene[c]	5.8×10^{-7}	D	34,46,226
	120-12-7	Anthracene[c]	2.1×10^{-7}	D	34,46,226
	56-55-3	Benzo(a)anthracene[c]	4.6×10^{-9}	E	46,226
	50-32-8	Benzo(a)pyrene[c]	3.1×10^{-10}	E	226
	205-99-2	Benzo(b)fluoranthene[c]	9.4×10^{-9}	D	34,46,226
	191-24-2	Benzo(g,h,i)perylene[c]	5.0×10^{-10}	E	226
	207-08-9	Benzo(k)fluoranthene[c]	1.3×10^{-8}	E	34,226
	218-01-9	Chrysene[c]	3.8×10^{-9}	E	46,226
	53-70-3	Dibenz(a,h)anthracene[c]	9.5×10^{-11}	E	226
	206-44-0	Fluoranthene[c]	1.6×10^{-7}	D	34,46,47,226
	86-73-7	Fluorene[c]	1.6×10^{-6}	D	34,46,47,226
	193-39-5	Indeno(1,2,3-cd)pyrene[c]	3.0×10^{-10}	E	226
	91-20-3	Naphthalene	3.6×10^{-5}	D	34,46,47,49,226
	85-01-8	Phenanthrene[c]	2.6×10^{-6}	D	34,46,47,226
	129-00-0	Pyrene[c]	6.2×10^{-8}	D	34,46,226
		Total PAH HAPs	0.00011		
	Total HAPs		0.0076		
	Non-HAP organic compounds				
	100-52-7	Benzaldehyde	0.00013	E	24
	78-84-2	Butyraldehyde/ isobutyraldehyde	3.0×10^{-5}	E	24
	4170-30-3	Crotonaldehyde	2.9×10^{-5}	E	24
	66-25-1	Hexanal	2.4×10^{-5}	E	24
		Total non-HAPs	0.00019		

Table 11.1-9 (cont.)

Process	Pollutant CASRN	Pollutant Name	Emission Factor, lb/ton	Emission Factor Rating	Ref. Nos.
Waste oil-, drain oil-, or No. 6 fuel oil-fired dryer, hot screens, and mixer with fabric filter (SCC 3-05-002-47)	Non-PAH Hazardous Air Pollutants[b]				
	75-07-0	Acetaldehyde	0.00032	E	24,34
	71-43-2	Benzene	0.00028	D	24,34,46, 382
	100-41-4	Ethylbenzene	0.0022	D	24,46,47,49
	50-00-0	Formaldehyde	0.00074	D	24,34,46,47,49,226, 382
	106-51-4	Quinone	0.00027	E	24
	108-88-3	Toluene	0.0010	D	24,34,46,47
	1330-20-7	Xylene	0.0027	D	24,46,47,49
		Total non-PAH HAPs	0.0075		
	PAH HAPs[b]				
	91-57-6	2-Methylnaphthalene[c]	7.1×10^{-5}	D	24,47,49
	83-32-9	Acenaphthene[c]	9.0×10^{-7}	D	34,46,226
	208-96-8	Acenaphthylene[c]	5.8×10^{-7}	D	34,46,226
	120-12-7	Anthracene[c]	2.1×10^{-7}	D	34,46,226
	56-55-3	Benzo(a)anthracene[c]	4.6×10^{-9}	E	46,226
	50-32-8	Benzo(a)pyrene[c]	3.1×10^{-10}	E	226
	205-99-2	Benzo(b)fluoranthene[c]	9.4×10^{-9}	D	34,46,226
	191-24-2	Benzo(g,h,i)perylene[c]	5.0×10^{-10}	E	226
	207-08-9	Benzo(k)fluoranthene[c]	1.3×10^{-8}	E	34,226
	218-01-9	Chrysene[c]	3.8×10^{-9}	E	46,226
	53-70-3	Dibenz(a,h)anthracene[c]	9.5×10^{-11}	E	226
	206-44-0	Fluoranthene[c]	2.4×10^{-5}	E	49
	86-73-7	Fluorene[c]	1.6×10^{-6}	D	34,46,47,226
	193-39-5	Indeno(1,2,3-cd)pyrene[c]	3.0×10^{-10}	E	226
	91-20-3	Naphthalene	3.6×10^{-5}	D	34,46,47,49, 226
	85-01-8	Phenanthrene[c]	3.7×10^{-5}	E	49
	129-00-0	Pyrene[c]	5.5×10^{-5}	E	49
		Total PAH HAPs	0.00023		
	Total HAPs		0.0077		
	Non-HAP organic compounds				
	100-52-7	Benzaldehyde	0.00013	E	24
	78-84-2	Butyraldehyde/ isobutyraldehyde	3.0×10^{-5}	E	24
	4170-30-3	Crotonaldehyde	2.9×10^{-5}	E	24
	66-25-1	Hexanal	2.4×10^{-5}	E	24
		Total non-HAPs	0.00019		

[a] Emission factor units are lb/ton of hot mix asphalt produced. Factors represent uncontrolled emissions, unless noted. CASRN = Chemical Abstracts Service Registry Number. SCC = Source Classification Code. To convert from lb/ton to kg/Mg, multiply by 0.5.

[b] Hazardous air pollutants (HAP) as defined in the 1990 Clean Air Act Amendments (CAAA).

[c] Compound is classified as polycyclic organic matter, as defined in the 1990 CAAA.

Table 11.1-10. EMISSION FACTORS FOR ORGANIC POLLUTANT EMISSIONS FROM DRUM MIX HOT MIX ASPHALT PLANTS[a]

Process	Pollutant CASRN	Pollutant Name	Emission Factor, lb/ton	Emission Factor Rating	Ref. No.
Natural gas-fired dryer with fabric filter[b] (SCC 3-05-002-55, -56,-57)	Non-PAH hazardous air pollutants[c]				
	71-43-2	Benzene[d]	0.00039	A	25,44,45,50, 341, 342, 344-351, 373, 376, 377, 383, 384
	100-41-4	Ethylbenzene	0.00024	D	25,44,45
	50-00-0	Formaldehyde[e]	0.0031	A	25,35,44,45,50, 339-344, 347-349, 371-373, 384, 388
	110-54-3	Hexane	0.00092	E	339-340
	540-84-1	Isooctane (2,2,4-trimethylpentane)	4.0×10^{-5}	E	339-340
	71-55-6	Methyl chloroform[f]	4.8×10^{-5}	E	35
	108-88-3	Toluene	0.00015	D	35,44,45
	1330-20-7	Xylene	0.00020	D	25,44,45
		Total non-PAH HAPs	0.0051		
	PAH HAPs				
	91-57-6	2-Methylnaphthalene[g]	7.4×10^{-5}	D	44,45,48
	83-32-9	Acenaphthene[g]	1.4×10^{-6}	E	48
	208-96-8	Acenaphthylene[g]	8.6×10^{-6}	D	35,45,48
	120-12-7	Anthracene[g]	2.2×10^{-7}	E	35,48
	56-55-3	Benzo(a)anthracene[g]	2.1×10^{-7}	E	48
	50-32-8	Benzo(a)pyrene[g]	9.8×10^{-9}	E	48
	205-99-2	Benzo(b)fluoranthene[g]	1.0×10^{-7}	E	35,48
	192-97-2	Benzo(e)pyrene[g]	1.1×10^{-7}	E	48
	191-24-2	Benzo(g,h,i)perylene[g]	4.0×10^{-8}	E	48
	207-08-9	Benzo(k)fluoranthene[g]	4.1×10^{-8}	E	35,48
	218-01-9	Chrysene[g]	1.8×10^{-7}	E	35,48
	206-44-0	Fluoranthene[g]	6.1×10^{-7}	D	35,45,48
	86-73-7	Fluorene[g]	3.8×10^{-6}	D	35,45,48,163
	193-39-5	Indeno(1,2,3-cd)pyrene[g]	7.0×10^{-9}	E	48
	91-20-3	Naphthalene[g]	9.0×10^{-5}	D	35,44,45,48,163
	198-55-0	Perylene[g]	8.8×10^{-9}	E	48
	85-01-8	Phenanthrene[g]	7.6×10^{-6}	D	35,44,45,48,163
	129-00-0	Pyrene[g]	5.4×10^{-7}	D	45,48
		Total PAH HAPs	0.00019		

Table 11.1-10 (cont.)

Process	Pollutant		Emission Factor, lb/ton	Emission Factor Rating	Ref. No.
	CASRN	Name			
Natural gas-fired dryer with fabric filter[b] (SCC 3-05-002-55, -56,-57) (cont.)	Total HAPs		0.0053		
	Non-HAP organic compounds				
	106-97-8	Butane	0.00067	E	339
	74-85-1	Ethylene	0.0070	E	339-340
	142-82-5	Heptane	0.0094	E	339-340
	763-29-1	2-Methyl-1-pentene	0.0040	E	339,340
	513-35-9	2-Methyl-2-butene	0.00058	E	339,340
	96-14-0	3-Methylpentane	0.00019	D	339,340
	109-67-1	1-Pentene	0.0022	E	339-340
	109-66-0	n-Pentane	0.00021	E	339-340
		Total non-HAP organics	0.024		
No. 2 fuel oil-fired dryer with fabric filter (SCC 3-05-002-58, -59,-60)	Non-PAH HAPs[c]				
	71-43-2	Benzene[d]	0.00039	A	25,44,45,50, 341, 342, 344-351, 373, 376, 377, 383, 384
	100-41-4	Ethylbenzene	0.00024	D	25,44,45
	50-00-0	Formaldehyde[e]	0.0031	A	25,35,44,45,50, 339-344, 347-349, 371-373, 384, 388
	110-54-3	Hexane	0.00092	E	339-340
	540-84-1	Isooctane (2,2,4-trimethylpentane)	4.0×10^{-5}	E	339-340
	71-55-6	Methyl chloroform[f]	4.8×10^{-5}	E	35
	108-88-3	Toluene	0.0029	E	25, 50, 339-340
	1330-20-7	Xylene	0.00020	D	25,44,45
		Total non-PAH HAPs	0.0078		
	PAH HAPs				
	91-57-6	2-Methylnaphthalene[g]	0.00017	E	50
	83-32-9	Acenaphthene[g]	1.4×10^{-6}	E	48
	208-96-8	Acenaphthylene[g]	2.2×10^{-5}	E	50
	120-12-7	Anthracene[g]	3.1×10^{-6}	E	50,162
	56-55-3	Benzo(a)anthracene[g]	2.1×10^{-7}	E	48
	50-32-8	Benzo(a)pyrene[g]	9.8×10^{-9}	E	48
	205-99-2	Benzo(b)fluoranthene[g]	1.0×10^{-7}	E	35,48
	192-97-2	Benzo(e)pyrene[g]	1.1×10^{-7}	E	48

Table 11.1-10 (cont.)

Process	Pollutant		Emission Factor, lb/ton	Emission Factor Rating	Ref. No.
	CASRN	Name			
No. 2 fuel oil-fired dryer with fabric filter (SCC 3-05-002-58, -59,-60) (cont.)	191-24-2	Benzo(g,h,i)perylene[g]	4.0×10^{-8}	E	48
	207-08-9	Benzo(k)fluoranthene[g]	4.1×10^{-8}	E	35,48
	218-01-9	Chrysene[g]	1.8×10^{-7}	E	35,48
	206-44-0	Fluoranthene[g]	6.1×10^{-7}	D	35,45,48
	86-73-7	Fluorene[g]	1.1×10^{-5}	E	50,164
	193-39-5	Indeno(1,2,3-cd)pyrene[g]	7.0×10^{-9}	E	48
	91-20-3	Naphthalene[g]	0.00065	D	25,50,162,164
	198-55-0	Perylene[g]	8.8×10^{-9}	E	48
	85-01-8	Phenanthrene[g]	2.3×10^{-5}	D	50,162,164
	129-00-0	Pyrene[g]	3.0×10^{-6}	E	50
		Total PAH HAPs	0.00088		
		Total HAPs	0.0087		
	Non-HAP organic compounds				
	106-97-8	Butane	0.00067	E	339
	74-85-1	Ethylene	0.0070	E	339-340
	142-82-5	Heptane	0.0094	E	339-340
	763-29-1	2-Methyl-1-pentene	0.0040	E	339,340
	513-35-9	2-Methyl-2-butene	0.00058	E	339,340
	96-14-0	3-Methylpentane	0.00019	D	339,340
	109-67-1	1-Pentene	0.0022	E	339-340
	109-66-0	n-Pentane	0.00021	E	339-340
		Total non-HAP organics	0.024		

Table 11.1-10 (cont.)

Process	Pollutant CASRN	Pollutant Name	Emission Factor, lb/ton	Emission Factor Rating	Ref. No.
Fuel oil- or waste oil-fired dryer with fabric filter (SCC 3-05-002-58, -59,-60,-61,-62, -63)		Dioxins			
	1746-01-6	2,3,7,8-TCDD[g]	$2.1x10^{-13}$	E	339
		Total TCDD[g]	$9.3x10^{-13}$	E	339
	40321-76-4	1,2,3,7,8-PeCDD[g]	$3.1x10^{-13}$	E	339
		Total PeCDD[g]	$2.2x10^{-11}$	E	339-340
	39227-28-6	1,2,3,4,7,8-HxCDD[g]	$4.2x10^{-13}$	E	339
	57653-85-7	1,2,3,6,7,8-HxCDD[g]	$1.3x10^{-12}$	E	339
	19408-24-3	1,2,3,7,8,9-HxCDD[g]	$9.8x10^{-13}$	E	339
		Total HxCDD[g]	$1.2x10^{-11}$	E	339-340
	35822-46-9	1,2,3,4,6,7,8-HpCDD[g]	$4.8x10^{-12}$	E	339
		Total HpCDD[g]	$1.9x10^{-11}$	E	339-340
	3268-87-9	Octa CDD[g]	$2.5x10^{-11}$	E	339
		Total PCDD[g]	$7.9x10^{-11}$	E	339-340
		Furans			
	51207-31-9	2,3,7,8-TCDF[g]	$9.7x10^{-13}$	E	339
		Total TCDF[g]	$3.7x10^{-12}$	E	339-340
		1,2,3,7,8-PeCDF[g]	$4.3x10^{-12}$	E	339-340
		2,3,4,7,8-PeCDF[g]	$8.4x10^{-13}$	E	339
		Total PeCDF[g]	$8.4x10^{-11}$	E	339-340
		1,2,3,4,7,8-HxCDF[g]	$4.0x10^{-12}$	E	339
		1,2,3,6,7,8-HxCDF[g]	$1.2x10^{-12}$	E	339
		2,3,4,6,7,8-HxCDF[g]	$1.9x10^{-12}$	E	339
		1,2,3,7,8,9-HxCDF[g]	$8.4x10^{-12}$	E	340
		Total HxCDF[g]	$1.3x10^{-11}$	E	339-340
		1,2,3,4,6,7,8-HpCDF[g]	$6.5x10^{-12}$	E	339
		1,2,3,4,7,8,9-HpCDF[g]	$2.7x10^{-12}$	E	339
		Total HpCDF[g]	$1.0x10^{-11}$	E	339-340
	39001-02-0	Octa CDF[g]	$4.8x10^{-12}$	E	339
		Total PCDF[g]	$4.0x10^{-11}$	E	339-340
		Total PCDD/PCDF[g]	$1.2x10^{-10}$	E	339-340

Table 11.1-10 (cont.)

Process	Pollutant CASRN	Pollutant Name	Emission Factor, lb/ton	Emission Factor Rating	Ref. No.
Fuel oil- or waste oil-fired dryer (uncontrolled) (SCC 3-05-002-58, -59,-60,-61,-62, -63)	Hazardous air pollutants[c]				
	Dioxins				
		Total HxCDD[g]	5.4×10^{-12}	E	340
	35822-46-9	1,2,3,4,6,7,8-HpCDD[g]	3.4×10^{-11}	E	340
		Total HpCDD[g]	7.1×10^{-11}	E	340
	3268-87-9	Octa CDD[g]	2.7×10^{-9}	E	340
		Total PCDD[g]	2.8×10^{-9}	E	340
	Furans				
		Total TCDF[g]	3.3×10^{-11}	E	340
		Total PeCDF[g]	7.4×10^{-11}	E	340
		1,2,3,4,7,8-HxCDF[g]	5.4×10^{-12}	E	340
		2,3,4,6,7,8-HxCDF[g]	1.6×10^{-12}	E	340
		Total HxCDF[g]	8.1×10^{-12}	E	340
Fuel oil- or waste oil-fired dryer (uncontrolled) (SCC 3-05-002-58, -59,-60,-61,-62, -63) (cont.)		1,2,3,4,6,7,8-HpCDF[g]	1.1×10^{-11}	E	340
		Total HpCDF[g]	3.8×10^{-11}	E	340
		Total PCDF[g]	1.5×10^{-10}	E	340
		Total PCDD/PCDF[g]	3.0×10^{-9}	E	340

Table 11.1-10 (cont.)

Process	Pollutant		Emission Factor, lb/ton	Emission Factor Rating	Ref. No.
	CASRN	Name			
Waste oil-fired dryer with fabric filter (SCC 3-05-002-61, -62,-63)	Non-PAH HAPs[c]				
	75-07-0	Acetaldehyde	0.0013	E	25
	107-02-8	Acrolein	2.6×10^{-5}	E	25
	71-43-2	Benzene[d]	0.00039	A	25,44,45,50,341,342, 344-351, 373, 376, 377, 383, 384
	100-41-4	Ethylbenzene	0.00024	D	25,44,45
	50-00-0	Formaldehyde[e]	0.0031	A	25,35,44,45,50,339-344,347-349,371-373, 384, 388
	110-54-3	Hexane	0.00092	E	339-340
	540-84-1	Isooctane (2,2,4-trimethylpentane)	4.0×10^{-5}	E	339-340
	78-93-3	Methyl Ethyl Ketone	2.0×10^{-5}	E	25
	123-38-6	Propionaldehyde	0.00013	E	25
	106-51-4	Quinone	0.00016	E	25
	71-55-6	Methyl chloroform[f]	4.8×10^{-5}	E	35
	108-88-3	Toluene	0.0029	E	25, 50, 339-340
	1330-20-7	Xylene	0.00020	D	25,44,45
		Total non-PAH HAPs	0.0095		
	PAH HAPs				
	91-57-6	2-Methylnaphthalene[g]	0.00017	E	50
	83-32-9	Acenaphthene[g]	1.4×10^{-6}	E	48
	208-96-8	Acenaphthylene[g]	2.2×10^{-5}	E	50
	120-12-7	Anthracene[g]	3.1×10^{-6}	E	50,162
	56-55-3	Benzo(a)anthracene[g]	2.1×10^{-7}	E	48
	50-32-8	Benzo(a)pyrene[g]	9.8×10^{-9}	E	48
	205-99-2	Benzo(b)fluoranthene[g]	1.0×10^{-7}	E	35,48
	192-97-2	Benzo(e)pyrene[g]	1.1×10^{-7}	E	48
	191-24-2	Benzo(g,h,i)perylene[g]	4.0×10^{-8}	E	48

Table 11.1-10 (cont.)

Process	Pollutant CASRN	Pollutant Name	Emission Factor, lb/ton	Emission Factor Rating	Ref. No.
Waste oil-fired dryer with fabric filter (SCC 3-05-002-61, -62,-63) (cont.)	207-08-9	Benzo(k)fluoranthene[g]	$4.1x10^{-8}$	E	35,48
	218-01-9	Chrysene[g]	$1.8x10^{-7}$	E	35,48
	206-44-0	Fluoranthene[g]	$6.1x10^{-7}$	D	35,45,48
	86-73-7	Fluorene[g]	$1.1x10^{-5}$	E	50,164
	193-39-5	Indeno(1,2,3-cd)pyrene[g]	$7.0x10^{-9}$	E	48
	91-20-3	Naphthalene[g]	0.00065	D	25,50,162,164
	198-55-0	Perylene[g]	$8.8x10^{-9}$	E	48
	85-01-8	Phenanthrene[g]	$2.3x10^{-5}$	D	50,162,164
	129-00-0	Pyrene[g]	$3.0x10^{-6}$	E	50
		Total PAH HAPs	0.00088		
		Total HAPs	0.010		
	Non-HAP organic compounds				
	67-64-1	Acetone[f]	0.00083	E	25
	100-52-7	Benzaldehyde	0.00011	E	25
	106-97-8	Butane	0.00067	E	339
	78-84-2	Butyraldehyde	0.00016	E	25
	4170-30-3	Crotonaldehyde	$8.6x10^{-5}$	E	25
	74-85-1	Ethylene	0.0070	E	339, 340
	142-82-5	Heptane	0.0094	E	339, 340
	66-25-1	Hexanal	0.00011	E	25
	590-86-3	Isovaleraldehyde	$3.2x10^{-5}$	E	25
	763-29-1	2-Methyl-1-pentene	0.0040	E	339, 340
	513-35-9	2-Methyl-2-butene	0.00058	E	339, 340
	96-14-0	3-Methylpentane	0.00019	D	339, 340
	109-67-1	1-Pentene	0.0022	E	339, 340
	109-66-0	n-Pentane	0.00021	E	339, 340
	110-62-3	Valeraldehyde	$6.7x10^{-5}$	E	25
		Total non-HAP organics	0.026		

[a] Emission factor units are lb/ton of hot mix asphalt produced. Table includes data from both parallel flow and counterflow drum mix dryers. Organic compound emissions from counterflow systems are expected to be less than from parallel flow systems, but the available data are insufficient to quantify

Table 11.1-10 (cont.)

accurately the difference in these emissions. CASRN = Chemical Abstracts Service Registry Number. SCC = Source Classification Code. To convert from lb/ton to kg/Mg, multiply by 0.5.

[b] Tests included dryers that were processing reclaimed asphalt pavement. Because of limited data, the effect of RAP processing on emissions could not be determined.

[c] Hazardous air pollutants (HAP) as defined in the 1990 Clean Air Act Amendments (CAAA).

[d] Based on data from 19 tests. Range: 0.000063 to 0.0012 lb/ton; median: 0.00030; Standard deviation: 0.00031.

[e] Based on data from 21 tests. Range: 0.0030 to 0.014 lb/ton; median: 0.0020; Standard deviation: 0.0036.

[f] Compound has negligible photochemical reactivity.

[g] Compound is classified as polycyclic organic matter, as defined in the 1990 CAAA. Total PCDD is the sum of the total tetra through octa dioxins; total PCDF is sum of the total tetra through octa furans; and total PCDD/PCDF is the sum of total PCDD and total PCDF.

Table 11.1-11. EMISSION FACTORS FOR METAL EMISSIONS FROM BATCH MIX HOT MIX ASPHALT PLANTS[a]

Process	Pollutant	Emission Factor, lb/ton	Emission Factor Rating	Reference Numbers
Dryer, hot screens, and mixer[b] (SCC 3-05-002-45,-46,-47)	Arsenic[c]	4.6×10^{-7}	D	34, 40, 226
	Barium	1.5×10^{-6}	E	24
	Beryllium[c]	1.5×10^{-7}	E	34, 226
	Cadmium[c]	6.1×10^{-7}	D	24, 34, 226
	Chromium[c]	5.7×10^{-7}	D	24, 34, 226
	Hexavalent chromium[c]	4.8×10^{-8}	E	34, 226
	Copper	2.8×10^{-6}	D	24, 34, 226
	Lead[c]	8.9×10^{-7}	D	24, 34, 226
	Manganese[c]	6.9×10^{-6}	D	24, 34, 226
	Mercury[c]	4.1×10^{-7}	E	34, 226
	Nickel[c]	3.0×10^{-6}	D	24, 34, 226
	Selenium[c]	4.9×10^{-7}	E	34, 226
	Zinc	6.8×10^{-6}	D	24, 34, 226

[a] Emission factor units are lb/ton of HMA produced. Emissions controlled by a fabric filter. SCC = Source Classification Code. To convert from lb/ton to kg/Mg, multiply by 0.5.
[b] Natural gas-, propane-, No. 2 fuel oil-, or waste oil-/drain oil-/No. 6 fuel oil-fired dryer. For waste oil-/drain oil-/No. 6 fuel oil-fired dryer, use a lead emission factor of 1.0×10^{-5} lb/ton (References 177 and 321, Emission factor rating: E) in lieu of the emission factor shown.
[c] Arsenic, beryllium, cadmium, chromium, hexavalent chromium, lead, manganese, mercury, nickel, and selenium are HAPs as defined in the 1990 CAAA.

Table 11.1-12. EMISSION FACTORS FOR METAL EMISSIONS FROM DRUM MIX HOT MIX ASPHALT PLANTS[a]

Process	Pollutant	Emission Factor, lb/ton	Emission Factor Rating	Reference Numbers
Fuel oil-fired dryer, uncontrolled (SCC 3-05-002-58, -59,-60)	Arsenic[b]	$1.3x10^{-6}$	E	340
	Barium	0.00025	E	340
	Beryllium[b]	0.0	E	340
	Cadmium[b]	$4.2x10^{-6}$	E	340
	Chromium[b]	$2.4x10^{-5}$	E	340
	Cobalt[b]	$1.5x10^{-5}$	E	340
	Copper	0.00017	E	340
	Lead[b]	0.00054	E	340
	Manganese[b]	0.00065	E	340
	Nickel[b]	0.0013	E	340
	Phosphorus[b]	0.0012	E	340
	Selenium[b]	$2.4x10^{-6}$	E	340
	Thallium	$2.2x10^{-6}$	E	340
	Zinc	0.00018	E	340
Natural gas- or propane-fired dryer, with fabric filter (SCC 3-05-002-55, -56,-57))	Antimony	$1.8x10^{-7}$	E	339
	Arsenic[b]	$5.6x10^{-7}$	D	25, 35, 339-340
	Barium	$5.8x10^{-6}$	E	25, 339-340
	Beryllium[b]	0.0	E	339-340
	Cadmium[b]	$4.1x10^{-7}$	D	25, 35, 162, 301, 339-340
	Chromium[b]	$5.5x10^{-6}$	C	25, 162-164, 301, 339-340
	Cobalt[b]	$2.6x10^{-8}$	E	339-340
	Copper	$3.1x10^{-6}$	D	25, 162-164, 339-340
	Hexavalent chromium[b]	$4.5x10^{-7}$	E	163
	Lead[b]	$6.2x10^{-7}$	E	35
	Manganese[b]	$7.7x10^{-6}$	D	25, 162-164, 339-340
	Mercury[b]	$2.4x10^{-7}$	E	35, 163
	Nickel[b]	$6.3x10^{-5}$	D	25, 163-164, 339-340
	Phosphorus[b]	$2.8x10^{-5}$	E	25, 339-340
	Silver	$4.8x10^{-7}$	E	25, 339-340
	Selenium[b]	$3.5x10^{-7}$	E	339-340
	Thallium	$4.1x10^{-9}$	E	339-340
	Zinc	$6.1x10^{-5}$	C	25, 35, 162-164, 339-340

Table 11.1-12 (cont.)

Process	Pollutant	Emission Factor, lb/ton	Emission Factor Rating	Reference Numbers
No. 2 fuel oil-fired dryer or waste oil/drain oil/No. 6 fuel oil-fired dryer, with fabric filter (SCC 3-05-002-58, -59,-60,-61,-62,-63)	Antimony	1.8×10^{-7}	E	339
	Arsenic[b]	5.6×10^{-7}	D	25, 35, 339-340
	Barium	5.8×10^{-6}	E	25, 339-340
	Beryllium[b]	0.0	E	339-340
	Cadmium[b]	4.1×10^{-7}	D	25, 35, 162, 301, 339-340
	Chromium[b]	5.5×10^{-6}	C	25, 162-164, 301, 339-340
	Cobalt[b]	2.6×10^{-8}	E	339-340
	Copper	3.1×10^{-6}	D	25, 162-164, 339-340
	Hexavalent chromium[b]	4.5×10^{-7}	E	163
	Lead[b]	1.5×10^{-5}	C	25, 162, 164, 178-179, 183, 301, 315, 339-340
	Manganese[b]	7.7×10^{-6}	D	25, 162-164, 339-340
	Mercury[b]	2.6×10^{-6}	D	162, 164, 339-340
	Nickel[b]	6.3×10^{-5}	D	25, 163-164, 339-340
	Phosphorus[b]	2.8×10^{-5}	E	25, 339-340
	Silver	4.8×10^{-7}	E	25, 339-340
	Selenium[b]	3.5×10^{-7}	E	339-340
	Thallium	4.1×10^{-9}	E	339-340
	Zinc	6.1×10^{-5}	C	25, 35, 162-164, 339-340

[a] Emission factor units are lb/ton of HMA produced. SCC = Source Classification Code. To convert from lb/ton to kg/Mg, multiply by 0.5. Emission factors apply to facilities processing virgin aggregate or a combination of virgin aggregate and RAP.

[b] Arsenic, beryllium, cadmium, chromium, hexavalent chromium, cobalt, lead, manganese, mercury, nickel, and selenium compounds are HAPs as defined in the 1990 CAAA. Elemental phosphorus also is a listed HAP, but the phosphorus measured by Method 29 is not elemental phosphorus.

Table 11.1-13. EMISSION FACTORS FOR HOT MIX ASPHALT HOT OIL SYSTEMS[a]

Process	Pollutant CASRN	Pollutant Name	Emission factor	Emission factor units	EMISSION FACTOR RATING	Reference
Hot oil system fired with natural gas (SCC 3-05-002-06)	630-08-0	Carbon monoxide	$8.9x10^{-6}$	lb/ft^3	C	395
	124-38-9	Carbon dioxide	0.20	lb/ft^3	C	395
	50-00-0	Formaldehyde	$2.6x10^{-8}$	lb/ft^3	C	395
Hot oil system fired with No. 2 fuel oil (SCC 3-05-002-08)	630-08-0	Carbon monoxide	0.0012	lb/gal	C	395
	124-38-9	Carbon dioxide	28	lb/gal	C	395
	50-00-0	Formaldehyde	$3.5x10^{-6}$	lb/gal	C	395
	83-32-9	Acenaphthene[b]	$5.3x10^{-7}$	lb/gal	E	35
	208-96-8	Acenaphthylene[b]	$2.0x10^{-7}$	lb/gal	E	35
	120-12-7	Anthracene[b]	$1.8x10^{-7}$	lb/gal	E	35
	205-99-2	Benzo(b)fluoranthene[b]	$1.0x10^{-7}$	lb/gal	E	35
	206-44-0	Fluoranthene[b]	$4.4x10^{-8}$	lb/gal	E	35
	86-73-7	Fluorene[b]	$3.2x10^{-8}$	lb/gal	E	35
	91-20-3	Naphthalene[b]	$1.7x10^{-5}$	lb/gal	E	35
	85-01-8	Phenanthrene[b]	$4.9x10^{-6}$	lb/gal	E	35
	129-00-0	Pyrene[b]	$3.2x10^{-8}$	lb/gal	E	35
	Dioxins					
	19408-74-3	1,2,3,7,8,9-HxCDD[b]	$7.6x10^{-13}$	lb/gal	E	35
	39227-28-6	1,2,3,4,7,8-HxCDD[b]	$6.9x10^{-13}$	lb/gal	E	35
		HxCDD[b]	$6.2x10^{-12}$	lb/gal	E	35
	35822-46-9	1,2,3,4,6,7,8-HpCDD[b]	$1.5x10^{-11}$	lb/gal	E	35
		HpCDD[b]	$2.0x10^{-11}$	lb/gal	E	35
	3268-87-9	OCDD[b]	$1.6x10^{-10}$	lb/gal	E	35
		Total PCDD	$2.0x10^{-10}$	lb/gal	E	35
	Furans					
		TCDF[b]	$3.3x10^{-12}$	lb/gal	E	35
		PeCDF[b]	$4.8x10^{-13}$	lb/gal	E	35
		HxCDF[b]	$2.0x10^{-12}$	lb/gal	E	35
		HpCDF[b]	$9.7x10^{-12}$	lb/gal	E	35
	67562-39-4	1,2,3,4,6,7,8-HpCDF[b]	$3.5x10^{-12}$	lb/gal	E	35
	39001-02-0	OCDF[b]	$1.2x10^{-11}$	lb/gal	E	35
		Total PCDF	$3.1x10^{-11}$	lb/gal	E	35
		Total PCDD/PCDF	$2.3x10^{-10}$	lb/gal	E	35

[a] Emission factor units are lb/gal of fuel consumed. To convert from pounds per standard cubic foot ($lb/ft^{3)}$ to kilograms per standard cubic meter ($kg/m^{3)}$, multiply by 16. To convert from lb/gal to kilograms per liter (kg/l), multiply by 0.12. CASRN = Chemical Abstracts Service Registry Number. SCC = Source Classification Code.

[b] Compound is classified as polycyclic organic matter, as defined in the 1990 Clean Air Act Amendments (CAAA). Total PCDD is the sum of the total tetra through octa dioxins; total PCDF is sum of the total tetra through octa furans; and total PCDD/PCDF is the sum of total PCDD and total PCDF.

Table 11.1-14. PREDICTIVE EMISSION FACTOR EQUATIONS FOR LOAD-OUT AND SILO FILLING OPERATIONS[a]

EMISSION FACTOR RATING: C

Source	Pollutant	Equation
Drum mix or batch mix plant load-out (SCC 3-05-002-14)	Total PM[b]	$EF = 0.000181 + 0.00141(-V)e^{((0.0251)(T + 460) - 20.43)}$
	Organic PM[c]	$EF = 0.00141(-V)e^{((0.0251)(T + 460) - 20.43)}$
	TOC[d]	$EF = 0.0172(-V)e^{((0.0251)(T + 460) - 20.43)}$
	CO	$EF = 0.00558(-V)e^{((0.0251)(T + 460) - 20.43)}$
Silo filling (SCC 3-05-002-13)	Total PM[b]	$EF = 0.000332 + 0.00105(-V)e^{((0.0251)(T + 460) - 20.43)}$
	Organic PM[c]	$EF = 0.00105(-V)e^{((0.0251)(T + 460) - 20.43)}$
	TOC[d]	$EF = 0.0504(-V)e^{((0.0251)(T + 460) - 20.43)}$
	CO	$EF = 0.00488(-V)e^{((0.0251)(T + 460) - 20.43)}$

[a] Emission factor units are lb/ton of HMA produced. SCC = Source Classification Code. To convert from lb/ton to kg/Mg, multiply by 0.5. EF = emission factor; V = asphalt volatility, as determined by ASTM Method D2872-88 "Effects of Heat and Air on a Moving Film of Asphalt (Rolling Thin Film Oven Test - RTFOT)," where a 0.5 percent loss-on-heating is expressed as "-0.5." Regional- or site-specific data for asphalt volatility should be used, whenever possible; otherwise, a default value of -0.5 should be used for V in these equations. T = HMA mix temperature in °F. Site-specific temperature data should be used, whenever possible; otherwise a default temperature of 325°F can be used. Reference 1, Tables 4-27 through 4-31, 4-34 through 4-36, and 4-38 through 4-41.

[b] Total PM, as measured by EPA Method 315 (EPA Method 5 plus the extractable organic particulate from the impingers). Total PM is assumed to be predominantly PM-2.5 since emissions consist of condensed vapors.

[c] Extractable organic PM, as measured by EPA Method 315 (methylene chloride extract of EPA Method 5 particulate plus methylene chloride extract of impinger particulate).

[d] TOC as propane, as measured with an EPA Method 25A sampling train or equivalent sampling train.

Table 11.1-15. SPECIATION PROFILES FOR LOAD-OUT, SILO FILLING, AND ASPHALT STORAGE EMISSIONS–ORGANIC PARTICULATE-BASED COMPOUNDS

EMISSION FACTOR RATING: C

Pollutant	CASRN[a]	Speciation Profile for Load-out and Yard Emissions[b] Compound/Organic PM[c]	Speciation Profile for Silo Filling and Asphalt Storage Tank Emissions Compound/Organic PM[c]
PAH HAPs			
Acenaphthene	83-32-9	0.26%	0.47%
Acenaphthylene	208-96-8	0.028%	0.014%
Anthracene	120-1207	0.070%	0.13%
Benzo(a)anthracene	56-55-3	0.019%	0.056%
Benzo(b)fluoranthene	205-99-2	0.0076%	ND[d]
Benzo(k)fluoranthene	207-08-9	0.0022%	ND[d]
Benzo(g,h,i)perylene	191-24-2	0.0019%	ND[d]
Benzo(a)pyrene	50-32-8	0.0023%	ND[d]
Benzo(e)pyrene	192-97-2	0.0078%	0.0095%
Chrysene	218-01-9	0.103%	0.21%
Dibenz(a,h)anthracene	53-70-3	0.00037%	ND[d]
Fluoranthene	206-44-0	0.050%	0.15%
Fluorene	86-73-7	0.77%	1.01%
Indeno(1,2,3-cd)pyrene	193-39-5	0.00047%	ND[d]
2-Methylnaphthalene	91-57-6	2.38%	5.27%
Naphthalene	91-20-3	1.25%	1.82%
Perylene	198-55-0	0.022%	0.030%
Phenanthrene	85-01-8	0.81%	1.80%
Pyrene	129-00-0	0.15%	0.44%
Total PAH HAPs		5.93%	11.40%
Other semi-volatile HAPs			
Phenol		1.18%	ND[d]

[a] Chemical Abstract Service Registry Number.
[b] Emissions from loaded trucks during the period between load-out and the time the truck departs the plant.
[c] Emission factor for compound is determined by multiplying the percentage presented for the compound by the emission factor for extractable organic particulate (organic PM) as determined from Table 11.1-14.
[d] ND = Measured data below detection limits.

Table 11.1-16. SPECIATION PROFILES FOR LOAD-OUT, SILO FILLING, AND ASPHALT STORAGE EMISSIONS–ORGANIC VOLATILE-BASED COMPOUNDS

EMISSION FACTOR RATING: C

Pollutant	CASRN	Speciation Profile for Load-Out and Yard Emissions	Speciation Profile for Silo Filling and Asphalt Storage Tank Emissions
		Compound/TOC[a]	Compound/TOC (%)[a]
VOC[b]		94%[b]	100%
Non-VOC/non-HAPs			
Methane	74-82-8	6.5%	0.26%
Acetone	67-64-1	0.046%	0.055%
Ethylene	74-85-1	0.71%	1.1%
Total non-VOC/non-HAPS		7.3%	1.4%
Volatile organic HAPS			
Benzene	71-43-2	0.052%	0.032%
Bromomethane	74-83-9	0.0096%	0.0049%
2-Butanone	78-93-3	0.049%	0.039%
Carbon Disulfide	75-15-0	0.013%	0.016%
Chloroethane	75-00-3	0.00021%	0.0040%
Chloromethane	74-87-3	0.015%	0.023%
Cumene	92-82-8	0.11%	ND[c]
Ethylbenzene	100-41-4	0.28%	0.038%
Formaldehyde	50-00-0	0.088%	0.69%
n-Hexane	100-54-3	0.15%	0.10%
Isooctane	540-84-1	0.0018%	0.00031%
Methylene Chloride	75-09-2	0.0%[d]	0.00027%
MTBE	596899	0.0%[d]	ND[c]
Styrene	100-42-5	0.0073%	0.0054%
Tetrachloroethene	127-18-4	0.0077%	ND[c]
Toluene	100-88-3	0.21%	0.062%
1,1,1-Trichloroethane	71-55-6	0.0%[d]	ND[c]
Trichloroethene	79-01-6	0.0%[d]	ND[c]
Trichlorofluoromethane	75-69-4	0.0013%	ND[c]
m-/p-Xylene	1330-20-7	0.41%	0.2%
o-Xylene	95-47-6	0.08%	0.057%
Total volatile organic HAPs		1.5%	1.3%

Table 11.1-16 (cont.)

[a] Emission factor for compound is determined by multiplying the percentage presented for the compound by the emission factor for total organic compounds (TOC) as determined from Table 11.1-14.

[b] The VOC percentages are equal to 100 percent of TOC minus the methane, acetone, methylene chloride, and 1,1,1-trichloroethane percentages.

[c] ND = Measured data below detection limits. Additional compounds that were not detected are: acrylonitrile, allyl chloride, bromodichloromethane, bromoform, 1,3-butadiene, carbon tetrachloride, chlorobenzene, chloroform, dibromochloromethane, 1,2-dibromoethane, 1,1-dichloroethane, 1,2-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, 1,2-dichloropropane, cis-1,3-dichloropropene, trans-1,3-dichloropropene, 1,2-epoxybutane, ethyl acrylate, 2-hexanone, iodomethane, methyl methacrylate, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, vinyl acetate, vinyl bromide, and vinyl chloride

[d] Values presented as 0.0% had background concentrations higher than the capture efficiency-corrected measured concentration.

AP-42 Section 11.12

11.12 Concrete Batching

11.12.1 Process Description [1-5]

Concrete is composed essentially of water, cement, sand (fine aggregate) and coarse aggregate. Coarse aggregate may consist of gravel, crushed stone or iron blast furnace slag. Some specialty aggregate products could be either heavyweight aggregate (of barite, magnetite, limonite, ilmenite, iron or steel) or lightweight aggregate (with sintered clay, shale, slate, diatomaceous shale, perlite, vermiculite, slag pumice, cinders, or sintered fly ash). Supplementary cementitious materials, also called mineral admixtures or pozzolan minerals may be added to make the concrete mixtures more economical, reduce permeability, increase strength, or influence other concrete properties. Typical examples are natural pozzolans, fly ash, ground granulated blast-furnace slag, and silica fume, which can be used individually with portland or blended cement or in different combinations. Chemical admixtures are usually liquid ingredients that are added to concrete to entrain air, reduce the water required to reach a required slump, retard or accelerate the setting rate, to make the concrete more flowable or other more specialized functions.

Approximately 75 percent of the U.S. concrete manufactured is produced at plants that store, convey, measure and discharge these constituents into trucks for transport to a job site. At most of these plants, sand, aggregate, cement and water are all gravity fed from the weight hopper into the mixer trucks. The concrete is mixed on the way to the site where the concrete is to be poured. At some of these plants, the concrete may also be manufactured in a central mix drum and transferred to a transport truck. Most of the remaining concrete manufactured are products cast in a factory setting. Precast products range from concrete bricks and paving stones to bridge girders, structural components, and panels for cladding. Concrete masonry, another type of manufactured concrete, may be best known for its conventional 8 x 8 x 16-inch block. In a few cases concrete is dry batched or prepared at a building construction site. Figure 11.12-1 is a generalized process diagram for concrete batching.

The raw materials can be delivered to a plant by rail, truck or barge. The cement is transferred to elevated storage silos pneumatically or by bucket elevator. The sand and coarse aggregate are transferred to elevated bins by front end loader, clam shell crane, belt conveyor, or bucket elevator. From these elevated bins, the constituents are fed by gravity or screw conveyor to weigh hoppers, which combine the proper amounts of each material.

11.12.2 Emissions and Controls [6-8]

Particulate matter, consisting primarily of cement and pozzolan dust but including some aggregate and sand dust emissions, is the primary pollutant of concern. In addition, there are emissions of metals that are associated with this particulate matter. All but one of the emission points are fugitive in nature. The only point sources are the transfer of cement and pozzolan material to silos, and these are usually vented to a fabric filter or “sock”. Fugitive sources include the transfer of sand and aggregate, truck loading, mixer loading, vehicle traffic, and wind erosion from sand and aggregate storage piles. The amount of fugitive emissions generated during the transfer of sand and aggregate depends primarily on the surface moisture content of these materials. The extent of fugitive emission control varies widely from plant to plant. Particulate emission factors for concrete batching are give in Tables 11.12-1 and 11.12-2.

Types of controls used may include water sprays, enclosures, hoods, curtains, shrouds, movable and telescoping chutes, central duct collection systems, and the like. A major source of potential emissions, the movement of heavy trucks over unpaved or dusty surfaces in and around the plant, can be controlled by good maintenance and wetting of the road surface.

Predictive equations that allow for emission factor adjustment based on plant specific conditions are given in the Background Document for Chapter 11.12 and Chapter 13. Whenever plant specific data are available, they should be used with these predictive equations (e.g. Equations 11.12-1 through 11.12-3) in lieu of the general fugitive emission factors presented in Table 11.12-1, 11.12-2, and 11.12-5 through11.12-8 in order to adjust to site specific conditions, such as moisture levels and localized wind speeds.

11.12.3 Updates since the 5th Edition.

October 2001

– This major revision of the section replaced emissions factors based upon engineering judgment and poorly documented and performed source test reports with emissions tests conducted at modern operating truck mix and central mix facilities. Emissions factors for both total PM and total PM_{10} were developed from this test data.

June 2006

– This revision of the section supplemented the two source tests with several additional source tests of central mix and truck mix facilities. The measurement of the capture efficiency, local wind speed and fines material moisture level was improved over the previous two source tests. In addition to quantifying total PM and PM_{10}, $PM_{2.5}$ emissions were quantified at all of the facilities. Single value emissions factors for truck mix and central mix operations were revised using all of the data. Additionally, parameterized emissions factor equations using local wind speed and fines material moisture content were developed from the newer data.

February 2011

– This is an editorial revision of the section. Emissions factors in Tables 11.12-1, 11.12-2, 11.12-7 and 11.12-8 were corrected to agree with the emissions factors presented in the background report.

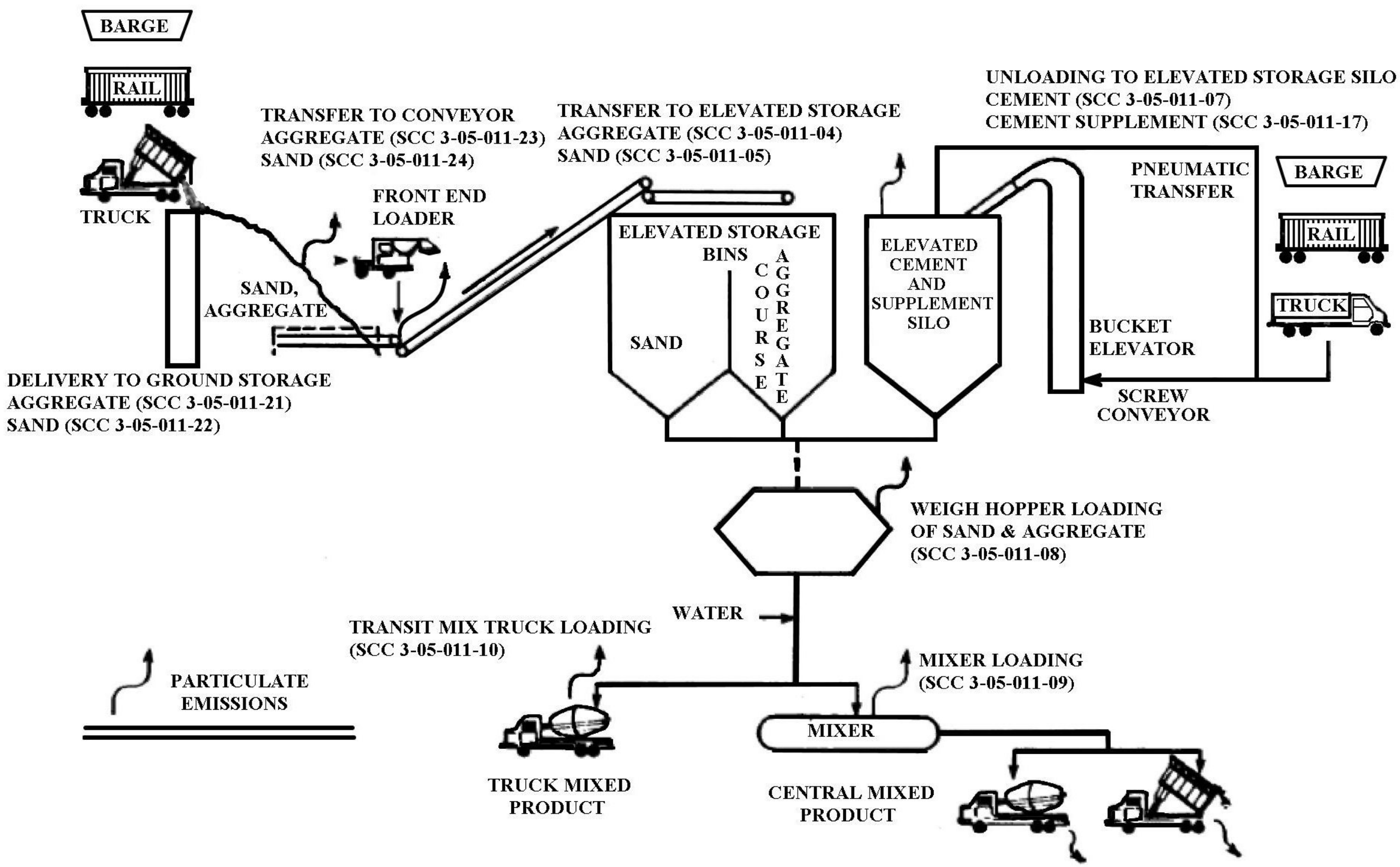

Figure 11.12-1. Typical Concrete Batching Process.

TABLE 11.12-1 (METRIC UNITS)
EMISSION FACTORS FOR CONCRETE BATCHING [a]

Source (SCC)	Uncontrolled				Controlled			
	Total PM	Emission Factor Rating	Total PM_{10}	Emission Factor Rating	Total PM	Emission Factor Rating	Total PM_{10}	Emission Factor Rating
Aggregate transfer [b] (3-05-011-04,-21,23)	0.0035	D	0.0017	D	ND		ND	
Sand transfer [b] (3-05-011-05,22,24)	0.0011	D	0.00051	D	ND		ND	
Cement unloading to elevated storage silo (pneumatic)[c] (3-05-011-07)	0.36	E	0.24	E	0.00050	D	0.00017	D
Cement supplement unloading to elevated storage silo (pneumatic)[d] (3-05-011-17)	1.57	E	0.65	E	0.0045	D	0.0024	E
Weigh hopper loading [e] (3-05-011-08)	0.0026	D	0.0013	D	ND		ND	
Mixer loading (central mix)[f] (3-05-011-09)	0.286 or Eqn. 11.12-1	B	0.078 or Eqn. 11.12-1	B	0.0092 or Eqn. 11.12-1	B	0.0028 or Eqn. 11.12-1	B
Truck loading (truck mix)[g] (3-05-011-10)	0.559	B	0.155	B	0.049 or Eqn. 11.12-1	B	0.0131 or Eqn. 11.12-1	B
Vehicle traffic (paved roads)	See AP-42 Section 13.2.1, Paved Roads							
Vehicle traffic (unpaved roads)	See AP-42 Section 13.2.2, Unpaved Roads							
Wind erosion from aggregate and sand storage piles	See AP-42 Section 13.2.5, Industrial Wind Erosion							

ND = No data

[a] All emission factors are in kg of pollutant per Mg of material loaded unless noted otherwise. Loaded material includes course aggregate, sand, cement, cement supplement and the surface moisture associated with these materials. The average material composition of concrete batches presented in references 9 and 10 was 846 kg course aggregate, 648 kg sand, 223 kg cement and 33kg cement supplement. Approximately 75 liters of water was added to this solid material to produce 1826 kg of concrete.

[b] Reference 9 and 10. Emission factors are based upon an equation from AP-42, section 13.2.4 Aggregate Handling And Storage Piles, equation 1 with k_{PM-10} =.35, k_{PM} = .74, U = 10mph, $M_{aggregate}$ =1.77%, and M_{sand} = 4.17%. These moisture contents of the materials ($M_{aggregate}$ and M_{sand}) are the averages of the values obtained from Reference 9 and Reference 10.

[c] The uncontrolled PM & PM-10 emission factors were developed from Reference 9. The controlled emission factor for PM was developed from References 9, 10, 11, and 12. The controlled emission factor for PM-10 was developed from References 9 and 10.

[d] The controlled PM emission factor was developed from Reference 10 and Reference 12, whereas the controlled PM-10 emission factor was developed from only Reference 10.

[e] Emission factors were developed by using the AP-42 Section 13.2.4, Aggregate and Sand Transfer Emission Factors in conjunction with the ratio of aggregate and sand used in an average yard^3 of concrete. The unit for these emission factors is kg of pollutant per Mg of aggregate and sand.

[f] References 9, 10, and 14. The emission factor units are kg of pollutant per Mg of cement and cement supplement. The general factor is the arithmetic mean of all test data.

[g] Reference 9, 10, and 14. The emission factor units are kg of pollutant per Mg of cement and cement supplement. The general factor is the arithmetic mean of all test data.

TABLE 11.12-2 (ENGLISH UNITS)
EMISSION FACTORS FOR CONCRETE BATCHING [a]

Source (SCC)	Uncontrolled				Controlled			
	Total PM	Emission Factor Rating	Total PM_{10}	Emission Factor Rating	Total PM	Emission Factor Rating	Total PM_{10}	Emission Factor Rating
Aggregate transfer [b] (3-05-011-04,-21,23)	0.0069	D	0.0033	D	ND		ND	
Sand transfer [b] (3-05-011-05,22,24)	0.0021	D	0.00099	D	ND		ND	
Cement unloading to elevated storage silo (pneumatic)[c] (3-05-011-07)	0.73	E	0.47	E	0.00099	D	0.00034	D
Cement supplement unloading to elevated storage silo (pneumatic)[d] (3-05-011-17)	3.14	E	1.10	E	0.0089	D	0.0049	E
Weigh hopper loading [e] (3-05-011-08)	0.0048	D	0.0028	D	ND		ND	
Mixer loading (central mix)[f] (3-05-011-09)	0.572 or Eqn. 11.12-1	B	0.156 or Eqn. 11.12-1	B	0.0184 or Eqn. 11.12-1	B	0.0055 or Eqn. 11.12-1	B
Truck loading (truck mix)[g] (3-05-011-10)	1.118	B	0.310	B	0.098 or Eqn. 11.12-1	B	0.0263 or Eqn. 11.12-1	B
Vehicle traffic (paved roads)	See AP-42 Section 13.2.1, Paved Roads							
Vehicle traffic (unpaved roads)	See AP-42 Section 13.2.2, Unpaved Roads							
Wind erosion from aggregate and sand storage piles	See AP-42 Section 13.2.5, Industrial Wind Erosion							

ND = No data

[a] All emission factors are in lb of pollutant per ton of material loaded unless noted otherwise. Loaded material includes course aggregate, sand, cement, cement supplement and the surface moisture associated with these materials. The average material composition of concrete batches presented in references 9 and 10 was 1865 lbs course aggregate, 1428 lbs sand, 491 lbs cement and 73 lbs cement supplement. Approximately 20 gallons of water was added to this solid material to produce 4024 lbs (one cubic yard) of concrete.

[b] Reference 9 and 10. Emission factors are based upon an equation from AP-42, section 13.2.4 Aggregate Handling And Storage Piles, equation 1 with k_{PM-10} =.35, k_{PM} = .74, U = 10mph, $M_{aggregate}$ =1.77%, and M_{sand} = 4.17%. These moisture contents of the materials ($M_{aggregate}$ and M_{sand}) are the averages of the values obtained from Reference 9 and Reference 10.

[c] The uncontrolled PM & PM-10 emission factors were developed from Reference 9. The controlled emission factor for PM was developed from References 9, 10, 11, and 12. The controlled emission factor for PM-10 was developed from References 9 and 10.

[d] The controlled PM emission factor was developed from Reference 10 and Reference 12, whereas the controlled PM-10 emission factor was developed from only Reference 10.

[e] Emission factors were developed by using the Aggregate and Sand Transfer Emission Factors in conjunction with the ratio of aggregate and sand used in an average $yard^3$ of concrete. The unit for these emission factors is lb of pollutant per ton of aggregate and sand.

[f] References 9, 10, and 14. The emission factor units are lb of pollutant per ton of cement and cement supplement. The general factor is the arithmetic mean of all test data.

[g] Reference 9, 10, and 14. The emission factor units are lb of pollutant per ton of cement and cement supplement. The general factor is the arithmetic mean of all test data.

The particulate matter emissions from truck mix and central mix loading operations are calculated in accordance with the values in Tables 11.12-1 or 11.12-2 or by Equation 11.12-1[14] when site specific data are available.

$$E = k\,(0.0032)\left[\frac{U^a}{M^b}\right] + c \qquad \text{Equation 11.12-1}$$

E	=	Emission factor in lbs./ton of cement and cement supplement
k	=	Particle size multiplier (dimensionless)
U	=	Wind speed at the material drop point, miles per hour (mph)
M	=	Minimum moisture (% by weight) of cement and cement supplement
a, b	=	Exponents
c	=	Constant

The parameters for Equation 11.12-1 are summarized in Tables 11.12-3 and 11.12-4.

Table 11.12-3. Equation Parameters for Truck Mix Operations

Condition	Parameter Category	k	a	b	c
Controlled[1]	Total PM	0.8	1.75	0.3	0.013
	PM_{10}	0.32	1.75	0.3	0.0052
	$PM_{10-2.5}$	0.288	1.75	0.3	0.00468
	$PM_{2.5}$	0.048	1.75	0.3	0.00078
Uncontrolled[1]	Total PM	0.995			
	PM_{10}	0.278			
	$PM_{10-2.5}$	0.228			
	$PM_{2.5}$	0.050			

Table 11.12-4. Equation Parameters for Central Mix Operations

Condition	Parameter Category	k	a	b	c
Controlled[1]	Total PM	0.19	0.95	0.9	0.0010
	PM_{10}	0.13	0.45	0.9	0.0010
	$PM_{10-2.5}$	0.12	0.45	0.9	0.0009
	$PM_{2.5}$	0.03	0.45	0.9	0.0002
Uncontrolled[1]	Total PM	5.90	0.6	1.3	0.120
	PM_{10}	1.92	0.4	1.3	0.040
	$PM_{10-2.5}$	1.71	0.4	1.3	0.036
	$PM_{2.5}$	0.38	0.4	1.3	0

1. Emission factors expressed in lbs/tons of cement and cement supplement

To convert from units of lbs/ton to units of kilograms per mega gram, the emissions calculated by Equation 11.12-1 should be divided by 2.0.

Particulate emission factors per yard of concrete for an average batch formulation at a typical facility are given in Tables 11.12-5 and 11.12-6. For truck mix loading and central mix loading, the

AP-42 Section 11.19.2

11.19.2 Crushed Stone Processing and Pulverized Mineral Processing

11.19.2.1 Process Description [24, 25]

Crushed Stone Processing

Major rock types processed by the crushed stone industry include limestone, granite, dolomite, traprock, sandstone, quartz, and quartzite. Minor types include calcareous marl, marble, shell, and slate. Major mineral types processed by the pulverized minerals industry, a subset of the crushed stone processing industry, include calcium carbonate, talc, and barite. Industry classifications vary considerably and, in many cases, do not reflect actual geological definitions.

Rock and crushed stone products generally are loosened by drilling and blasting and then are loaded by power shovel or front-end loader into large haul trucks that transport the material to the processing operations. Techniques used for extraction vary with the nature and location of the deposit. Processing operations may include crushing, screening, size classification, material handling and storage operations. All of these processes can be significant sources of PM and PM-10 emissions if uncontrolled.

Quarried stone normally is delivered to the processing plant by truck and is dumped into a bin. A feeder is used as illustrated in Figure 11.19.2-1. The feeder or screens separate large boulders from finer rocks that do not require primary crushing, thus reducing the load to the primary crusher. Jaw, impactor, or gyratory crushers are usually used for initial reduction. The crusher product, normally 7.5 to 30 centimeters (3 to 12 inches) in diameter, and the grizzly throughs (undersize material) are discharged onto a belt conveyor and usually are conveyed to a surge pile for temporary storage or are sold as coarse aggregates.

The stone from the surge pile is conveyed to a vibrating inclined screen called the scalping screen. This unit separates oversized rock from the smaller stone. The undersized material from the scalping screen is considered to be a product stream and is transported to a storage pile and sold as base material. The stone that is too large to pass through the top deck of the scalping screen is processed in the secondary crusher. Cone crushers are commonly used for secondary crushing (although impact crushers are sometimes used), which typically reduces material to about 2.5 to 10 centimeters (1 to 4 inches). The material (throughs) from the second level of the screen bypasses the secondary crusher because it is sufficiently small for the last crushing step. The output from the secondary crusher and the throughs from the secondary screen are transported by conveyor to the tertiary circuit, which includes a sizing screen and a tertiary crusher.

Tertiary crushing is usually performed using cone crushers or other types of impactor crushers. Oversize material from the top deck of the sizing screen is fed to the tertiary crusher. The tertiary crusher output, which is typically about 0.50 to 2.5 centimeters (3/16th to 1 inch), is returned to the sizing screen. Various product streams with different size gradations are separated in the screening operation. The products are conveyed or trucked directly to finished product bins, to open area stock piles, or to other processing systems such as washing, air separators, and screens and classifiers (for the production of manufactured sand).

Some stone crushing plants produce manufactured sand. This is a small-sized rock product with a maximum size of 0.50 centimeters (3/16 th inch). Crushed stone from the tertiary sizing screen is sized in a vibrating inclined screen (fines screen) with relatively small mesh sizes.

Table 11.19.2-2 (English Units). EMISSION FACTORS FOR CRUSHED STONE PROCESSING OPERATIONS (lb/Ton)[a]

Source [b]	Total Particulate Matter [r,s]	EMISSION FACTOR RATING	Total PM-10	EMISSION FACTOR RATING	Total PM-2.5	EMISSION FACTOR RATING
Primary Crushing (SCC 3-05-020-01)	ND		ND[n]		ND[n]	
Primary Crushing (controlled) (SCC 3-05-020-01)	ND		ND[n]		ND[n]	
Secondary Crushing (SCC 3-05-020-02)	ND		ND[n]		ND[n]	
Secondary Crushing (controlled) (SCC 3-05-020-02)	ND		ND[n]		ND[n]	
Tertiary Crushing (SCC 3-050030-03)	0.0054[d]	E	0.0024[o]	C	ND[n]	
Tertiary Crushing (controlled) (SCC 3-05-020-03)	0.0012[d]	E	0.00054[p]	C	0.00010[q]	E
Fines Crushing (SCC 3-05-020-05)	0.0390[e]	E	0.0150[e]	E	ND	
Fines Crushing (controlled) (SCC 3-05-020-05)	0.0030[f]	E	0.0012[f]	E	0.000070[q]	E
Screening (SCC 3-05-020-02, 03)	0.025[c]	E	0.0087[l]	C	ND	
Screening (controlled) (SCC 3-05-020-02, 03)	0.0022[d]	E	0.00074[m]	C	0.000050[q]	E
Fines Screening (SCC 3-05-020-21)	0.30[g]	E	0.072[g]	E	ND	
Fines Screening (controlled) (SCC 3-05-020-21)	0.0036[g]	E	0.0022[g]	E	ND	
Conveyor Transfer Point (SCC 3-05-020-06)	0.0030[h]	E	0.00110[h]	D	ND	
Conveyor Transfer Point (controlled) (SCC 3-05-020-06)	0.00014[i]	E	4.6×10^{-5}[i]	D	1.3×10^{-5}[q]	E
Wet Drilling - Unfragmented Stone (SCC 3-05-020-10)	ND		8.0×10^{-5}[j]	E	ND	
Truck Unloading -Fragmented Stone (SCC 3-05-020-31)	ND		1.6×10^{-5}[j]	E	ND	
Truck Unloading - Conveyor, crushed stone (SCC 3-05-020-32)	ND		0.00010[k]	E	ND	

a. Emission factors represent uncontrolled emissions unless noted. Emission factors in lb/Ton of material of throughput. SCC = Source Classification Code. ND = No data.

b. Controlled sources (with wet suppression) are those that are part of the processing plant that employs current wet suppression technology similar to the study group. The moisture content of the study group without wet suppression systems operating (uncontrolled) ranged from 0.21 to 1.3 percent, and the same facilities operating wet suppression systems (controlled) ranged from 0.55 to 2.88 percent. Due to carry over of the small amount of moisture required, it has been shown that each source, with the exception of crushers, does not need to employ direct water sprays. Although the moisture content was the only variable measured, other process features may have as much influence on emissions from a given source. Visual observations from each source under normal operating conditions are probably the best indicator of which emission factor is most appropriate. Plants that employ substandard control measures as indicated by visual observations should use the uncontrolled factor with an appropriate control efficiency that best reflects the effectiveness of the controls employed.

c. References 1, 3, 7, and 8

d. References 3, 7, and 8

e. Reference 4

f. References 4 and 15

g. Reference 4

h. References 5 and 6

i. References 5, 6, and 15

j. Reference 11

k. Reference 12

l. References 1, 3, 7, and 8

m. References 1, 3, 7, 8, and 15

n. No data available, but emission factors for PM-10 for tertiary crushers can be used as an upper limit for primary or secondary crushing

o. References 2, 3, 7, 8

p. References 2, 3, 7, 8, and 15

q. Reference 15

r. PM emission factors are presented based on PM-100 data in the Background Support Document for Section 11.19.2

s. Emission factors for PM-30 and PM-50 are available in Figures 11.19.2-3 through 11.19.2-6.

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AP-42 Section 13.2.1

13.2.1 Paved Roads

13.2.1.1 General

Particulate emissions occur whenever vehicles travel over a paved surface such as a road or parking lot. Particulate emissions from paved roads are due to direct emissions from vehicles in the form of exhaust, brake wear and tire wear emissions and resuspension of loose material on the road surface. In general terms, resuspended particulate emissions from paved roads originate from, and result in the depletion of, the loose material present on the surface (i.e., the surface loading). In turn, that surface loading is continuously replenished by other sources. At industrial sites, surface loading is replenished by spillage of material and trackout from unpaved roads and staging areas. Figure 13.2.1-1 illustrates several transfer processes occurring on public streets.

Various field studies have found that public streets and highways, as well as roadways at industrial facilities, can be major sources of the atmospheric particulate matter within an area.[1-9] Of particular interest in many parts of the United States are the increased levels of emissions from public paved roads when the equilibrium between deposition and removal processes is upset. This situation can occur for various reasons, including application of granular materials for snow and ice control, mud/dirt carryout from construction activities in the area, and deposition from wind and/or water erosion of surrounding unstabilized areas. In the absence of continuous addition of fresh material (through localized track out or application of antiskid material), paved road surface loading should reach an equilibrium value in which the amount of material resuspended matches the amount replenished. The equilibrium surface loading value depends upon numerous factors. It is believed that the most important factors are: mean speed of vehicles traveling the road; the average daily traffic (ADT); the number of lanes and ADT per lane; the fraction of heavy vehicles (buses and trucks); and the presence/absence of curbs, storm sewers and parking lanes.[10]

The particulate emission factors presented in a previous version of this section of AP-42, dated October 2002, implicitly included the emissions from vehicles in the form of exhaust, brake wear, and tire wear as well as resuspended road surface material. EPA included these sources in the emission factor equation for paved roads since the field testing data used to develop the equation included both the direct emissions from vehicles and emissions from resuspension of road dust.

This version of the paved road emission factor equation only estimates particulate emissions from resuspended road surface material[28]. The particulate emissions from vehicle exhaust, brake wear, and tire wear are now estimated separately using EPA's MOVES [29] model. This approach eliminates the possibility of double counting emissions. Double counting results when employing the previous version of the emission factor equation in this section and MOVES to estimate particulate emissions from vehicle traffic on paved roads. It also incorporates the decrease in exhaust emissions that has occurred since the paved road emission factor equation was developed. Earlier versions of the paved road emission factor equation includes estimates of emissions from exhaust, brake wear, and tire wear based on emission rates for vehicles in the 1980 calendar year fleet. The amount of PM released from vehicle exhaust has decreased since 1980 due to lower new vehicle emission standards and changes in fuel characteristics.

13.2.1.3 Predictive Emission Factor Equations[10,29]

The quantity of particulate emissions from resuspension of loose material on the road surface due to vehicle travel on a dry paved road may be estimated using the following empirical expression:

$$E = k\,(sL)^{0.91} \times (W)^{1.02} \qquad (1)$$

where: E = particulate emission factor (having units matching the units of k),
k = particle size multiplier for particle size range and units of interest (see below),
sL = road surface silt loading (grams per square meter) (g/m^2), and
W = average weight (tons) of the vehicles traveling the road.

It is important to note that Equation 1 calls for the average weight of all vehicles traveling the road. For example, if 99 percent of traffic on the road are 2 ton cars/trucks while the remaining 1 percent consists of 20 ton trucks, then the mean weight "W" is 2.2 tons. More specifically, Equation 1 is *not* intended to be used to calculate a separate emission factor for each vehicle weight class. Instead, only one emission factor should be calculated to represent the "fleet" average weight of all vehicles traveling the road.

The particle size multiplier (k) above varies with aerodynamic size range as shown in Table 13.2.1-1. To determine particulate emissions for a specific particle size range, use the appropriate value of k shown in Table 13.2.1-1.

To obtain the total emissions factor, the emission factors for the exhaust, brake wear and tire wear obtained from either EPA's MOBILE6.2 [27] or MOVES2010 [29] model should be added to the emissions factor calculated from the empirical equation.

Table 13.2.1-1. PARTICLE SIZE MULTIPLIERS FOR PAVED ROAD EQUATION

Size range[a]	Particle Size Multiplier k[b]		
	g/VKT	g/VMT	lb/VMT
PM-2.5[c]	0.15	0.25	0.00054
PM-10	0.62	1.00	0.0022
PM-15	0.77	1.23	0.0027
PM-30[d]	3.23	5.24	0.011

[a] Refers to airborne particulate matter (PM-x) with an aerodynamic diameter equal to or less than x micrometers.

[b] Units shown are grams per vehicle kilometer traveled (g/VKT), grams per vehicle mile traveled (g/VMT), and pounds per vehicle mile traveled (lb/VMT). The multiplier k includes unit conversions to produce emission factors in the units shown for the indicated size range from the mixed units required in Equation 1.

[c] The k-factors for $PM_{2.5}$ were based on the average $PM_{2.5}$:PM_{10} ratio of test runs in Reference 30.

[d] PM-30 is sometimes termed "suspendable particulate" (SP) and is often used as a surrogate for TSP.

Equation 1 is based on a regression analysis of 83 tests for PM-10.[3, 5-6, 8, 27-29, 31-36] Sources tested include public paved roads, as well as controlled and uncontrolled industrial paved roads. The majority of tests involved freely flowing vehicles traveling at constant speed on relatively level roads. However, 22 tests of slow moving or "stop-and-go" traffic or vehicles under load were available for inclusion in the data base.[32-36] Engine exhaust, tire wear and break wear were subtracted from the emissions measured in the test programs prior to stepwise regression to determine Equation 1.[37, 39] The equations retain the quality rating of A (D for PM-2.5), if applied within the range of source conditions that were tested in developing the equation as follows:

Silt loading:	0.03 - 400 g/m^2 0.04 - 570 grains/square foot (ft^2)
Mean vehicle weight:	1.8 - 38 megagrams (Mg) 2.0 - 42 tons
Mean vehicle speed:	1 - 88 kilometers per hour (kph) 1 - 55 miles per hour (mph)

The upper and lower 95% confidence levels of equation 1 for PM_{10} is best described with equations using an exponents of 1.14 and 0.677 for silt loading and an exponents of 1.19 and 0.85 for weight. Users are cautioned that application of equation 1 outside of the range of variables and operating conditions specified above, e.g., application to roadways or road networks with speeds above 55 mph and average vehicle weights of 42 tons, will result in emission estimates with a higher level of uncertainty. In these situations, users are encouraged to consider an assessment of the impacts of the influence of extrapolation to the overall emissions and alternative methods that are equally or more plausible in light of local emissions data and/or ambient concentration or compositional data.

To retain the quality rating for the emission factor equation when it is applied to a specific paved road, it is necessary that reliable correction parameter values for the specific road in question be determined. With the exception of limited access roadways, which are difficult to sample, the collection and use of site-specific silt loading (sL) data for public paved road emission inventories are strongly recommended. The field and laboratory procedures for determining surface material silt content and surface dust loading are summarized in Appendices C.1 and C.2. In the event that site-specific values cannot be obtained, an appropriate value for a paved public road may be selected from the values in Table 13.2.1-2, but the quality rating of the equation should be reduced by 2 levels.

Equation 1 may be extrapolated to average uncontrolled conditions (but including natural mitigation) under the simplifying assumption that annual (or other long-term) average emissions are inversely proportional to the frequency of measurable (> 0.254 mm [0.01 inch]) precipitation by application of a precipitation correction term. The precipitation correction term can be applied on a daily or an hourly basis [26, 38].

For the daily basis, Equation 1 becomes:

$$E_{ext} = [\, k\,(sL)^{0.91} \times (W)^{1.02}\,]\,(1 - P/4N) \qquad (2)$$

where k, sL, W, and S are as defined in Equation 1 and

E_{ext} = annual or other long-term average emission factor in the same units as k,

P = number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period, and

N = number of days in the averaging period (e.g., 365 for annual, 91 for seasonal, 30 for monthly).

Note that the assumption leading to Equation 2 is based on analogy with the approach used to develop long-term average unpaved road emission factors in Section 13.2.2. However, Equation 2 above incorporates an additional factor of "4" in the denominator to account for the fact that paved roads dry more quickly than unpaved roads and that the precipitation may not occur over the complete 24-hour day.

For the hourly basis, equation 1 becomes:

$$E_{ext} = [\ k\ (sL)^{0.91} \times (W)^{1.02}\ ]\ (1 - 1.2P/N) \qquad (3)$$

where k, sL, W, and S are as defined in Equation 1 and

E_{ext} = annual or other long-term average emission factor in the same units as k,

P = number of hours with at least 0.254 mm (0.01 in) of precipitation during the averaging period, and

N = number of hours in the averaging period (e.g., 8760 for annual, 2124 for season 720 for monthly)

Note: In the hourly moisture correction term (1-1.2P/N) for equation 3, the 1.2 multiplier is applied to account for the residual mitigative effect of moisture. For most applications, this equation will produce satisfactory results. Users should select a time interval to include sufficient "dry" hours such that a reasonable emissions averaging period is evaluated. For the special case where this equation is used to calculate emissions on an hour by hour basis, such as would be done in some emissions modeling situations, the moisture correction term should be modified so that the moisture correction "credit" is applied to the first hours following cessation of precipitation. In this special case, it is suggested that this 20% "credit" be applied on a basis of one hour credit for each hour of precipitation up to a maximum of 12 hours.

Note that the assumption leading to Equation 3 is based on analogy with the approach used to develop long-term average unpaved road emission factors in Section 13.2.2.

Figure 13.2.1-2 presents the geographical distribution of "wet" days on an annual basis for the United States. Maps showing this information on a monthly basis are available in the *Climatic Atlas of the United States*[23]. Alternative sources include other Department of Commerce publications (such as local climatological data summaries). The National Climatic Data Center (NCDC) offers several products that provide hourly precipitation data. In particular, NCDC offers *Solar and Meteorological Surface Observation Network 1961-1990* (SAMSON) CD-ROM, which contains 30 years worth of hourly meteorological data for first-order National Weather Service locations. Whatever meteorological data are used, the source of that data and the averaging period should be clearly specified.

It is emphasized that the simple assumption underlying Equations 2 and 3 has not been verified in any rigorous manner. For that reason, the quality ratings for Equations 2 and 3 should be downgraded one letter from the rating that would be applied to Equation 1.

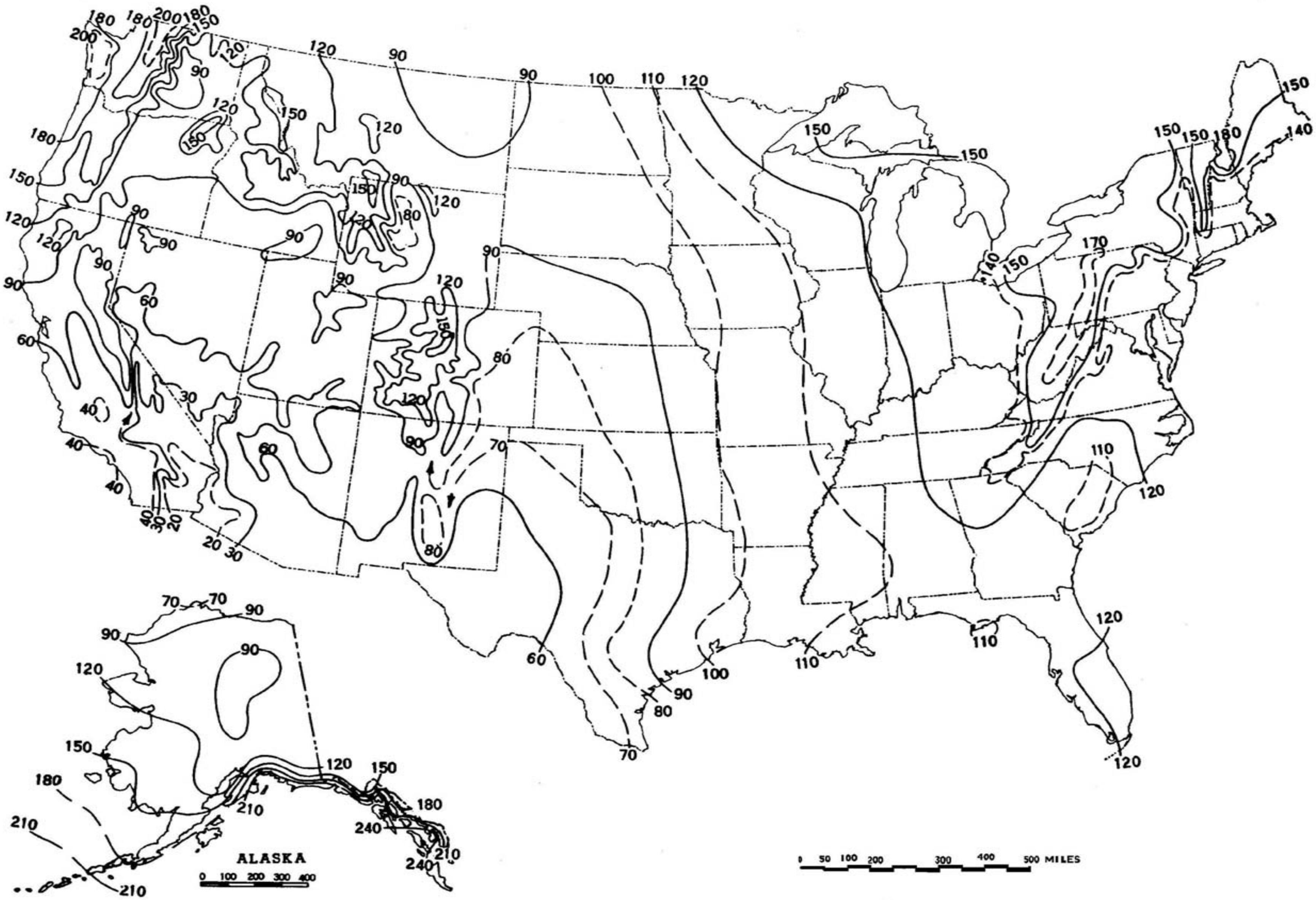

Figure 13.2.1-2. Mean number of days with 0.01 inch or more of precipitation in the United States.

Table 13.2.1-2 presents recommended default silt loadings for normal baseline conditions and for wintertime baseline conditions in areas that experience frozen precipitation with periodic application of antiskid material[24]. The winter baseline is represented as a multiple of the non-winter baseline, depending on the ADT value for the road in question. As shown, a multiplier of 4 is applied for low volume roads (< 500 ADT) to obtain a wintertime baseline silt loading of 4 X 0.6 = 2.4 g/m^2.

Table 13.2.1-2. Ubiquitous Silt Loading Default Values with Hot Spot Contributions from Anti-Skid Abrasives (g/m^2)

ADT Category	< 500	500-5,000	5,000-10,000	> 10,000
Ubiquitous Baseline g/m^2	0.6	0.2	0.06	0.03 0.015 limited access
Ubiquitous Winter Baseline Multiplier during months with frozen precipitation	X4	X3	X2	X1
Initial peak additive contribution from application of antiskid abrasive (g/m^2)	2	2	2	2
Days to return to baseline conditions (assume linear decay)	7	3	1	0.5

It is suggested that an additional (but temporary) silt loading contribution of 2 g/m^2 occurs with each application of antiskid abrasive for snow/ice control. This was determined based on a typical application rate of 500 lb per lane mile and an initial silt content of 1 % silt content. Ordinary rock salt and other chemical deicers add little to the silt loading, because most of the chemical dissolves during the snow/ice melting process.

To adjust the baseline silt loadings for mud/dirt trackout, the number of trackout points is required. It is recommended that in calculating PM_{10} emissions, six additional miles of road be added for each active trackout point from an active construction site, to the paved road mileage of the specified category within the county. In calculating $PM_{2.5}$ emissions, it is recommended that three additional miles of road be added for each trackout point from an active construction site.

It is suggested the number of trackout points for activities other than road and building construction areas be related to land use. For example, in rural farming areas, each mile of paved road would have a specified number of trackout points at intersections with unpaved roads. This value could be estimated from the unpaved road density (mi/sq. mi.).

The use of a default value from Table 13.2.1-2 should be expected to yield only an order-of-magnitude estimate of the emission factor. Public paved road silt loadings are dependent

AP-42 Section 13.2.4

13.2.4 Aggregate Handling And Storage Piles

13.2.4.1 General

Inherent in operations that use minerals in aggregate form is the maintenance of outdoor storage piles. Storage piles are usually left uncovered, partially because of the need for frequent material transfer into or out of storage.

Dust emissions occur at several points in the storage cycle, such as material loading onto the pile, disturbances by strong wind currents, and loadout from the pile. The movement of trucks and loading equipment in the storage pile area is also a substantial source of dust.

13.2.4.2 Emissions And Correction Parameters

The quantity of dust emissions from aggregate storage operations varies with the volume of aggregate passing through the storage cycle. Emissions also depend on 3 parameters of the condition of a particular storage pile: age of the pile, moisture content, and proportion of aggregate fines.

When freshly processed aggregate is loaded onto a storage pile, the potential for dust emissions is at a maximum. Fines are easily disaggregated and released to the atmosphere upon exposure to air currents, either from aggregate transfer itself or from high winds. As the aggregate pile weathers, however, potential for dust emissions is greatly reduced. Moisture causes aggregation and cementation of fines to the surfaces of larger particles. Any significant rainfall soaks the interior of the pile, and then the drying process is very slow.

Silt (particles equal to or less than 75 micrometers [µm] in diameter) content is determined by measuring the portion of dry aggregate material that passes through a 200-mesh screen, using ASTM-C-136 method.[1] Table 13.2.4-1 summarizes measured silt and moisture values for industrial aggregate materials.

The quantity of particulate emissions generated by either type of drop operation, per kilogram (kg) (ton) of material transferred, may be estimated, with a rating of A, using the following empirical expression:[11]

$$E = k(0.0016) \frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \text{ (kg/megagram [Mg])}$$

$$E = k(0.0032) \frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \text{ (pound [lb]/ton)} \qquad (1)$$

where:

E = emission factor
k = particle size multiplier (dimensionless)
U = mean wind speed, meters per second (m/s) (miles per hour [mph])
M = material moisture content (%)

The particle size multiplier in the equation, k, varies with aerodynamic particle size range, as follows:

Aerodynamic Particle Size Multiplier (k) For Equation 1				
< 30 µm	< 15 µm	< 10 µm	< 5 µm	< 2.5 µm
0.74	0.48	0.35	0.20	0.053[a]

[a] Multiplier for < 2.5 µm taken from Reference 14.

The equation retains the assigned quality rating if applied within the ranges of source conditions that were tested in developing the equation, as follows. Note that silt content is included, even though silt content does not appear as a correction parameter in the equation. While it is reasonable to expect that silt content and emission factors are interrelated, no significant correlation between the 2 was found during the derivation of the equation, probably because most tests with high silt contents were conducted under lower winds, and vice versa. It is recommended that estimates from the equation be reduced 1 quality rating level if the silt content used in a particular application falls outside the range given:

Ranges Of Source Conditions For Equation 1			
Silt Content (%)	Moisture Content (%)	Wind Speed	
		m/s	mph
0.44 - 19	0.25 - 4.8	0.6 - 6.7	1.3 - 15

To retain the quality rating of the equation when it is applied to a specific facility, reliable correction parameters must be determined for specific sources of interest. The field and laboratory procedures for aggregate sampling are given in Reference 3. In the event that site-specific values for

AP-42 Table B.2-3

Table B.2-3 (cont.).

AIRS Code[b]	Type Of Collector	Particle Size (µm)		
		0 - 2.5	2.5 - 6	6 - 10
016	Fabric filter - high temperature	99	99.5	99.5
017	Fabric filter - med temperature	99	99.5	99.5
018	Fabric filter - low temperature	99	99.5	99.5
046	Process change	NA	NA	NA
049	Liquid filtration system	50	75	85
050	Packed-gas absorption column	90	95	99
051	Tray-type gas absorption column	25	85	95
052	Spray tower	20	80	90
053	Venturi scrubber	90	95	99
054	Process enclosed	1.5	3.2	3.7
055	Impingement plate scrubber	25	95	99
056	Dynamic separator (dry)	90	95	99
057	Dynamic separator (wet)	50	75	85
058	Mat or panel filter - mist collector	92	94	97
059	Metal fabric filter screen	10	15	20
061	Dust suppression by water sprays	40	65	90
062	Dust suppression by chemical stabilizer or wetting agents	40	65	90
063	Gravel bed filter	0	5	80
064	Annular ring filter	80	90	97
071	Fluid bed dry scrubber	10	20	90
075	Single cyclone	10	35	50
076	Multiple cyclone w/o fly ash reinjection	80	95	95
077	Multiple cyclone w/fly ash reinjection	50	75	85
085	Wet cyclonic separator	50	75	85
086	Water curtain	10	45	90

[a] Data represent an average of actual efficiencies. Efficiencies are representative of well designed and well operated control equipment. Site-specific factors (e. g., type of particulate being collected, varying pressure drops across scrubbers, maintenance of equipment, etc.) will affect collection efficiencies. Efficiencies shown are intended to provide guidance for estimating control equipment performance when source-specific data are not available. NA = not applicable.
[b] Control codes in Aerometric Information Retrieval System (AIRS), formerly National Emissions Data Systems.

EIIP Volume II: Chapter 3

VOLUME II: CHAPTER 3

PREFERRED AND ALTERNATIVE METHODS FOR ESTIMATING AIR EMISSIONS FROM HOT-MIX ASPHALT PLANTS

Final Report

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Emission Inventory Improvement Program

In the counterflow drum mixing process, the aggregate is proportioned through a cold feed system prior to introduction to the drying process. As opposed to the parallel flow drum mixing process though, the aggregate moves opposite to the flow of the exhaust gases. After drying and heating take place, the aggregate is transferred to a part of the drum that is not exposed to the exhaust gas and coated with asphalt cement. This process prevents stripping of the asphalt cement by the hot exhaust gas. If RAP is used, it is usually introduced into the coating chamber.

2.2 EMISSION SOURCES

Emissions from HMA plants derive from both controlled (i.e., ducted) and uncontrolled sources. Section 7 lists the source classification codes (SCCs) for these emission points.

2.2.1 MATERIAL HANDLING (FUGITIVE EMISSIONS)

Material handling includes the receipt, movement, and processing of fuel and materials used at the HMA facility. Fugitive particulate matter (PM) emissions from aggregate storage piles are typically caused by front-end loader operations that transport the aggregate to the cold feed unit hoppers. The amount of fugitive PM emissions from aggregate piles will be greater in strong winds (Gunkel, 1992). Piles of RAP, because RAP is coated with asphalt cement, are not likely to cause significant fugitive dust problems. Other pre-dryer fugitive emission sources include the transfer of aggregate from the cold feed unit hoppers to the dryer feed conveyor and, subsequently, to the dryer entrance. Aggregate moisture content prior to entry into the dryer is typically 3 percent to 7 percent. This moisture content, along with aggregate size classification, tend to minimize emissions from these sources, which contribute little to total facility PM emissions. PM less than or equal to 10 µm in diameter (PM_{10}) emissions from these sources are reported to account for about 19 percent of their total PM emissions (NAPA, 1995).

If crushing, breaking, or grinding operations occur at the plant, these may result in fugitive PM emissions (TNRCC, 1994). Also, fine particulate collected from the baghouses can be a source of fugitive emissions as the overflow PM is transported by truck (enclosed or tarped) for on-site disposal. At all HMA plants there may be PM and slight process fugitive volatile organic compound (VOC) emissions from the transport and handling of the hot-mix from the mixer to the storage silo and also from the load-out operations to the delivery trucks (EPA, 1994a). Small amounts of VOC emissions can also result from the transfer of liquid and gaseous fuels, although natural gas is normally transported in a pipeline (Gunkel, 1992, Wiese, 1995).

TABLE 3.2-1

TYPICAL HOT-MIX ASPHALT PLANT EMISSION CONTROL TECHNIQUES

Emission Source	Pollutant	Control Technique	Typical Efficiency (%)
Process	PM and PM_{10}	Cyclones	50 - 75[a,b]
		Multiple cyclones	90[c]
		Settling chamber	<50[b]
		Baghouse	99 - 99.97[a,d]
		Venturi scrubber	90 - 99.5[d,e]
	VOC	Dryer and combustion process modifications	37 - 86[f,g]
	SO_x	Limestone	50[b,e]
		Low sulfur fuel	80[c]
Fugitive dust	PM and PM_{10}	Paving and maintenance	60 - 99[g]
		Wetting and crusting agents	70[b] - 80[c]
		Crushed RAP material, asphalt shingles	70[h]

[a] Control efficiency dependent on particle size ratio and size of equipment.
[b] Source: Patterson, 1995c.
[c] Source: EIIP, 1995.
[d] Typical efficiencies at a hot-mix asphalt plant.
[e] Source: TNRCC, 1995.
[f] Source: Gunkel, 1992.
[g] Source: TNRCC, 1994.
[h] Source: Patterson, 1995a.

NM Windspeed

NEW MEXICO

AVERAGE WIND SPEED - MPH

STATION	ID	Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
ALAMOGORDO AIRPORT ASOS	KALM	1996-2006	5.1	6.3	7.1	7.9	7.1	6.9	6.1	5.3	5.2	5.2	5.0	5.0	6.0
ALAMOGORDO-HOLLOMAN AFB	KHMN	1996-2006	8.5	9.7	10.6	11.8	10.8	10.6	9.8	9.1	8.8	8.5	8.1	8.3	9.6
ALBUQUERQUE AP ASOS	KABQ	1996-2006	7.0	8.2	9.3	11.1	10.0	10.0	8.7	8.3	8.0	7.9	7.2	6.9	8.5
ALBUQUERQUE-DBLE EAGLE	KAEG	1999-2006	7.1	7.9	9.0	10.6	9.5	8.6	7.0	6.2	7.0	6.5	6.5	6.1	7.7
ARTESIA AIRPORT ASOS	KATS	1997-2006	7.8	9.1	10.1	10.9	10.2	9.9	7.8	6.9	7.6	7.8	7.6	7.4	8.5
CARLSBAD AIRPORT ASOS	KCNM	1996-2006	9.2	9.8	10.9	11.4	10.4	9.9	8.5	7.7	8.2	8.5	8.4	8.8	9.3
CLAYTON MUNI AP ASOS	KCAO	1996-2006	11.9	12.7	13.4	14.6	13.4	13.0	11.7	10.8	11.8	12.1	12.1	12.0	12.4
CLINES CORNERS	KCQC	1998-2006	16.2	16.1	15.7	16.9	14.6	13.5	10.6	10.1	11.8	13.3	15.0	16.0	14.1
CLOVIS AIRPORT AWOS	KCVN	1996-2006	12.3	12.3	13.4	13.8	12.4	11.9	9.7	8.9	9.7	10.9	11.6	12.2	11.6
CLOVIS-CANNON AFB	KCVS	1996-2006	12.5	12.6	13.6	13.8	12.2	12.5	10.7	10.0	10.2	11.3	11.7	12.4	12.0
DEMING AIRPORT ASOS	KDMN	1996-2006	8.7	9.7	10.9	12.0	10.6	10.1	8.9	8.1	8.4	8.2	8.5	8.1	9.3
FARMINGTON AIRPORT ASOS	KFMN	1996-2006	7.3	8.3	9.0	9.8	9.4	9.4	8.7	8.2	8.0	7.8	7.6	7.3	8.4
GALLUP AIRPORT ASOS	KGUP	1996-2006	5.7	6.9	7.8	10.0	9.0	8.8	6.9	6.0	6.5	6.1	5.6	5.3	7.0
GRANTS-MILAN AP ASOS	KGNT	1997-2006	7.8	8.8	9.6	10.9	10.0	9.8	8.1	7.2	7.9	8.4	8.0	7.6	8.7
HOBBS AIRPORT AWOS	KHOB	1996-2006	11.3	11.9	12.6	13.4	12.5	12.3	11.0	10.0	10.2	10.6	10.7	11.1	11.4
LAS CRUCES AIRPORT AWOS	KLRU	2000-2006	6.4	7.5	8.8	10.1	8.7	8.2	6.8	6.0	6.2	6.1	6.4	6.0	7.3
LAS VEGAS AIRPORT ASOS	KLVS	1996-2006	10.9	12.2	12.5	14.3	12.4	11.8	10.0	9.2	10.9	10.8	11.0	10.9	11.4
LOS ALAMOS AP AWOS	KLAM	2005-2006	3.9	5.7	7.5	8.1	7.1	7.3	5.3	4.8	5.7	5.1	4.4	3.2	5.4
RATON AIRPORT ASOS	KRTN	1998-2006	8.9	9.4	10.4	12.2	10.8	10.2	8.4	8.1	8.6	9.0	8.6	8.5	9.4
ROSWELL AIRPORT ASOS	KROW	1996-2006	7.4	8.9	9.9	11.1	10.3	10.2	8.8	7.9	8.3	8.0	7.5	7.3	8.8
RUIDOSO AIRPORT AWOS	KSRR	1996-2006	8.8	9.6	10.0	11.6	10.0	8.4	5.9	5.3	6.4	7.4	7.9	8.7	8.3
SANTA FE AIRPORT ASOS	KSAF	1996-2006	8.9	9.5	9.9	11.2	10.6	10.5	9.2	8.8	8.8	9.1	8.7	8.5	9.5
SILVER CITY AP AWOS	KSVC	1999-2006	8.1	8.7	9.9	10.8	10.2	9.9	8.5	7.2	6.9	7.6	7.9	7.7	8.5
TAOS AIRPORT AWOS	KSKX	1996-2006	5.8	6.5	7.7	9.1	8.6	8.5	7.1	6.6	6.7	6.6	6.0	5.7	7.0
TRUTH OR CONSEQ AP ASOS	KTCS	1996-2006	7.4	8.7	9.9	11.1	10.4	9.8	8.1	7.4	7.7	8.0	7.7	7.3	8.6
TUCUMCARI AIRPORT ASOS	KTCC	1999-2006	10.0	11.2	11.9	13.6	11.9	11.6	9.9	9.3	10.0	10.0	10.4	10.2	10.8

TANK 4.0.9d

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Identification and Physical Characteristics

Identification	
User Identification:	BlackRockASTank1
City:	Albuquerque
State:	New Mexico
Company:	Black Rock Services
Type of Tank:	Vertical Fixed Roof Tank
Description:	Asphalt Cement Storage Tank 1
Tank Dimensions	
Shell Height (ft):	61.50
Diameter (ft):	11.50
Liquid Height (ft) :	57.50
Avg. Liquid Height (ft):	40.00
Volume (gallons):	45,000.00
Turnovers:	139.79
Net Throughput(gal/yr):	6,290,672.00
Is Tank Heated (y/n):	Y
Paint Characteristics	
Shell Color/Shade:	Aluminum/Specular
Shell Condition	Good
Roof Color/Shade:	Aluminum/Specular
Roof Condition:	Good
Roof Characteristics	
Type:	Cone
Height (ft)	1.00
Slope (ft/ft) (Cone Roof)	0.17
Breather Vent Settings	
Vacuum Settings (psig):	0.00
Pressure Settings (psig)	0.00

Meteorological Data used in Emissions Calculations: Albuquerque, New Mexico (Avg Atmospheric Pressure = 12.15 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

BlackRockASTank1 - Vertical Fixed Roof Tank
Albuquerque, New Mexico

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Asphalt Cement	All	350.00	350.00	350.00	350.00	0.0347	0.0347	0.0347	105.0000			1,000.00	Option 3: A=75350.06, B=9.00346

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

BlackRockASTank1 - Vertical Fixed Roof Tank
Albuquerque, New Mexico

Annual Emission Calculations	
Standing Losses (lb):	0.0000
Vapor Space Volume (cu ft):	2,267.8045
Vapor Density (lb/cu ft):	0.0004
Vapor Space Expansion Factor:	0.0000
Vented Vapor Saturation Factor:	0.9614
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	2,267.8045
Tank Diameter (ft):	11.5000
Vapor Space Outage (ft):	21.8333
Tank Shell Height (ft):	61.5000
Average Liquid Height (ft):	40.0000
Roof Outage (ft):	0.3333
Roof Outage (Cone Roof)	
Roof Outage (ft):	0.3333
Roof Height (ft):	1.0000
Roof Slope (ft/ft):	0.1700
Shell Radius (ft):	5.7500
Vapor Density	
Vapor Density (lb/cu ft):	0.0004
Vapor Molecular Weight (lb/lb-mole):	105.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0347
Daily Avg. Liquid Surface Temp. (deg. R):	809.6700
Daily Average Ambient Temp. (deg. F):	56.1542
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	809.6700
Tank Paint Solar Absorptance (Shell):	0.3900
Tank Paint Solar Absorptance (Roof):	0.3900
Daily Total Solar Insulation Factor (Btu/sqft day):	1,765.3167
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0000
Daily Vapor Temperature Range (deg. R):	0.0000
Daily Vapor Pressure Range (psia):	0.0000
Breather Vent Press. Setting Range(psia):	0.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0347
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0347
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0347
Daily Avg. Liquid Surface Temp. (deg R):	809.6700
Daily Min. Liquid Surface Temp. (deg R):	809.6700
Daily Max. Liquid Surface Temp. (deg R):	809.6700
Daily Ambient Temp. Range (deg. R):	27.9250
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9614
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0347
Vapor Space Outage (ft):	21.8333
Working Losses (lb):	208.2191
Vapor Molecular Weight (lb/lb-mole):	105.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0347
Annual Net Throughput (gal/yr.):	6,290,672.0000
Annual Turnovers:	139.7927
Turnover Factor:	0.3813
Maximum Liquid Volume (gal):	45,000.0000
Maximum Liquid Height (ft):	57.5000
Tank Diameter (ft):	11.5000
Working Loss Product Factor:	1.0000
Total Losses (lb):	208.2191

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

BlackRockASTank1 - Vertical Fixed Roof Tank
Albuquerque, New Mexico

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Asphalt Cement	208.22	0.00	208.22

TANKS 4.0.9d

Emissions Report - Detail Format

Tank Identification and Physical Characteristics

Identification	
User Identification:	BlackRockASTank2
City:	Albuquerque
State:	New Mexico
Company:	Black Rock Services
Type of Tank:	Vertical Fixed Roof Tank
Description:	Asphalt Cement Storage Tank 2
Tank Dimensions	
Shell Height (ft):	61.50
Diameter (ft):	11.50
Liquid Height (ft) :	57.50
Avg. Liquid Height (ft):	40.00
Volume (gallons):	45,000.00
Turnovers:	139.79
Net Throughput(gal/yr):	6,290,672.00
Is Tank Heated (y/n):	Y
Paint Characteristics	
Shell Color/Shade:	Aluminum/Specular
Shell Condition	Good
Roof Color/Shade:	Aluminum/Specular
Roof Condition:	Good
Roof Characteristics	
Type:	Cone
Height (ft)	1.00
Slope (ft/ft) (Cone Roof)	0.17
Breather Vent Settings	
Vacuum Settings (psig):	0.00
Pressure Settings (psig)	0.00

Meteorological Data used in Emissions Calculations: Albuquerque, New Mexico (Avg Atmospheric Pressure = 12.15 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

BlackRockASTank2 - Vertical Fixed Roof Tank
Albuquerque, New Mexico

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Asphalt Cement	All	350.00	350.00	350.00	350.00	0.0347	0.0347	0.0347	105.0000			1,000.00	Option 3: A=75350.06, B=9.00346

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

BlackRockASTank2 - Vertical Fixed Roof Tank
Albuquerque, New Mexico

Annual Emission Calculations	
Standing Losses (lb):	0.0000
Vapor Space Volume (cu ft):	2,267.8045
Vapor Density (lb/cu ft):	0.0004
Vapor Space Expansion Factor:	0.0000
Vented Vapor Saturation Factor:	0.9614
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	2,267.8045
Tank Diameter (ft):	11.5000
Vapor Space Outage (ft):	21.8333
Tank Shell Height (ft):	61.5000
Average Liquid Height (ft):	40.0000
Roof Outage (ft):	0.3333
Roof Outage (Cone Roof)	
Roof Outage (ft):	0.3333
Roof Height (ft):	1.0000
Roof Slope (ft/ft):	0.1700
Shell Radius (ft):	5.7500
Vapor Density	
Vapor Density (lb/cu ft):	0.0004
Vapor Molecular Weight (lb/lb-mole):	105.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0347
Daily Avg. Liquid Surface Temp. (deg. R):	809.6700
Daily Average Ambient Temp. (deg. F):	56.1542
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	809.6700
Tank Paint Solar Absorptance (Shell):	0.3900
Tank Paint Solar Absorptance (Roof):	0.3900
Daily Total Solar Insulation Factor (Btu/sqft day):	1,765.3167
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0000
Daily Vapor Temperature Range (deg. R):	0.0000
Daily Vapor Pressure Range (psia):	0.0000
Breather Vent Press. Setting Range(psia):	0.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0347
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0347
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0347
Daily Avg. Liquid Surface Temp. (deg R):	809.6700
Daily Min. Liquid Surface Temp. (deg R):	809.6700
Daily Max. Liquid Surface Temp. (deg R):	809.6700
Daily Ambient Temp. Range (deg. R):	27.9250
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9614
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0347
Vapor Space Outage (ft):	21.8333
Working Losses (lb):	208.2191
Vapor Molecular Weight (lb/lb-mole):	105.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0347
Annual Net Throughput (gal/yr.):	6,290,672.0000
Annual Turnovers:	139.7927
Turnover Factor:	0.3813
Maximum Liquid Volume (gal):	45,000.0000
Maximum Liquid Height (ft):	57.5000
Tank Diameter (ft):	11.5000
Working Loss Product Factor:	1.0000
Total Losses (lb):	208.2191

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

BlackRockASTank2 - Vertical Fixed Roof Tank
Albuquerque, New Mexico

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Asphalt Cement	208.22	0.00	208.22

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Identification and Physical Characteristics

Identification	
User Identification:	BlackRockASTank3
City:	Albuquerque
State:	New Mexico
Company:	Black Rock Services
Type of Tank:	Vertical Fixed Roof Tank
Description:	Asphalt Cement Storage Tank 3
Tank Dimensions	
Shell Height (ft):	61.50
Diameter (ft):	11.50
Liquid Height (ft) :	57.50
Avg. Liquid Height (ft):	40.00
Volume (gallons):	45,000.00
Turnovers:	139.79
Net Throughput(gal/yr):	6,290,672.00
Is Tank Heated (y/n):	Y
Paint Characteristics	
Shell Color/Shade:	Aluminum/Specular
Shell Condition	Good
Roof Color/Shade:	Aluminum/Specular
Roof Condition:	Good
Roof Characteristics	
Type:	Cone
Height (ft)	1.00
Slope (ft/ft) (Cone Roof)	0.17
Breather Vent Settings	
Vacuum Settings (psig):	0.00
Pressure Settings (psig)	0.00

Meteorological Data used in Emissions Calculations: Albuquerque, New Mexico (Avg Atmospheric Pressure = 12.15 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

BlackRockASTank3 - Vertical Fixed Roof Tank
Albuquerque, New Mexico

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Asphalt Cement	All	350.00	350.00	350.00	350.00	0.0347	0.0347	0.0347	105.0000			1,000.00	Option 3: A=75350.06, B=9.00346

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

BlackRockASTank3 - Vertical Fixed Roof Tank
Albuquerque, New Mexico

Annual Emission Calculations	
Standing Losses (lb):	0.0000
Vapor Space Volume (cu ft):	2,267.8045
Vapor Density (lb/cu ft):	0.0004
Vapor Space Expansion Factor:	0.0000
Vented Vapor Saturation Factor:	0.9614
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	2,267.8045
Tank Diameter (ft):	11.5000
Vapor Space Outage (ft):	21.8333
Tank Shell Height (ft):	61.5000
Average Liquid Height (ft):	40.0000
Roof Outage (ft):	0.3333
Roof Outage (Cone Roof)	
Roof Outage (ft):	0.3333
Roof Height (ft):	1.0000
Roof Slope (ft/ft):	0.1700
Shell Radius (ft):	5.7500
Vapor Density	
Vapor Density (lb/cu ft):	0.0004
Vapor Molecular Weight (lb/lb-mole):	105.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0347
Daily Avg. Liquid Surface Temp. (deg. R):	809.6700
Daily Average Ambient Temp. (deg. F):	56.1542
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	809.6700
Tank Paint Solar Absorptance (Shell):	0.3900
Tank Paint Solar Absorptance (Roof):	0.3900
Daily Total Solar Insulation Factor (Btu/sqft day):	1,765.3167
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0000
Daily Vapor Temperature Range (deg. R):	0.0000
Daily Vapor Pressure Range (psia):	0.0000
Breather Vent Press. Setting Range(psia):	0.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0347
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0347
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0347
Daily Avg. Liquid Surface Temp. (deg R):	809.6700
Daily Min. Liquid Surface Temp. (deg R):	809.6700
Daily Max. Liquid Surface Temp. (deg R):	809.6700
Daily Ambient Temp. Range (deg. R):	27.9250
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9614
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0347
Vapor Space Outage (ft):	21.8333
Working Losses (lb):	208.2191
Vapor Molecular Weight (lb/lb-mole):	105.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0347
Annual Net Throughput (gal/yr.):	6,290,672.0000
Annual Turnovers:	139.7927
Turnover Factor:	0.3813
Maximum Liquid Volume (gal):	45,000.0000
Maximum Liquid Height (ft):	57.5000
Tank Diameter (ft):	11.5000
Working Loss Product Factor:	1.0000
Total Losses (lb):	208.2191

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

BlackRockASTank3 - Vertical Fixed Roof Tank
Albuquerque, New Mexico

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Asphalt Cement	208.22	0.00	208.22

Blue Smoke Documentation

National Pollutant Inventory

Emission Estimation Technique Manual

for

Hot Mix Asphalt Manufacturing

First published in June 1999

EMISSION ESTIMATION TECHNIQUES
FOR
HOT MIX ASPHALT MANUFACTURING

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HOT MIX ASPHALT MANUFACTURING

LIST OF FIGURES AND TABLES

usually fixed roof (closed or enclosed) due to the smaller size of the tanks, usually less than 100 000 litres. Emissions from fixed-roof tanks (closed or enclosed) are generally divided into two categories: working losses and breathing losses.

Working losses refer to the combined loss from filling and emptying the tank. Filling losses occur when the VOCs contained in the saturated air are displaced from a fixed-roof vessel during loading. Emptying losses occur when air drawn into the tank becomes saturated and expands, exceeding the capacity of the vapour space. Breathing losses are the expulsion of vapour from a tank through vapour expansion caused by changes in temperature and pressure. Because of the small tank sizes and fuel usage, total VOC emissions would generally be less than 700 kilograms per year. Emissions from tanks used for residual fuel oils or for bitumen may be increased when they are heated to control oil viscosity. Emissions from bitumen tanks are particularly low, due to their low vapour pressure.

The *Fuel and Organic Liquid Storage EET Manual* and the AUSTanks software program are available to assist reporting asphalt plants quantify emissions of organic liquids from tank storage.

3.4 Process Emissions

The most significant source of emissions from hot mix asphalt plants is the dryer. Combustion emissions from the dryer include products of complete and incomplete combustion. Products of complete combustion include oxides of nitrogen (NO_x) and, if sulfur is present in the fuel, sulfur dioxide (SO_2) and other non NPI-listed substances such as carbon dioxide (CO_2) and water. Products of incomplete combustion include carbon monoxide (CO), VOCs (including benzene, toluene, and xylenes), and other organic particulate matter. These incomplete combustion emissions result from improper air and fuel mixtures, such as poor mixing of fuel and air, inadequate fuel air residence time and temperature, and quenching of the burner flame. Depending on the fuel, small amounts of ash may also be emitted. In addition to combustion emissions, emissions from a dryer include water and PM_{10} from the aggregate. Non-combustion emissions from rotary drum dryers may include small amounts of VOCs, polycyclic aromatic hydrocarbons (PAHs), NPI-listed aldehydes, and listed hazardous organics from the volatile fraction of the bitumen and organic residues that are commonly found in recycled asphalt.

For drum mix processes, the dryer contributes most of the facility's total PM_{10} emissions. At these plants, PM_{10} emissions from post-dryer processes are minimal due to the mixing of the bitumen.

In batch mix plants, post-dryer PM_{10} emission sources include hot aggregate screens, hot bins, weigh hoppers, and mill mixers. Uncontrolled PM_{10} emissions from these sources will be greater than emissions from pre-dryer sources primarily due to the lower aggregate moisture content in addition to the greater number of transfer points. Post-dryer emission sources at batch plants are usually controlled by venting to the primary dust collector (along with the dryer gas) or sometimes to a separate dust collection system. Captured emissions 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 the cooling of organic vapours volatilised from the asphalt cement and recycled asphalt pavement in the mill. The aerosol emissions are primarily dependent upon the temperatures of the materials entering the mixing process.

Recycled tyres, which are increasingly being used in Australia in the production of asphalt, may also be a source of VOC and PM_{10} emissions. When heated, ground up tyre pieces have been shown to emit VOCs, these emissions are a function of the quantity of shredded or crumbed tyre rubber used in the liquid bitumen and the temperature of the mix.

If cutback or emulsions are used to make cold mix asphalt, VOC emissions can be significant. These emissions can occur as stack emissions from mixing of bitumen batches and as fugitive emissions from handling areas. Emission levels depend on the type and quantity of the cold mix produced. VOC emissions associated with cutback bitumen production may include naphtha, kerosene, or diesel vapours which require reporting collectively to the NPI as emissions of total VOCs.

3.5 Process Design and Operating Factors Influencing Emissions

There are two methods for introducing combustion air to the dryer burners and two types of combustion chambers, with the combination resulting in four types of burner systems that can be found at hot mix asphalt plants. The type of burner system employed has a direct effect on gaseous combustion emissions, including VOCs, listed organics, CO, and NO_x. The two types of burners related to the introduction of combustion air include the induced draft burner and the forced draft burner. Forced draft burners are usually more fuel efficient under proper operating and maintenance conditions and, consequently, have lower emissions. The two types of burners related to the use of combustion chambers include those with refractory-lined combustion chambers and those without combustion chambers. While most older burners had combustion chambers, today’s burners by and large do not.

Incomplete combustion in the dryer burner increases emissions of CO and organics. This may be caused by:

(1) improper air and fuel mixtures such as poor mixing prior to combustion;
(2) inadequate residence time, and temperature that is too low; and
(3) flame quenching.

CO and organic emissions in chamberless burners primarily results from the quenching of the flame caused by improper flighting. This occurs when the flame temperature is reduced by contact with cold surfaces or cold material dropping through the flame. Moreover, the moisture content of the aggregate in the dryer may contribute to the formation of CO and unburned fuel emissions by reducing the temperature. A secondary cause of these gaseous pollutants may be excess air entering the combustion process, particularly in the case of an induced draft burner. The use of a precombustion chamber to promote better fuel air mixing may reduce VOC and CO emissions.

NO_x is primarily formed from nitrogen in the combustion air (thermal NO_x) and from nitrogen in the fuel. Thermal NO_x is negligible below 1300 °C and increases with combustion temperature. Fuel NO_x, which is likely to be lower than thermal NO_x from dryer burners, is formed by conversion of some of the nitrogen in the burner fuel. While residual fuel oils (Nos. 4, 5, and 6) may contain significant amounts of nitrogen, distillate oils (Nos. 1 and 2) and natural gas contain very little.

Dryer burners can be designed to operate on almost any type of fuel, including natural gas, liquefied petroleum gas (LPG), light fuel oils, and waste fuel oils. The type of fuel and its sulfur content will affect SO_2, VOC, and hazardous organic emissions and, to a lesser extent, NO_x and CO emissions. Sulfur in the burner fuel will convert to sulfur oxides during combustion; burner operation will have little effect on the percent of this conversion. There is negligible sulfur content in Australian natural gas and LPG; it is only added in trace amounts to give the gas a detectable odour.

VOC emissions from natural gas combustion are less than emissions from LPG or fuel oil combustion, which are lower than emissions from waste-blended fuel combustion. Ash levels and concentrations of most of the trace elements in waste oils are normally much higher than those in virgin oils, producing higher emission levels of PM_{10} and trace metals. Chlorine in waste oils also generally exceeds levels found in virgin oils. High levels of halogenated solvents are often found in waste oil as a result of the additions of contaminant solvents to the waste oils.

When cold mix bitumen is heated, organic fumes and VOCs may be emitted as visible emissions if the asphalt is cut with lighter ends or other additives needed for a specification; however, these emissions are not normally seen when heating bitumen, as the boiling point of bitumen is much higher. In drum mix plants, hydrocarbons and PAH emissions may result from the heating and mixing of liquid bitumen inside the drum as hot exhaust gas in the drum strips light ends from the bitumen. The magnitude of these emissions is a function of the process temperatures and constituents of the bitumen being used. The mixing zone temperature in parallel flow drums is largely a function of drum length. The processing of recycled asphalt pavement materials, particularly in parallel flow plants, may also increase VOC emissions, because of an increase in mixing zone temperature during processing.

In counter flow drum mix plants, the liquid bitumen, aggregate, and recycled asphalt pavement, are mixed in a zone not in contact with the hot exhaust gas stream. Consequently, counter flow drum mix plants will likely have lower VOC emissions than parallel flow drum mix plants. In batch mix plants, the amount of hydrocarbons (ie, liquid aerosol) produced depends to a large extent on the temperature of the asphalt cement and aggregate entering the mill. PM_{10} emissions from parallel flow drum mix plants are reduced because the aggregate and asphalt cement mix for a longer time. The amount of PM_{10} generated within the dryer in this process is usually lower than that generated within batch dryers, but because the bitumen is heated to higher temperatures for a longer period of time, organic emissions (gaseous and liquid aerosol) are generally greater than in conventional batch plants.

4.0 Control Technologies

Control technologies and devices used at hot mix asphalt plants are described below and presented in Table 1. Control efficiency for a specific piece of equipment will vary depending not only on the type of equipment and quality of the maintenance and repair program at a particular facility, but also on the velocity of the air flow through the dryer.

4.1 Process and Process Fugitive Particulate and Metal Control

Process and process fugitive particulates at hot mix asphalt plants are generally controlled using primary and secondary collection devices. Primary devices generally include cyclone and settling chambers to remove larger particulates. Secondary devices, including fabric filters and venturi scrubbers, generally collect PM_{10}. PM_{10} from the dry control devices is usually collected and mixed back into the process near the entry point of the bitumen in drum-mix plants. In addition to PM_{10} emissions, particulate control also serves to remove trace metals emitted as particulates. These controls are primarily used to reduce PM_{10} emissions from the dryer; however at batch mix plants, these controls are also used for post-dryer sources, where fugitive emissions may be scavenged at an efficiency up to 98 percent.

4.1.1 Cyclones

The cyclone is a particulate control device that uses gravity, inertia, and impaction to remove particles from a ducted stream. Large diameter cyclones are often used as primary pre-cleaners to remove the bulk of heavier particles from the flue gas before it enters a secondary or final collection system. A secondary collection device, which is more effective at removing particulates than a primary collector, is used to capture remaining PM_{10} from the primary collector effluent.

Table 1 - Typical Hot Mix Asphalt Plant Emission Control Technologies

Emission Source	Pollutant	Control Technique	Typical Efficiency (%)
Process	PM_{10}	Cyclones	50 - 75
		Multiple cyclones	90
		Settling chamber	< 50
		Baghouse	99 - 99.7
		Venturi scrubber	90 - 99.5
	VOCs	Dryer and combustion process modifications	37 - 86
	SO_2	Limestone	50
		Low sulfur fuel	80
Fugitive dust	PM_{10}	Paving maintenance	60 - 99
		Wetting & crusting agents	70 - 80
		Crushed recycled asphalt pavement material	70

Adapted from: Gunke., Kathryn O'C., 1992.

4.1.2 Multiple Cyclones

A multiple cyclone consists of numerous small-diameter cyclones operating in parallel. Multiple cyclones are less expensive to install and operate than fabric filters, but are not as effective at removing smaller particulates. They are often used as pre-cleaners to remove the bulk of heavier particles from the flue gas before it enters the main control device.

4.1.3 Settling Chambers

Settling chambers, also referred to as knock-out boxes, are used at hot mix asphalt plants as primary dust collection equipment. To capture remaining PM_{10}, the primary collector effluent is ducted to a secondary collection device such as a baghouse, which is more effective at removing particulates.

4.1.4 Baghouses

Baghouses, or fabric filter systems, filter particles through fabric filtering systems (bags). Particles are caught on the surface of the bags, while the cleaned flue gas passes through. To minimise pressure drop, the bags must be cleaned periodically as the dust layer builds up. Fabric filters can achieve the highest particulate collection efficiency of all particulate control devices. Most hot mix asphalt plants with baghouses use them for process and fugitive emissions control. The captured dust from these devices is usually returned to the production process.

4.1.5 Venturi Scrubbers

Venturi scrubbers (sometimes referred to as high energy wet scrubbers) are used to remove coarse and fine particulate matter. Flue gas passes through a venturi tube while low-pressure water is added at the throat. The turbulence in the venturi promotes intimate contact between the particles and the water. The wetted particles and droplets are collected in a cyclone spray separator (sometimes called a cyclonic demister). Venturi scrubbers are often used in similar applications to baghouses.

In addition to controlling particulate emissions, the venturi scrubber is likely to remove some of the process organic emissions from the exhaust gas. While the high-pressure venturi scrubber is reliable at controlling PM_{10}, it requires considerable attention and daily maintenance to maintain a high degree of particulate removal efficiency.

With regards to emission controls for PM_{10}, in the absence of measured data, or knowledge of the collection efficiency for a particular piece of equipment, an efficiency of 90% should be used in the emission factor equation to calculate actual mass emissions. This default should only be used if there is no other available control efficiency.

Technical Paper T-143

HOT MIX BLUE SMOKE EMISSIONS

by Catherine L. Sutton

CONTENTS

INTRODUCTION

Blue smoke is a visible aerosol emission capable of traveling long distances before dissipating sufficiently to become invisible. It is an industry-wide concern for several reasons. These include regulatory limitations, organized opposition, community concerns, and control equipment requirements.

DISCHARGE GATE EMISSIONS F1

Visible emissions produced at a hot mix asphalt (HMA) plant look bad to the community. People make assumptions about the "smoke" that they see. Their perceptions are often based on a lack of knowledge or incorrect information. In fact, there is no way to know whether a plant is out of compliance by simple visual observation. Nonetheless, visible emissions can trigger complaints by the community, which can in turn lead to permitting and zoning difficulties for new facilities. It is the intent of this paper to educate HMA producers about blue smoke so they are in turn equipped to educate the community.

Another area of concern is the equipment required to control blue smoke. This includes the costs of purchasing and maintaining such equipment. Several methods are available to control fugitive emissions at hot mix facilities. Some states require such control equipment on all new facilities. Whether implementing control devices at an existing plant or specifying controls for a new plant, there are monetary considerations to be made.

Blue smoke is seen in **Figure 1** rising from a truck bed at the loadout zone of an HMA facility that does not have control equipment. Smoke wafting from the top of storage silos is another typical example.

A final purpose of this paper is to distinguish between the different types of emissions found at HMA plants. Only those emissions that can contribute to the formation of blue smoke will be explored. In addition, some of the available emission control methods currently available will be examined. A glossary of helpful terms is located at the conclusion of the paper.

TYPES OF BLUE SMOKE EMISSIONS

Process Emissions

Process emissions are those emissions ducted to a single discharge point. They result from plant operations such as fuel combustion. These emissions may include particulate matter, steam, combustion products, unconsumed air, and unburned hydrocarbons (i.e., fuel droplets).

Fugitive Emissions

Fugitive emissions result from such activities as vehicular travel and material transfer between plant components. Fugitive emissions are divided into two major categories:

1. **INVISIBLE EMISSIONS** — *Emissions that primarily consist of non-condensable volatile organic compounds (VOCs) that participate in the production of ground-level ozone (smog).*

2. **VISIBLE EMISSIONS** — *There are two types. The first are visible fugitive dust emissions generated at conveyors, stockpiles, and roadways. These emissions are not in the scope of this paper and will not be explored. Other visible fugitive emissions contain heavier hydrocarbons (compounds made of hydrogen and carbon molecules) that readily vaporize at temperatures around 300°F (150°C). They condense in ambient air and adsorb to dust and water particles. These emissions have a characteristic fuel odor.*

BLUE SMOKE CHARACTERISTICS

What is it?

The EPA conducted extensive testing on gaseous emissions that occur while filling silos and loading haul trucks. Tests were conducted at a batch plant and a drum mix facility. The emissions were found to contain organic (carbon-based) and inorganic particulate matter. Analysis also revealed the presence of carbon monoxide. However, hydrocarbons were found to be the predominant component of blue smoke. These hydrocarbons are collectively categorized as Total Organic Compounds (TOCs).

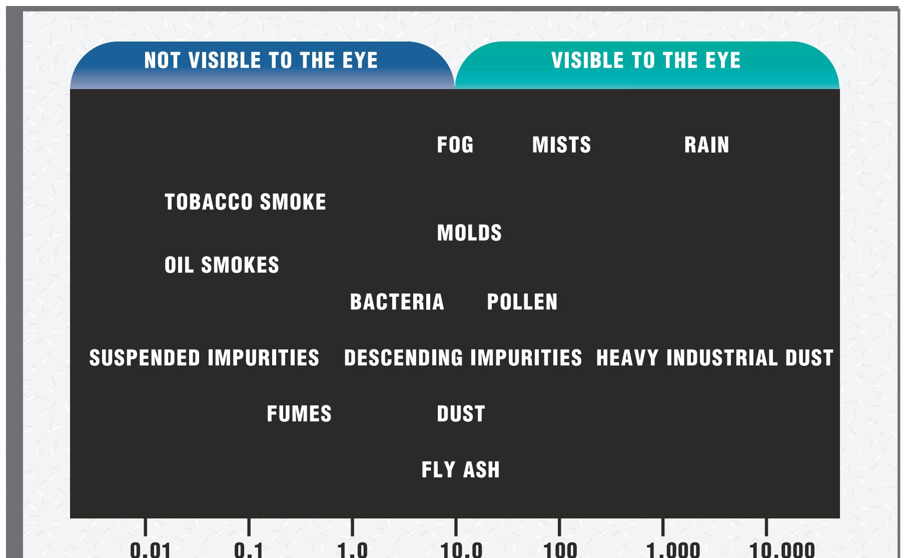
Emission rates were found to vary with asphalt binder volatility and mix temperature. The tests also revealed that pollutant emission rates differ for silo filling and truck loading operations. TOC emissions are almost three times higher during silo filling. Total particulate matter emissions are somewhat higher for silo filling operations. Organic particulate matter and carbon monoxide emissions are slightly higher during truck loadout. Equations derived from the EPA test results are available to predict pollutant emissions rates per ton of mix produced for both operations.

Fugitive hydrocarbon emissions from HMA facilities are insignificant in comparison to emission sources from non-HMA facilities. For example, take a plant producing 400 tons of mix per hour. Assuming an asphalt volatility of 0.5 percent (suggested value from AP-42 in absence of a Material Safety Data Sheet - MSDS) and a mix temperature of 300°F, the expected hydrocarbon emissions from silo filling are 2.60 lb./hr. The truck loadout hydrocarbon emissions are 0.89 lb./hr. Hydrocarbon emissions from both operations total 3.49 lb./hr.

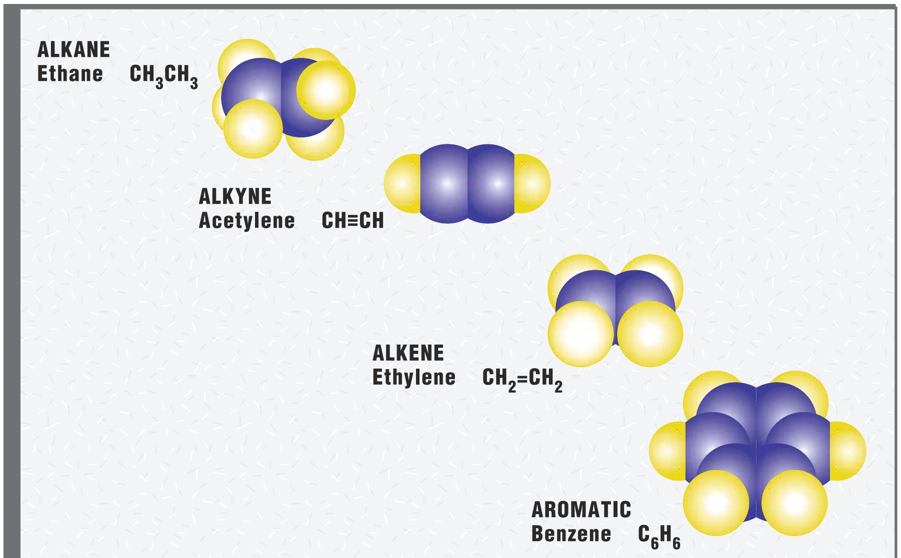
According to the EPA, the average passenger car is driven 12,500 miles per year. Its fuel consumption is approximately 22.5 miles per gallon. The yearly hydrocarbon emissions are roughly 77.1 pounds. This equates to an emission rate of 0.133 pounds per gallon of fuel combusted. Assuming a travel rate of 55 miles per hour, it would only take about ten passenger cars to equal the hourly fugitive hydrocarbon emission rate of the aforementioned HMA facility.

The average light duty (pick-up) truck is driven approximately 14,000 miles annually. Its fuel consumption rate is roughly 17.2 miles per gallon. Statistically, the average light duty truck emits 108 pounds of hydrocarbons per year. This equates to 0.0077 pounds per mile driven. The hourly fugitive hydrocarbon emissions from the HMA facility would be equivalent to approximately five light duty trucks traveling 55 miles in one hour.

A typical drum mix facility produces 200,000 tons of mix per year. The annual fugitive hydrocarbon emissions from such a facility would total 1,746 pounds (0.87 tons). This is equivalent to the annual hydrocarbon emissions of 23 passenger cars or 16 light duty trucks. According to census statistics, in a town with a population of 20,000 people, there will be 9,077 passenger cars and 6,082 light duty trucks. Those vehicles would emit 678 tons of hydrocarbons per year. As these calculations reveal, fugitive hydrocarbon emissions from HMA facilities are comparatively low. However, these emissions are subject to intense scrutiny by community members. Many facilities are installing control devices solely to be a good neighbor. Capturing blue smoke particles presents quite a challenge though due to their submicron size. In fact, these particles range in diameter between 0.4 to 0.5 microns. **Figure 2** is a chart showing the approximate sizes of various particles, including those found in blue smoke. Notice that individual blue smoke components are in the invisible range. These particles become visible only at sufficient concentrations.



PARTICLE SIZE VISIBILITY F2



HYDROCARBON MOLECULE EXAMPLES F3

Molecular Structure

The by-products of complete combustion are carbon dioxide and water. However, the combustion process is never fully complete when burning organic fuels. Therefore, a variety of compounds can form depending on fuel type. Resulting compounds may include carbon monoxide, nitrogen oxides, sulfur oxides and various hydrocarbons. Natural chemical processes limit the type of hydrocarbons formed.

There are two major classifications of hydrocarbons, open chain and cyclic. Carbon atoms in organic compounds always form four bonds. In open-chain hydrocarbons, carbon atoms attach to each other to form a chain that may include side branches. Carbon atoms form one or more closed rings in cyclic hydrocarbons. A compound's molecular structure determines its melting and boiling points. The boiling point increases with the number of carbon atoms.

Hydrocarbons can be further subdivided into saturated and unsaturated compounds. Atoms in saturated compounds are linked by single bonds and contain the maximum possible number of hydrogen atoms. They are used primarily as fuels as they are not very chemically reactive. Unsaturated compounds have at lease one ring, or a double or triple bond, between carbon atoms. These compounds have fewer than the maximum possible hydrogen atoms and are very reactive. They are used primarily as feedstock for other products. **Figure 3** contains the simplest molecular structures for each type of hydrocarbon. Each structure will be discussed further.

Alkanes are saturated open-chain hydrocarbons. They are particularly important compounds because they release large amounts of heat energy during combustion. Those with fewer than 5 carbon atoms are gases at standard temperature and pressure. Compounds with between 5 and 15 carbon atoms are typically liquids at standard temperature and pressure. Alkanes with more than 15 carbon atoms can be viscous liquids or solids at standard conditions.

Cycloalkanes are alkanes containing a ring structure. These saturated compounds exhibit slightly more reactive behavior than their open-chain counterparts. The carbon-to-carbon bond present in the ring results in the loss of two hydrogen atoms. Like alkanes, they generally have low melting and boiling points. All cycloalkanes are liquid at standard temperature and pressure. These hydrocarbons make up approximately forty percent of crude oil.

Alkenes, dienes, and alkynes are unsaturated hydrocarbons. Alkenes have chain structures similar to alkanes. However, the chain will contain at least one double bond between carbon atoms. Alkenes are not normally found in nature. Rather, they result from the breakdown of complex hydrocarbons during petroleum refining. (More will be said about this process in the next section.) Dienes contain two carbon double bonds. These compounds are used as feedstock. Members of the alkyne group are very chemically reactive. They have at least one triple carbon bond. alkynes are also a by-product of the distillation process. They behave similarly to the compounds in the alkane group.

The most important group of unsaturated cyclic hydrocarbons is known as aromatics. These compounds usually contain closed rings comprised of six carbon atoms. Some rings may however contain an oxygen or nitrogen atom. Aromatics have alternating single and double carbon bonds. Though aromatics are unsaturated hydrocarbons, they are very stable compounds. Chemical reactions occur only by applying heat and/or using a catalyst, such as in the cracking process. These compounds are the source of the characteristic odor associated with HMA facilities.

Some compounds may fall into multiple categories. For example, gasoline is a complex mixture of various hydrocarbons, including alkanes and aromatics. Aromatics are the predominant compound classification present in blue smoke. The speciation list found in AP-42 also includes compounds such as aldehydes and halons. Boiling points for blue smoke compounds range from -258.6°F to 975°F.

Volatile Organic Compounds

Volatile organic compounds (VOCs), a subset of TOCs, are hydrocarbons that readily vaporize at room temperature and pressure. They are produced during the combustion or breakdown of complex hydrocarbons. According to the EPA tests, 94 percent of the compounds present in blue smoke are VOCs. Their presence in blue smoke is of concern because of their contribution to air pollution. These compounds react with nitrogen oxides in the presence of sunlight to form photochemical smog. They also trap heat, which contributes to the so-called “greenhouse effect”.

Hazardous Air Pollutants

Hazardous wastes are compounds known, or suspected, to be dangerous to humans and the environment. The airborne components of these chemicals are known as hazardous air pollutants (HAPs). HAPs produced through combustion are fuel-type dependent, as is the quantity emitted. Approximately 9 percent of the compounds in blue smoke are classified as HAPs. Their boiling points vary widely according to molecular weight.

CAUSES OF BLUE SMOKE

Chemistry of Asphalt

Asphalt is a complex mixture of hydrocarbons that remain after refining crude oil. In addition to carbon and hydrogen atoms, asphalt also contains sulfur, nitrogen, and oxygen. Trace amounts of the metals vanadium, iron, and nickel may also be present. According to most sources, asphalt constituents can be grouped into either of two broad categories: asphaltenes and maltenes (also known as petrolenes).

Asphalt is typically composed of between 5 and 25 percent by weight of asphaltenes. These compounds are dark brown solids that easily crumble. They are aromatic hydrocarbons with high molecular weights. High concentrations of asphaltenes produce a hard binder with a low penetration, high softening point, and high viscosity.

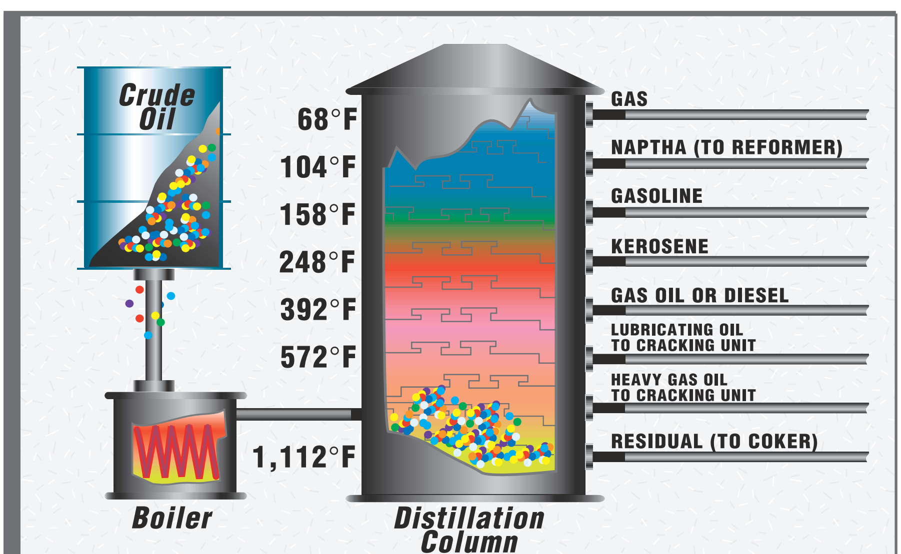
Maltenes can be further subdivided into two groups. The first group is resins. These compounds are similar to asphaltenes, though they have lower molecular weights. They account for the adhesive and ductile properties of asphalt. Resins are typically dark colored and can be either semi-solid or solid. They exhibit thermoplastic behavior (fluid when heated and brittle when cold). When oxidized, resins develop into asphaltene molecules.

The second sub-category of maltenes is known as oils. They can be either colorless or white liquids. These compounds influence the viscosity of asphalt binder. Oxidation of oils can produce either asphaltene or resin molecules. Oils are the major component of asphalt binder. Resins serve to disperse asphaltene compounds within the oils to produce a uniform liquid.

Distillation Process

Crude oil is the foundation of many organic compounds. It can be asphaltic-based, paraffin-based, or a mixture of the two. Asphaltic crude oil yields asphalt cement from simple atmospheric distillation. Paraffin type crude oil yields asphalt cement only through destructive distillation involving chemical reactions. Crude oil's chemical composition, and thus its source, determines what fractions, or compounds, are acquired through distillation. Individual fractions exhibit different behaviors based on their atomic structure.

Asphaltic crude oil is superheated to approximately 1,100°F (600°C) during simple atomospheric distillation. The resulting vapors enter a distillation column filled with separation trays for collecting the various fractions. Temperatures within the column decrease with height. Fractions condense according to their boiling point as they rise through the tower. Light fractions include gasoline, kerosene, and fuel oils. Heavy fractions include lubricating oils and heavy gas oil. **Figure 4** shows the separation of fractions in an atmospheric distillation column. It is important to note that injecting steam, as a catalyst, will increase the level of separation at lower temperatures. With steam injection, distillation can occur at temperatures as low as 300°F.



FRACTION SEPARATION F4

Asphalt cement, waxes, and feedstock are residual compounds from the distillation tower. Some heavy fractions will be subjected to further processing. They are often sent to cracking units. Cracking is the process in which large hydrocarbon molecules are broken into smaller molecules by applying heat and high pressure. Catalysts, such as steam, can be applied to the process in order to lower the temperatures required. Lighter fractions acquired by cracking are sent to another distillation tower for separation.

Despite processing, all light fractions are never completely removed from asphalt cement. The quantity remaining depends on the original crude oil and the degree of processing that has taken place. Asphalt cement viscosity, or resistance to flow, is dependent on the quantity of light fractions retained after processing. Studies of crude oils from around the world show that different asphalts will contain varying quantities of light fractions even after undergoing the same processing.

Asphalt hardness greatly affects mix performance. It is directly related to the amount of light fractions retained by the asphalt cement. Hardness increases as the quantity of light fractions decreases. In the early to mid 20th century, there were no hardness specifications for asphalt binder from state to state. State highway departments decided to implement a uniform hardness specification. In order to meet those specifications (the asphalt's pen, or penetration number), artificial softening of the asphalt cement may be required.

The softening process involves blending an asphalt cement with softer cements, if available, or other light fractions. This increases the quantity of light fractions present that may vaporize under appropriate conditions. The smoke temperature of the asphalt cement is dependent on the light fractions present. Temperatures at HMA facilities are higher than many hydrocarbon boiling points. Vaporization may occur during the production of hot mix when conditions are favorable. More information on this topic may be found in Technical Paper T-116 ("Light Ends in Asphalt").

Light fraction vaporization can cause blue smoke formation during mix production and storage. A binder's MSDS provides the suggested mixing and storage temperatures. It is advantageous to keep those temperatures as low as possible without compromising mix quality. Excessive temperatures can result in binder damage, tender mixes, and asphalt drain-down, in addition to blue smoke formation. There are other advantages to keeping the mix temperature low. These include reduced fuel consumption and asphalt oxidation, as well as increased production rates. For more information on these topics, refer to Technical Paper T-103 ("Oxidation of Asphalt"), Technical Paper T-126 ("Productivity"), and Technical Paper T-132 ("Aggregate Drying").

Atmospheric conditions also influence blue smoke formation. Saturation is an atmospheric condition in which the air contains the maximum possible quantity of water vapor at a particular temperature and pressure. Humidity is a measure of atmospheric moisture content. Relative humidity denotes the amount of water vapor in the air compared to the amount required for saturation. Hot gaseous emissions cause localized temperature increases. An elevation in temperature raises the quantity of water vapor required for saturation. Blue smoke can form until saturation is reached. Thus, areas with low relative humidity are favorable to blue smoke formation.

Asphalt Binder Additives

Anti-strip additives can also affect blue smoke formation. These compounds alter the chemical composition of a binder by adding light fractions. Typically, the smoke temperature of a binder is lowered when using anti-strip additives. The type of additive can also influence the smoke temperature of the augmented binder. Binders with anti-strip additives should be stored and mixed at the lowest temperature that produces acceptable results. Consult the MSDS for recommendations.

Additives should be used only when mix tests indicate the need for them. The minimum quantity of additive that attains the desired binder properties should be used because of the additional light fractions. More efficient additive formulas should be selected when high percentages are required to obtain proper adhesion.

Recycled Materials

There are significant economic advantages to using Reclaimed Asphalt Product (RAP). RAP usage proportionally decreases the quantity of virgin aggregate and asphalt cement in a mix. However, RAP is another source of hydrocarbons. When blended with superheated virgin aggregate, RAP melts and steam is released. At sufficiently high mix temperatures, steam can initiate hydrocarbon vaporization from the RAP. These hydrocarbons will form blue smoke if allowed to condense. Smoke formation from recycle mixes generally results from excessive mix temperatures.

Extended periods of precipitation can cause fluctuations in the RAP moisture content. The resulting increase in steam volume can enhance smoke production, depending on the light fractions present in the recycle material. It is advantageous to take steps to minimize RAP moisture. This can be achieved through various methods, including paved or covered stockpile areas and proper stockpile management.

Mixer Designs

Mixer design also influences blue smoke formation. In a parallel-flow drum mixer, mix is showered through the hot gas stream being pulled through the drum. Steam in the drum can initiate hydrocarbon vaporization. Unlike most freestanding mixers, parallel-flow drum mixers are not equipped with separate fugitive emission scavenging systems. In such drums, all gases are ducted a single emission point, typically the baghouse exhaust stack. Vaporized hydrocarbons present in the gas stream will condense upon ejection from the stack. Blue smoke emissions are appreciably higher for this type of plant.

In the ASTEC® Double Barrel® drum mixer, RAP and asphalt cement are injected in the mixing chamber, away from the hot exhaust gases in the inner drum. Steam is released as the RAP mixes with superheated aggregate. Hydrocarbons vaporized in the mixing chamber are pulled into the inner drum by the exhaust fan, where they are consumed by burner flame. The Double Barrel® drum mixer has been designed to meet emission requirements by eliminating the potential for blue smoke formation while running up to fifty percent RAP.

Air Exposure

Blue smoke can form at material transfer points because of exposure to ambient air. As mix falls, through a discharge gate for example, it does not remain in a slug. The turbulent fall of the mix exposes a larger surface area, thus allowing for even greater interaction with cool air. Any vaporized hydrocarbons that have been trapped in the mix are then released. Blue smoke forms as they condense. Enclosing transfer points, where possible, will greatly reduce, but not eliminate, blue smoke formation.

Oxidation

Oxidation is a chemical reaction in which a substance combines with oxygen. When exposed to air, HMA oxidizes at practically all temperatures. However, the reaction rate is extremely temperature sensitive. For every 25˚F increase over 200˚F, the reaction rate doubles. For example, a mix at 350˚F will oxidize four times faster than a mix at 300˚F.

Oxidation is dependent on the amount of mix surface area exposed to oxygen. The reaction rate is also affected by the duration of exposure. Simply put, more oxidation will occur the longer mix is exposed to oxygen. Another factor affecting oxidation rate is the mix's chemical composition. While oxidation occurs to a limited extent at transfer points, it occurs to the greatest degree in storage silos. Carbon dioxide (CO_2) forms as the upper mix surface oxidizes. Being heavier than air, CO_2 settles on top of the mix to form a protective "blanket", shielding the mix from further oxidation.

Conditions within storage silos are similar to other situations in which hydrocarbons vaporize. Vaporization within a silo is restricted due to a limited air volume. Once saturated with hydrocarbons, the trapped air halts further vaporization until there is an influx of fresh air to the silo. Some hydrocarbons may escape when the silo top gate opens. However, some will remain trapped by mix as the silo is filled. They are released as mix is discharged into haul trucks. The hydrocarbons then condense in the ambient air at the silo tops and truck loading zones to form blue smoke.

Once in the truck bed, interaction between the mix and ambient air continues. Exposed mix will oxidize to form a thin layer of hardened mix. This layer will trap any further vaporized hydrocarbons not yet released. That protective layer is disrupted at the job site as the haul trucks are emptied. This affords vaporized hydrocarbons yet another opportunity to escape into the atmosphere. Condensation will occur as they cool in the ambient air, thus forming blue smoke.

EMISSION REGULATIONS

Air Quality Standards

The Clean Air Act (CAA) was established by Congress to prevent significant deterioration of air quality. Each state is responsible for meeting the National Ambient Air Quality Standards (NAAQS). Areas that do not meet certain baseline standards are classified as non-attainment zones. The Environmental Protection Agency (EPA) established standards for six criteria pollutants. These include: particulate matter smaller than 10 microns (PM-10), sulfur dioxide (SO_2), nitrogen oxides (NO_x), ozone (O_3), carbon monoxide (CO), and lead (Pb).

A major source is defined as a stationary source that emits, or has the potential to emit, 100 tons per year (TPY) of any of the six criteria pollutants. Because of their potentially harmful effects on the environment, criteria pollutants are further restricted in non-attainment zones depending on severity. Additionally, major sources emit, or have the potential to emit, 10 TPY of any single HAP or 25 TPY of any combination of HAPs. These limits typically pertain to process emissions that are ducted to the atmosphere through a single emission point.

Air emission sources are required to obtain permits to operate. Permits are issued based on estimated annual pollutant emission rates. Emissions from most hot mix facilities are significantly below federal major source thresholds. Even so, some states require emission modeling to determine their impact downwind of the site. Many states have passed regulations further restricting emissions from the hot mix industry. Restrictions may include limits on annual production, fuel usage, or pollutant concentration. Federal regulations do not currently restrict fugitive emissions from HMA facilities. However, future regulations are likely because blue smoke emissions can now be predicted and thus modeled.

ORGANIZED OPPOSITION

Environmental and Citizens Groups

Public perception of HMA facilities is making it increasingly difficult for new plants to acquire permits. This is due in part to a general lack of knowledge concerning plant operations. Contrary to popular belief, the HMA industry is not a leading source of air pollution. Roughly 3,600 plants produce approximately 500 million tons of mix annually. Industry emissions can be estimated using accepted emission factors. Calculations show that the entire industry is responsible for less than one tenth of one percent of all criteria pollutant emissions in the United States.

In fact, the majority of HMA facility emissions are not visible. Blue smoke emission levels are significantly lower than stack emissions by weight. However, uncontrolled blue smoke is readily visible and therefore scrutinized more heavily by observers. Education is the key. Proactive community work can help to achieve this objective. Permitting requirements make this is especially important because of the difficulties in establishing new HMA facilities. Controlling blue smoke may alleviate many of their concerns.

CONTROL METHODS

Need for Control

While HMA facility emissions are lower than most other industries, the implementation of blue smoke control may still be warranted. Any control method applied to plant components will entail collecting and transporting hydrocarbon-laden air. Individual pieces of any control system must all work together to form a scavenger system. This involves:

- Sealing all material transfer points to trap blue smoke
- Ductwork to transport smoke from collection points to the chosen disposal method
- Utilizing separate scavenger fan to convey captured emissions through the ductwork
- Installing dampers within the ductwork to control airflow

Smoke is either transported to the burner for incineration or to a collection unit. Control systems can be implemented at existing facilities. The various methods of controlling the blue smoke will be addressed in detail later in this section.

Blue smoke systems are likely to become a standard pollution control device at HMA facilities. Some state regulations limit pollutant concentrations at the property line. Determining those concentrations involves modeling emissions from the exhaust stack, silo tops, and the truck loadout zone. Several control devices are readily available to meet these standards. However, as with any addition to a plant, fugitive emission control units add to the cost of purchasing or upgrading a plant. Yearly operational costs will also reflect increased electrical requirements and maintenance costs.

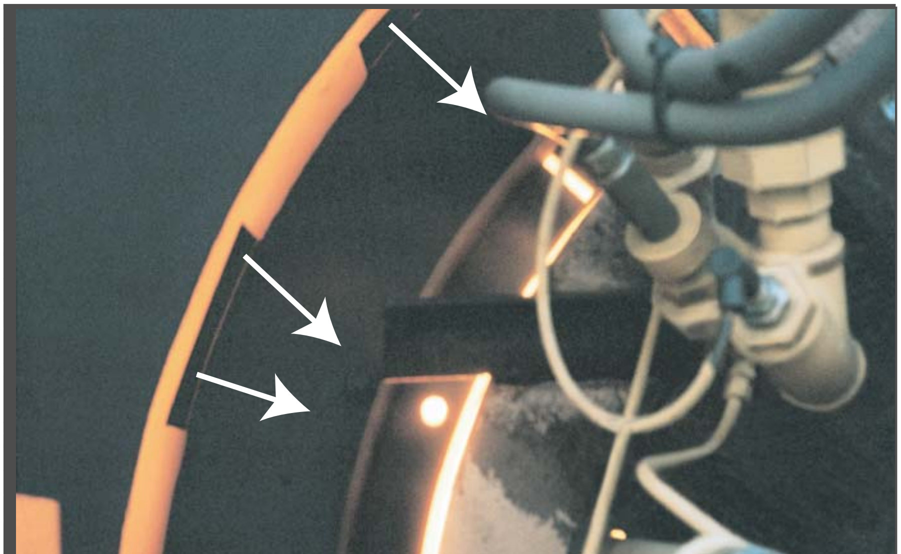
DISPOSABLE METHODS

Effective smoke collection involves sealing all material transfer points. This eliminates the opportunity for vaporized hydrocarbons to condense in ambient air. Pick-up points are positioned at material transfer locations, such as atop batchers and the drag discharge chute. Dampers in the ductwork at each pick-up point are used to balance airflow. They may be manual or automatic depending on the overall system set-up. A radial blade centrifugal fan is used to transport contaminated air through the ductwork. A damper is located at the fan inlet to control suction.

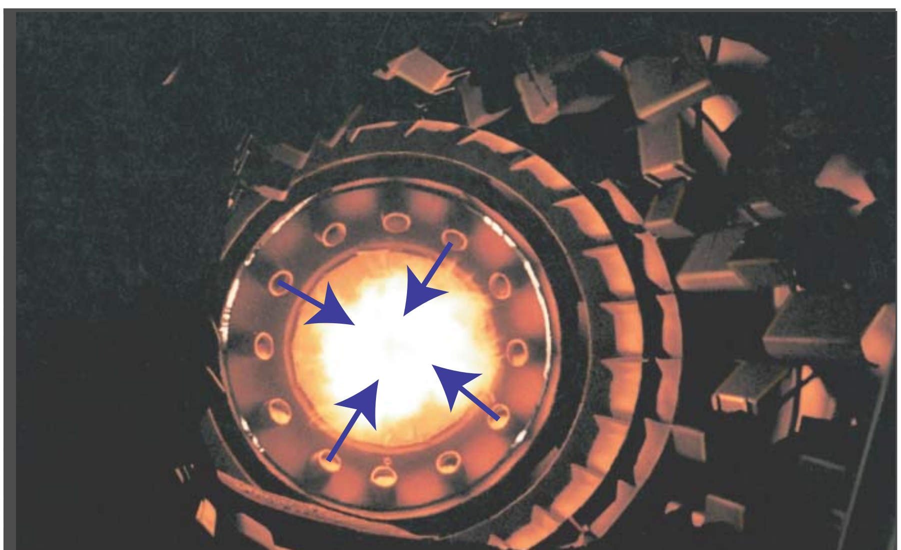
Because hydrocarbons are essentially fuel droplets, a logical method of disposal is incineration. Smoke collected between the mixer and silo tops can either be routed to the burner or a collection unit. Plants with scavenging at the silo tops only generally opt to incinerate the hydrocarbons. **Figure 5** shows ductwork transporting smoke from the storage silos to the burner. The captured smoke is ejected from a dispersion ring encircling the burner. The main system exhaust fan pulls the hydrocarbon-laden air into the flame of induced-air burners. Smoke particles are blown directly into the flame of forced-air (total air) burners by the scavenger fan. **Figure 6** shows the dispersion ring for an induced air burner. The internal injection pipes for a forced air burner are visible in **Figure 7**.

Blue smoke formation at the load-out zone is problematic for both continuous mix and batch plants. Collection involves surrounding discharge gate on three sides with horseshoe-shaped intake hoods. Automatic dampers synchronized with the discharge gates regulate the airflow through the intake hoods. They assure that scavenging occurs only at the silo in use.

DUCTWORK FROM SILOS TO BURNER F5



DISPERSION RING FOR INDUCED AIR BURNER F6



INJECTION PIPES FOR FORCED AIR BURNER F7

TRUCK LOADING ZONE SCAVENGING DUCT F8

DUCTWORK TO ELECTROSTATIC PRECIPITATOR F9

The air volume captured at the loadout zone limits control options. Burner excess air limits generally rule out incineration. Thus, smoke from the loadout is typically routed to an alternate control device. **Figure 8** shows a plant with intake hoods located within a partially enclosed loadout zone. Plates are positioned between the silo legs to form a wind barrier. Note the automatic dampers to control airflow at the silo gates. This particular plant utilizes several methods for blue smoke control, including incineration and a collection unit.

A tunnel is the most effective method of scavenging smoke during silo discharge. These structures have roll-up doors that can be closed when the wind is blowing parallel to the enclosure. Intake hoods are located at each end near the doors to prevent smoke from escaping the enclosure. The airflow required for effective smoke collection in the tunnel is determined by setting an appropriate face velocity at the door openings. Smoke captured in a tunnel is always routed to a control unit because of the volume of air being handled.

As with the plant shown in **Figure 8**, the blue smoke system can include both incineration and collection options. Such systems generally involve ducting smoke from silo tops to the burner and loadout zone emissions to a collection device. During midstream stops, silo loadout can continue even though mix production has ceased. Thus, there may still be a need to collect smoke at the silo tops. In this situation, automatic dampers will redirect the captured smoke from the silo tops to the control unit rather than the burner.

Collection Units

Figure 9 shows a loadout enclosure with intakes positioned at each discharge gate. This plant utilizes an electrostatic precipitator to remove hydrocarbons from the gas stream. Incoming gases flow past a series of electrodes suspended in the passage through the first stage of the unit. The electrodes are supplied with high-voltage DC power that ionizes (causes to have a negative electrical charge) the particles as they pass. The gases then flow past collector electrodes in the second stage of the device. Collector electrodes have a positive charge that attracts the ionized hydrocarbons, removing them from the gas stream. Treated air is exhausted to the atmosphere. Collector electrodes have to be cleaned regularly to remove particle buildup.

An alternate destination for smoke is a media-type filtration system. Smoke is pulled through a unit containing an assembly of disposable, pleated filter cartridges. Vaporized hydrocarbons and steam cool as the gas stream enters the unit. As smoke particles condense, some collect in a sump located in the expansion chamber. Filter cartridges collect the remaining particles as the gas stream flows through the unit. This device is designed to collect smoke particles only and is not suitable for high concentrations of fine dust particles.

MEDIA-TYPE FILTRATION SYSTEM F10

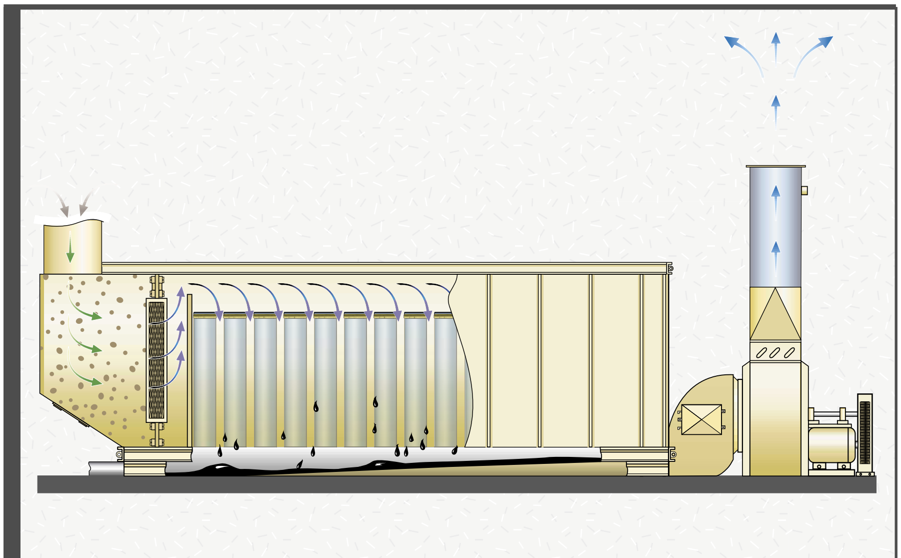
Filter cartridge units consist of two filtration stages. The first stage involves preliminary filtration of condensed droplets via impingement filters. Primary filtration of the gas stream involves second stage oil mist filters. Oil collects on the preliminary and primary filters. These systems include their own high efficiency centrifugal fan that exhausts treated air into the air.

Media-type filtration systems require routine filter replacement to ensure proper operation. The pressure drop across the filter media increases as condensates accumulate. Filter replacement is required when the differential pressure across the filters reaches a specified level. Replacement of the first stage system filters is generally sufficient to return the differential pressure to an acceptable level. However, replacement of all filters is required when changing the first stage filters fails to drop the differential pressure sufficiently. The system manufacturer determines proper operating pressures according to unit size and smoke loading. First stage filters can often be replaced several times before replacement of all filters is required. **Figure 10** depicts a media-type filtration system in use at a hot mix asphalt facility.

Another system newly available for controlling blue smoke is a fiberbed mist collector. They are currently used extensively in the roofing asphalt industry. These units employ three methods for collection: impaction, interception, and Brownian diffusion. Impaction involves the collision of blue smoke particles with a fiber filter. This method is effective for particles larger than 3 microns. Interception is used to collect smaller particles in the 1 to 3 micron range. Collection occurs as smoke particles graze the sides of the fiber filter while passing through the media pores.

Brownian diffusion is employed for the collection of sub-micron particles. Particles rotate and move along curved paths after colliding with air molecules, which move along a straight path between collisions. The random movement exhibited by the particles is known as Brownian motion. Air molecules are able to adeptly maneuver between the filter’s fibers. The haphazard movement of the smoke particles causes them to collide with the filter fibers, thus removing them from the gas stream.

As particles condense on the filters, they encounter other captured particles. Multiple particles unite to form large droplets. Gravity will cause these droplets to drain from the filters. The bottom of the filter housing is sloped to allow condensate to be drained via a piping system. Because the filters are designed for oil droplet collection, particulate matter pre-filters are required.



FIBERBED MIST COLLECTOR F11

VAPOR RECOVERY SYSTEM F12

VAPOR RECOVERY CONNECTOR F13

They are positioned in the inlet expansion area of the unit. Collection efficiencies of over 99% have been achieved with these control units.

Fiberbed mist collectors operate similarly to a particulate baghouse. **Figure 11** depicts a fiberbed unit in an outdoor environment. A damper or a variable frequency drive is used to regulate airflow. The pressure drop across the collection filters is monitored. It generally ranges between 5 and 10 in WC during normal operation. Filter replacement is required when the pressure drop reaches the specified maximum with the damper fully open. Otherwise, airflow through the system will decrease. Filtered air is exhausted to the atmosphere at the outlet of the fan.

Another potential source of blue smoke emissions is the binder storage tank. These tanks are heated to maintain an appropriate viscosity. Tank filling provides an excellent opportunity for hydrocarbon emissions. There are several methods available to control this type of emission. One system consists of a vapor recovery apparatus that displaces air from inside the tank to the binder supply truck. Because this air is laden with vaporized hydrocarbons, smoke will form if they are allowed to condense. Piping the vapors into the supply truck eliminates the opportunity for them to escape into the atmosphere.

Once the gases have been pumped into the truck, they are transported away from the plant for disposal at the supplier's facility. **Figure 12** shows the pipe configuration for transferring the hydrocarbon gases to the delivery truck. **Figure 13** depicts the connector that attaches to the truck.

Vent condensers can also be used to control blue smoke emissions from asphalt storage tanks. The vent condenser itself consists of a number of tubes with external fins. Ambient air circulates through the fins, cooling the tubes and the gases passing through them. Hydrocarbons in the gas stream condense and drain back down into the tank. Purified air is released into the atmosphere through the vent. **Figure 14** shows a vent condenser on an asphalt storage tank.

VENT CONDENSER F14

Smoke Suppression In Haul Trucks

Suppressing blue smoke formation in a loaded truck bed is a control method that any facility can implement. It simply involves ensuring that truck beds are covered as soon as they are loaded. When left uncovered, mix is exposed to cooler air, which may lead to the condensation of vaporized hydrocarbons. As with silos, a tarp limits the quantity of air that hydrocarbons have to vaporize into. Once the air under the tarp has reached the saturation point, further evaporation is halted.

Covering the truck bed has yet another benefit. It protects the mix from excessive cooling during transport. The temperature of hot mix asphalt is critical at the job site to ensure proper compaction. Minimizing heat loss during transport also allows a reduction in mix temperature without compromising quality. Lowering temperatures at an HMA facility is the greatest contributor to retarding blue smoke formation.

CONCLUSION

Through application of these methods, blue smoke formation and release can be controlled sufficiently to meet all existing codes and regulations. As regulations tighten, new methods and equipment for meeting the environmental concerns of hot mix facilities will be developed.

Asphalt Heater

HELICAL COIL HEATERS

FOR HOT MIX ASPHALT

HC-120 with side pumps and Stackpack heat exchanger

HEATEC THERMAL FLUID (hot oil) heaters for the hot mix asphalt (HMA) industry are designed around a helical coil. Our coil meets ASME code.

Although we make several other types of heaters for other industries, our helical coil heaters are the most popular heater in the HMA industry. Their popularity comes from their simplicity, efficiency, low maintenance and relatively low cost.

MODELS AND OUTPUTS

Nine standard models are available. Rated thermal outputs range from 0.7 to 4 million Btu per hour. All can be customized to meet your specific needs.

TWO BASIC CONFIGURATIONS

Heatec helical coil heaters are available in two basic configurations: HC and HCS. The HC configuration (above) has a manifold that enables the heater to operate with multiple thermal fluid circuits.

HEATEC

Heatec HCS helical coil heater for single thermal fluid circuit

LH side of Heatec HCS helical coil heater

The HCS configuration is virtually identical to the HC except that it is intended to operate with a single circuit. It has no manifold.

HCS heater can be upgraded

However, the HCS heater can be upgraded to the HC configuration by adding an optional manifold. The upgrade can be done at any time as needed.

High efficiency reduces costs

A hallmark of our helical coil heater is high thermal efficiency. Thermal efficiencies of our standard heaters range up to 85 percent LHV, depending upon fluid outlet temperature and fuel.

Thermal efficiency is the total amount of heat produced by the burner versus the portion actually transferred to thermal fluid flowing through the coil. Thus, in our heaters, up to 85 percent of the total heat is transferred to the thermal fluid. Increasing efficiency reduces fuel usage.

Achieving super-efficiency

Adding a **STACKPACK™** heat exchanger boosts thermal efficiency another 5 percent. It makes our current heater super-efficient. That extra percentage reduces monthly fuel usage by 261 gallons of No. 2 fuel oil or 345 therms of natural gas. The Stackpack heat exchanger usually pays for itself in a year or less.

Controls

Heater controls automatically maintain the operating temperature set by the operator. Accuracy is within a half percent of set temperature. The temperature of thermal fluid at the heater's outlet can be maintained up to 450 degrees F (depending on variables).

Numerous safety features ensure heater operation is always within prescribed limits. Heaters shut down automatically if an abnormal operating condition occurs.

Switches and sensors in a ***limit*** circuit ensure normal operation. They monitor burner flame, thermal fluid temperature, exhaust gas temperature, flow of thermal fluid, and combustion air pressure.

Burner controls

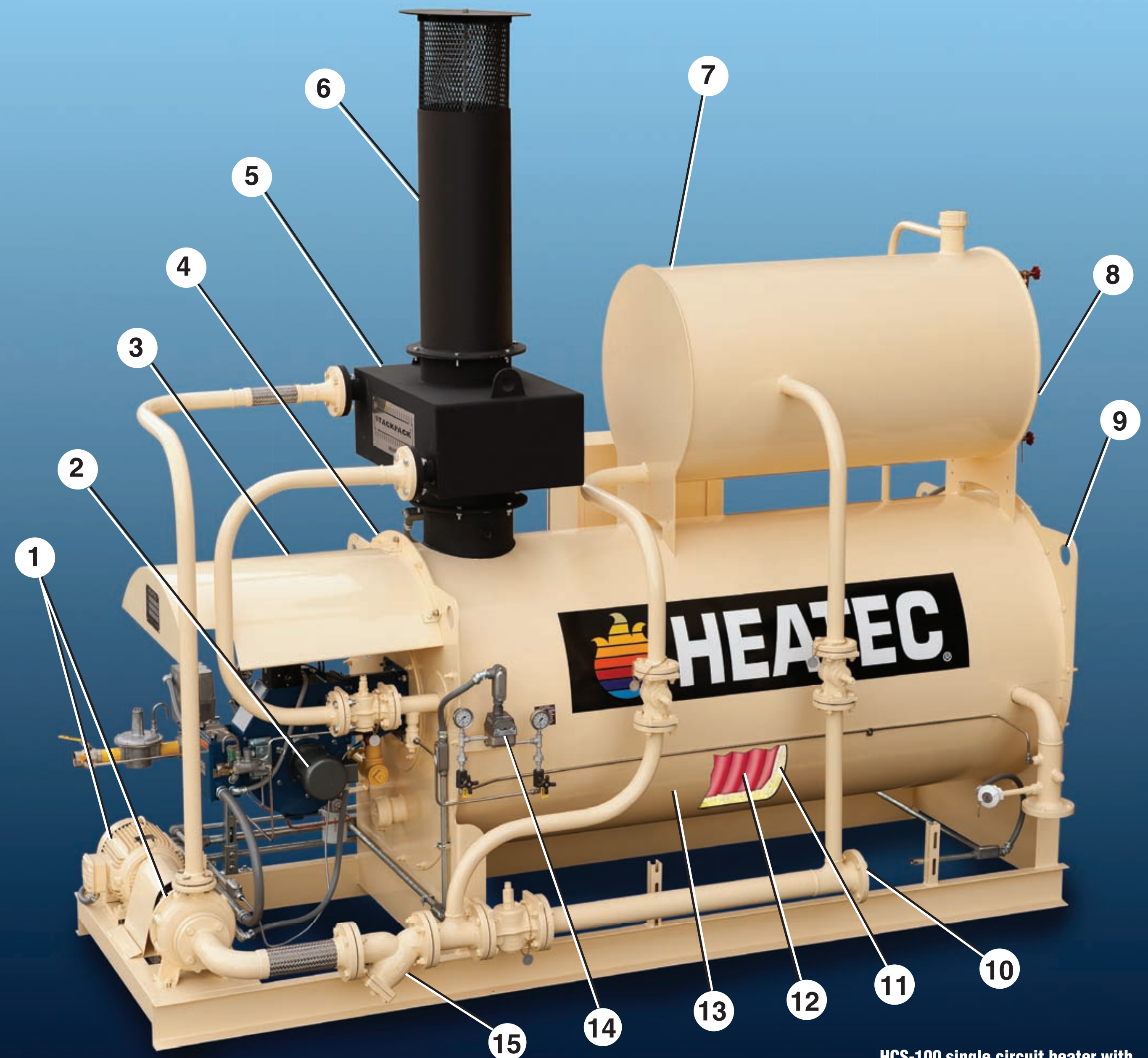
Fireye™ burner management controls known as BurnerLogix™ provide proper and safe operation of the burner. They include a display, burner control, programmer, annunciator and flame scanner.

The burner control uses a microprocessor for its management functions. The processor provides the proper burner sequencing, ignition and flame monitoring protection.

The controls provide important messages about the operating status of the heater. If there is an alarm condition, a message will appear on the display. The message identifies the cause of the alarm, including which safety device in the *limit* circuit may have caused the shutdown.

Control panel

Main controls are in a UL approved NEMA-4 panel, which protects against wind-blown dust and rain, splashing water and hose-directed water. Wiring workmanship is meticulous and meets strict standards. All wires and terminals are labeled for easy identification of circuits. A laminated circuit diagram is furnished.



HCS-100 single circuit heater with optional Stackpack™ heat exchanger.

1. Hot oil (thermal fluid) recirculation pump and motor.
2. Fully modulating burner.
3. Rain shield.
4. End plates bolt on and have lifting eyes.
5. Stackpack™ heat exchanger (optional).
6. Exhaust stack.
7. Thermal fluid expansion tank.
8. Low media level switch (not visible).
9. One of four lifting eyes.
10. Single circuit configuration shown can be upgraded to multiple circuit by adding manifold.
11. 3” ceramic fiberglass insulation.
12. Helical coil. Built to ASME code.
13. Heater shell. Welded A-36 steel plate.
14. Pressure differential switch.
15. Thermal fluid Y-strainer.

SPECIFICATIONS

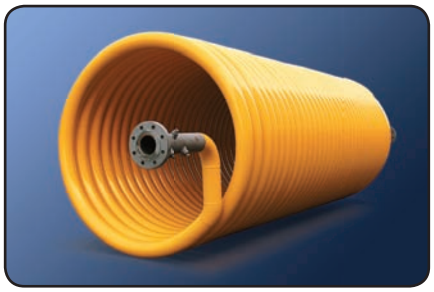
BASIC MODEL	MAXIMUM OUTPUT	FUEL USED PER HOUR		RECIRCULATION PUMP		EXPANSION TANK	APPROXIMATE OVERALL SIZE			NET WEIGHT
	Btu/Hour	No. 2 Fuel Oil Gallons	Natural Gas Cubic feet/hour	Hp	GPM	Gallons	Length	Width	Height	Pounds
SINGLE CIRCUIT HEATERS										
HCS-70	700,000	6	910	10	100	100	10'-5"	5'-7"	8'-10"	3,700
HCS-100	1,200,000	11	1,560	10	100	175	12'-1"	5'-9"	9"-0"	5,000
HCS-175	2,000,000	18	2,600	15	150	280	14'-5"	6'-3"	9'-7"	6,500
HCS-250	3,000,000	27	3,900	15	150	280	15'-9"	7'-4"	10'-6"	9,300
HCS-350	4,000,000	36	5,200	15	200	400	18'-1"	7'-4"	11'-5"	10,700
MULTI-CIRCUIT HEATERS										
HC-120	1,200,000	11	1560	10	100	175	12'-1"	5'-11"	9"-0"	5,100
HC-200	2,000,000	18	2600	15	150	280	14'-5"	6'-5"	9'-7"	6,600
HC-300	3,000,000	27	3,900	15	150	280	15'-9"	7'-6"	10'-6"	9,500
HC-400	4,000,000	36	5,200	15	200	400	18'-1"	7'-6"	11'-5"	10,900

The amount of fuel used is for a thermal efficiency of 85% and one hour of operation at maximum output. A properly sized heater normally runs for intermittent periods at lower outputs. No. 2 fuel usage is based on 132,000 Btu per gallon, its LHV (low heating value). Natural gas usage is based on 905 Btu per cubic foot, its LHV. Heights include the exhaust stack without a Stackpack heat exchanger. The Stackpack exchanger for the HCS-350 and HC-400 weighs 800 pounds and adds 2'-7" to their height. For all other models it weighs 460 pounds and adds 1'-9" to their height.

NOTE: Specifications are subject to change without prior notice or obligation.

Burner modulation

The heater has a fully modulating burner with appropriate turndown ratios. Modulation allows its firing rate to closely match the heat demand. This conserves fuel, reduces temperature overshooting and eliminates constant on-off recycling.



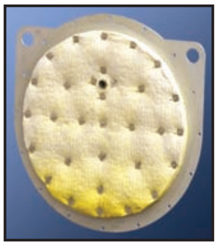
Helical coils

Helical coils in our heaters set us apart from others that produce helical coil heaters for the HMA industry. We are the only heater manufacturer that builds *all* coils to ASME code. Certification is optional.

Coils in HCS heaters have a three year warranty. Coils in HC heaters have a five year warranty.

Insulation

The shell of our heater is fully insulated with 3 inches of ceramic fiberglass insulation. The end plates are also insulated. All insulation is treated to retard errosion.



Options

Options include: Stackpack heat exchanger, seven-day time clock, sock filter, automated monitor (dialer), burners for various fuels, and steel valves. A variety of electrical power options are available.

Factory testing and startup

All HC and HCS heaters are factory-tested. We provide startup services with fees based on time at site plus travel time and expenses.

Warranty and factory support

Our heaters have a one-year limited warranty. Additionally, the coils have an extended warranty as noted earlier. Round-the-clock support is available from our in-house parts and service departments.

HEATEC

HEATEC, INC. an Astec Industries Company
5200 WILSON RD • CHATTANOOGA, TN 37410 USA 800.235.5200 • FAX 423.821.7673 • heatec.com

ASTE NASDAQ LISTED

Attachment D
Site Location Aerial Map

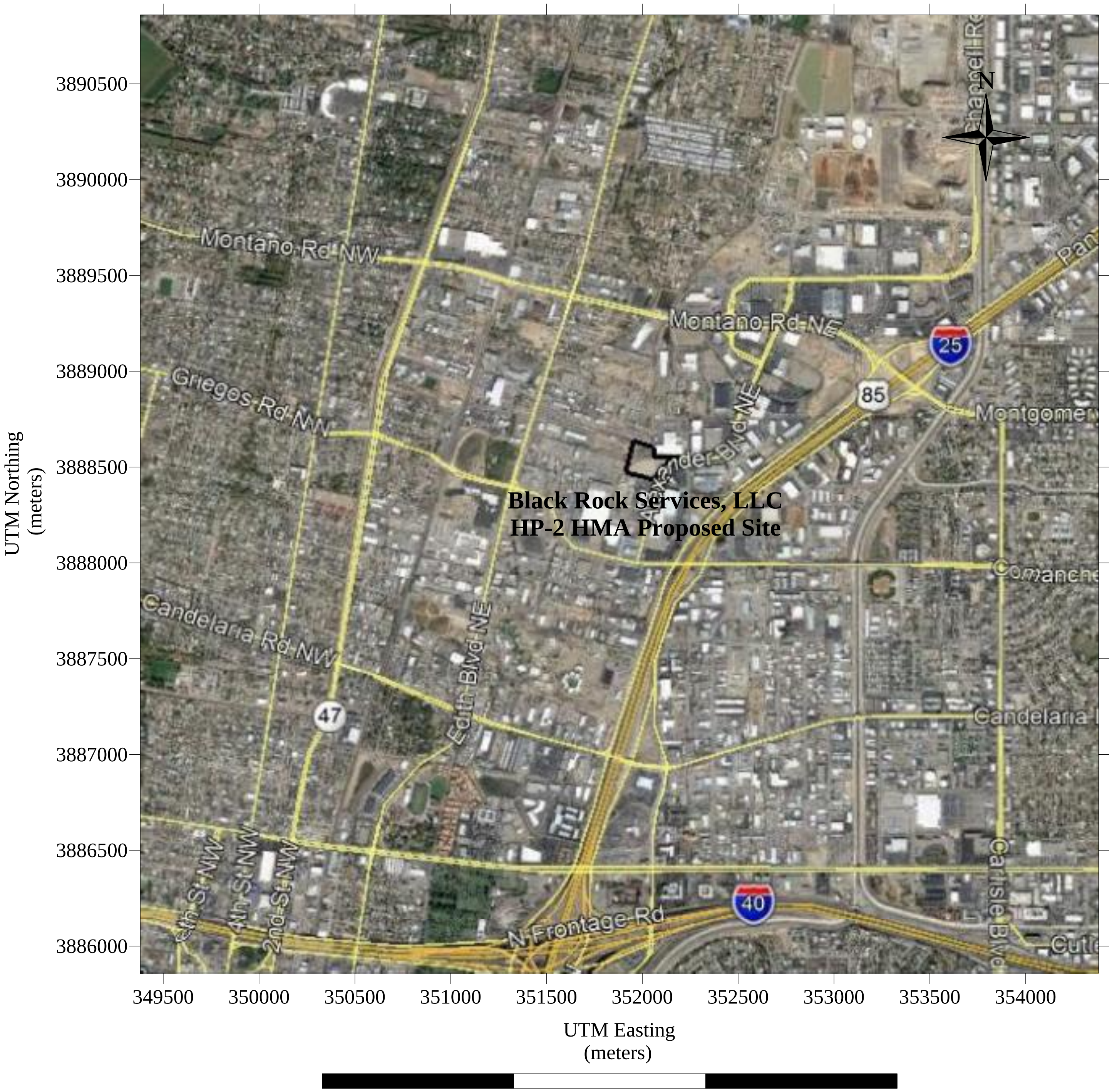


Figure D-1: Aerial Map Showing Site Location
NAD 83

Attachment E
Facility Process Description

Facility Process Description

The Black Rock Services HP-2 HMA Plant produces hot mix asphalt concrete. The operation is typical of a continuous drum mix HMA operation. Aggregate from storage piles (Unit 1) is loaded into the Cold Aggregate Feed Bins (Unit 2), where it is metered onto the Aggregate Feed Bin Conveyor (Unit 3). From the Aggregate Feed Bin Conveyor, the aggregate is sent to the Aggregate Scalping Screen and Aggregate Scalping Screen Conveyor (Units 4 and 5), then transferred by conveyor (Unit 6) to the drum dryer/mixer. RAP from a storage pile (Unit 7) is loaded into the RAP Bins (Unit 8), where it is metered onto the RAP Bin Conveyor (Unit 9) and then transferred to the RAP Screen (Unit 10). From the RAP screen, oversized material is sent to the RAP crusher (Unit 12) by the RAP Screen Recycle Conveyor (Unit 11). From the RAP Crusher, crushed RAP is sent back on the RAP conveyor (Unit 9) to the RAP screen (Unit 10). From the RAP screen, the RAP Transfer Conveyors (Units 13 and 14) transports RAP to the Drum Dryer/Mixer (Unit 16). There the material is dried and asphalt cement is added to make asphalt concrete. From the Drum Dryer/Mixer the asphalt concrete is sent by the Asphalt Drag Conveyor (Unit 17) to the Asphalt Silos (6 total) (Unit 18). Mineral Filler, from the mineral filler silo (Unit 15), will be added to the drum dryer/mixer at a percentage of 1.5% of the asphalt concrete. The mineral filler silo will be loaded by pneumatic truck loading controlled with a baghouse (Unit 15b). The mineral filler silo will be unloaded using a screw conveyor that meters the mineral fill into the drum dryer/mixer. As a substitute to the addition of mineral filler, the plant will use Evotherm. Evotherm will be measured into the drum dryer/mixer during asphalt production with the asphalt cement. Evotherm is a fatty amine derivative that is used as an anti-stripping agent.

Control Units include a Drum Dryer/Mixer Dust Collector (Unit 16b), that captures particulates generated at the Drum Dryer/Mixer. Baghouse fines from the Drum Dryer/Mixer Dust Collector be recycled through a closed loop system back to the drum dryer/mixer. Included in the permit application is additional pollution control equipment installed on the exit of the drum dryer/mixer and asphalt silo loading. For drum drum/mixer unloading (Unit 17) pollution control equipment installed is a recirculation system that captures blue smoke (asphalt fumes, organic PM, carbon monoxide, VOC gases) (Unit 17b), then recirculates the gas back to the drum dryer to be incinerated to reduce these pollutants. It is estimated that the system will reduce these pollutant emissions by 60%.

Fugitive dust is controlled when material exits the Cold Aggregate or RAP Feed Bins to the Cold Aggregate or RAP Feed Bin Collection Conveyors with enclosures to reduce the chance that wind will blow any generated fugitive dust away and/or water sprays, as needed, at the exit of the feed bins.

Fugitive dust is controlled when material exits the Scalping Screen (Unit 4), and RAP Screen (Unit 10) and RAP Crusher (Unit 12) with the addition of water on the material at the Scalping Screen, RAP Screen, and RAP Crusher.

There are no pollution controls for the Aggregate or RAP Storage Piles (Units 1, 7), Aggregate or RAP Feed Bin (Units 2, 8), Asphalt Silos (Unit 18), Hot Oil Asphalt Storage Tanks (Unit 19), or Asphalt Heater (Unit 20).

All truck traffic travels to the HMA Plant is on paved roads (Unit 21). Paved roads will be periodically swept to reduce the buildup of silt on the road surface. Aggregate/RAP material is delivered by trucks and stored in on-site stockpiles.

Annual emissions are controlled by permit limits on annual production for processing equipment and hours of operation for the HMA plant processing. Commercial line power will provide electricity to power the HMA plant.

Process flow diagrams are presented in Attachment A.

Attachment F

Regulatory Applicability Determination

The following is a list of city and federal regulations that may or may not be applicable to Black Rock

Albuquerque/Bernalillo County Regulations

20.11.1 NMAC– General Provisions: Applicable to Black Rock

Requirement: Compliance with ambient air quality standards.

Compliance: Compliance with 20.11.8 NMAC is compliance with this regulation.

20.11.2 NMAC– Permit Fees: Applicable to Black Rock

Requirement: A one-time permit application fee will be assessed by the Albuquerque/Bernalillo County Environmental Department.

Compliance: Black Rock will pay all required permit revision application fees applicable to their facility.

20.11.5 NMAC– Visible Air Contaminants: Applicable to Black Rock

Requirement: Places limits of 20 percent opacity on stationary combustion equipment.

Compliance: Black Rock will perform any required opacity observations using Method 9 and/or Method 22 with certified opacity observers.

20.11.8 NMAC– Ambient Air Quality Standards: Applicable to Black Rock

Requirement: Compliance with all federal, state and local ambient air quality standards.

Compliance: Black Rock HP-2 Plant demonstrated compliance by performing and submitting dispersion modeling analysis for applicable pollutants per Albuquerque/ Bernalillo County and New Mexico State Environmental Department’s modeling guidelines.

20.11.20 NMAC– Airborne Particulate Matter: Applicable to Black Rock

Requirement: Requires the facility to obtain a permit prior to start of surface disturbances.

Compliance: Black Rock will apply for a 20.11.20 NMAC permit prior to start of surface disturbances.

20.11.41 NMAC– Authority to Construct: Applicable to Black Rock

Requirement: Requires the facility to obtain a permit prior to start of construction.

Compliance: Black Rock is applying for a new 20.11.41 NMAC permit with this application.

20.11.49 NMAC– Excess Emissions: Applicable to Black Rock

Requirement: To implement requirements for the reporting of excess emissions and establish affirmative defense provisions for facility owners and operators for excess emissions.

Compliance: Black Rock will report all excess emissions following 20.11.49 NMAC guidelines.

20.11.63 NMAC– New Source Performance Standards: Applicable to Black Rock

Requirement: Adoption of all federal 40 CFR Part 60 new source performance standards.

Compliance: Black Rock will comply with all applicable 40 CFR Part 60 NSPS that have been identified for this facility. For this facility 40 CFR Part 60 Subpart I has been identified as an applicable standard.

20.11.64 NMAC– Emission Standards for Hazardous Air Pollutants for Stationary Sources: Not applicable to Black Rock

Requirement: Adoption of all federal 40 CFR Part 61 and 63 National Emissions Standards for Hazardous Air Pollutants (HAPS).

Compliance: No 40 CFR Part 63 NESHAPS requirements have been identified for this permit application.

20.11.66 NMAC– Process Equipment: Applicable to Black Rock

Requirement: The objective of this Part is to achieve attainment of regulatory air pollution standards and to minimize air pollution emissions.

Compliance: Except as otherwise provided in this section, Black Rock shall not cause or allow the emission of particulate matter to the atmosphere from process equipment in any one hour in total quantities in excess of the amount shown in 20.11.66.18 NMAC Table 1.

20.11.90 NMAC– Administration, Enforcement, Inspection: Applicable to Black Rock

Requirement: General requirement on record keeping and data submission. Black Rock will notify the bureau regarding periods of excess emissions along with cause of the excess and actions taken to minimize duration and recurrence.

Compliance: It is expected that specific record keeping and data submission requirements will be specified in the 20.11.41 NMAC permit issued to Black Rock. It is expected the 20.11.41 NMAC permit issued to Black Rock will contain specific methods for determining compliance with each specific emission limitation. Black Rock's HP-2 HMA Plant will report any periods of excess emissions as required by specific 20.11.90 NMAC provisions.

Federal Regulations

40 CFR 50 – National Ambient Air Quality Standards: Applicable to Black Rock

Requirement: Compliance with federal ambient air quality standards.

Compliance: Black Rock's HP-2 HMA Plant will demonstrate compliance by performing and submitting dispersion modeling analysis for applicable pollutants per the Albuquerque/ Bernalillo County and New Mexico State Environmental Department's modeling guidelines.

40 CFR 60 Kb – NSPS Standards of Performance for Volatile Liquid Storage Vessels: Not applicable to Black Rock

Requirement: For any volatile liquid storage vessel greater than or equal to 75 m^3, but less than 151 m^3 storing liquid with a true vapor pressure less than 15.0 kPa constructed, reconstructed or modified after July 23, 1984 shall keep records of the dimensions and capacity of applicable storage tanks

Compliance: At present, Black Rock will have no volatile liquid storage vessel greater than or equal to 75 m^3 with a vapor pressure less than 15.0 kPa constructed, reconstructed or modified after July 23, 1984.

40 CFR 60 I – NSPS Standards of Performance for Hot Mix Asphalt Facilities: Applicable to Black Rock

Requirement: No facility that commenced construction or modification after June 11, 1973 will discharge or cause to discharge gases containing Particulate Matter in excess of 0.04 gr/dscf. No facility that commenced construction or modification after June 11, 1973 will discharge or cause to discharge gases exhibiting opacities 20 percent or greater.

Compliance: Black Rock will perform any required Method 5 stack testing to show compliance with the 0.04 gr/dscf emission standard. Black Rock will perform any required opacity observations using Method 9 and/or Method 22 with certified opacity observers.

.

Attachment G

Dispersion Modeling Summary

DISPERSION MODEL REPORT
FOR BLACK ROCK SERVICES, LLC
BLACK ROCK SERVICES' HP-2
NEW PERMIT APPICATION

Albuquerque, New Mexico

PREPARED FOR
BLACK ROCK SERVICES, LLC

October 25, 2021

Prepared by

Montrose Air Quality Services, LLC

MONTROSE
AIR QUALITY SERVICES

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1.0 INTRODUCTION

This dispersion modeling analysis will be conducted by Montrose Air Quality Service, LLC (Montrose) on behalf of Black Rock Services, LLC (Black Rock), to evaluate ambient air quality impacts for a new 400 tph hot mix asphalt (HMA) plant to be sited at the northwest corner of Carmony Ln NE and Alexander Blvd NE. Black Rock is applying for a 20.11.41 NMAC Permit. The plant will be identified as Black Rock Services HP-2. The UTM coordinates of the proposed HMA plant will be; 352,000 easting, 3,888,500 northing, Zone 13, NAD 83. The objective of this evaluation is to determine whether ambient air concentrations from the maximum operation of the proposed plant for nitrogen dioxide, carbon monoxide, sulfur dioxide, and particulate matter; both 10 microns or less (PM_{10}) and 2.5 microns or less ($PM_{2.5}$); are below Class II federal and state ambient air quality standards (NAAQS and NMAAQS) found in 40 CFR Part 50 and the City of Albuquerque/Bernalillo County Health Division (AEHD) air quality regulation 20.11.8 NMAC.

The dispersion modeling will be conducted using the American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee Dispersion Model (AERMOD), Version 19191. This model is recommended by EPA for determining Class II impacts within 50 km of the source being assessed. Additionally, AERMOD was developed to handle complex terrain. In this analysis, AERMOD will be used to estimate pollutant ambient air concentrations from the Black Rock HMA emission sources. Montrose employs the general modeling procedures outlined in “Permit Modeling Guidelines, Albuquerque Environmental Health Department”, revised 10/10/2019, “New Mexico Air Pollution Control Bureau, Dispersion Modeling Guidelines”, revised 10/26/2020, and the most up to date EPA’s *Guideline on Air Quality Models*.

Figure 1 below shows the location of the site and proposed equipment layout. Figure 2 shows the equipment process flow for the HMA plant.

HMA plant material handling equipment, stockpiles, and haul roads will be input into the model as volume sources. Exhaust stack sources, drum baghouse, mineral filler silo, and asphalt heater, will be input into the model as point sources. Model input parameters for feeders, screens, RAP crusher, and transfer points will follow the NMED model guidelines Table 27. Model input parameters for haul roads will follow the NMED model guidelines Tables 28 and 29. Model input parameters for storage piles will be based on site conditions and AERMOD volume source methodologies.

Black Rock Services will model any additional neighboring sources identified by the AEHD ADP Modeling Section.

The following modeling restrictions will be requested for this permit application. These limits will be included in the dispersion modeling analysis. The following is a list of these restrictions to be used in the dispersion modeling analysis:

1. The HMA plant will reduce daily throughput to the following;

Month	Tons Per Day
January	4000
February	4000
March	4800
April	6000
May	6000
June	6000
July	6000
August	6000
September	4800
October	4000
November	4000
December	4000

2. With the daily limits discussed above, the maximum annual production is 1,814,800 tons per year. The requested annual permit limit is 1,450,000 tons per year. The annual modeled hourly factor is then 1,450,000/1,814,800 = 0.799.

3. Daily operating hours will be daylight hours for the months of December and January

4. Daily operating hours for the months of February, October, and November are 5 AM to 10 PM.

5. Daily operating hours for the months of March through September are 24 hours per day.

6. Virgin aggregate/RAP/Mineral Filler/Asphalt cement ratios used in estimating material handling particulate emission rates is equal to 57.5/35.0/1.5/6.0. If no RAP is allowed in a mix, the Virgin aggregate/RAP/Mineral Filler/Asphalt cement ratios used in estimating material handling particulate emission rates is equal to 92.5/0.0/1.5/6.0. The maximum plant input for aggregate/RAP is 370 tons per hour at any time. This allows a range for aggregate and RAP to be 230 to 370 tons for aggregate and 140 to 0 for RAP. Particulate emission rates were calculated using maximum aggregate (370 tons per hour) and RAP (140 tons per hour) inputs. Some RAP input to the typical mix rate will be normal operations. Modeling was performed for all 12 modeling scenarios at a RAP mix ratio of 35%. The 3 or 4 highest results from the 12 modeling scenarios were rerun using a maximum aggregate input of 370 tph and a RAP input of 0 tph. While this scenario is not expected to happen, this scenario will generate the highest particulate emission rates from the material handling.

FIGURE 1: Black Rock Services, Inc's 400 TPH HMA Site Layout

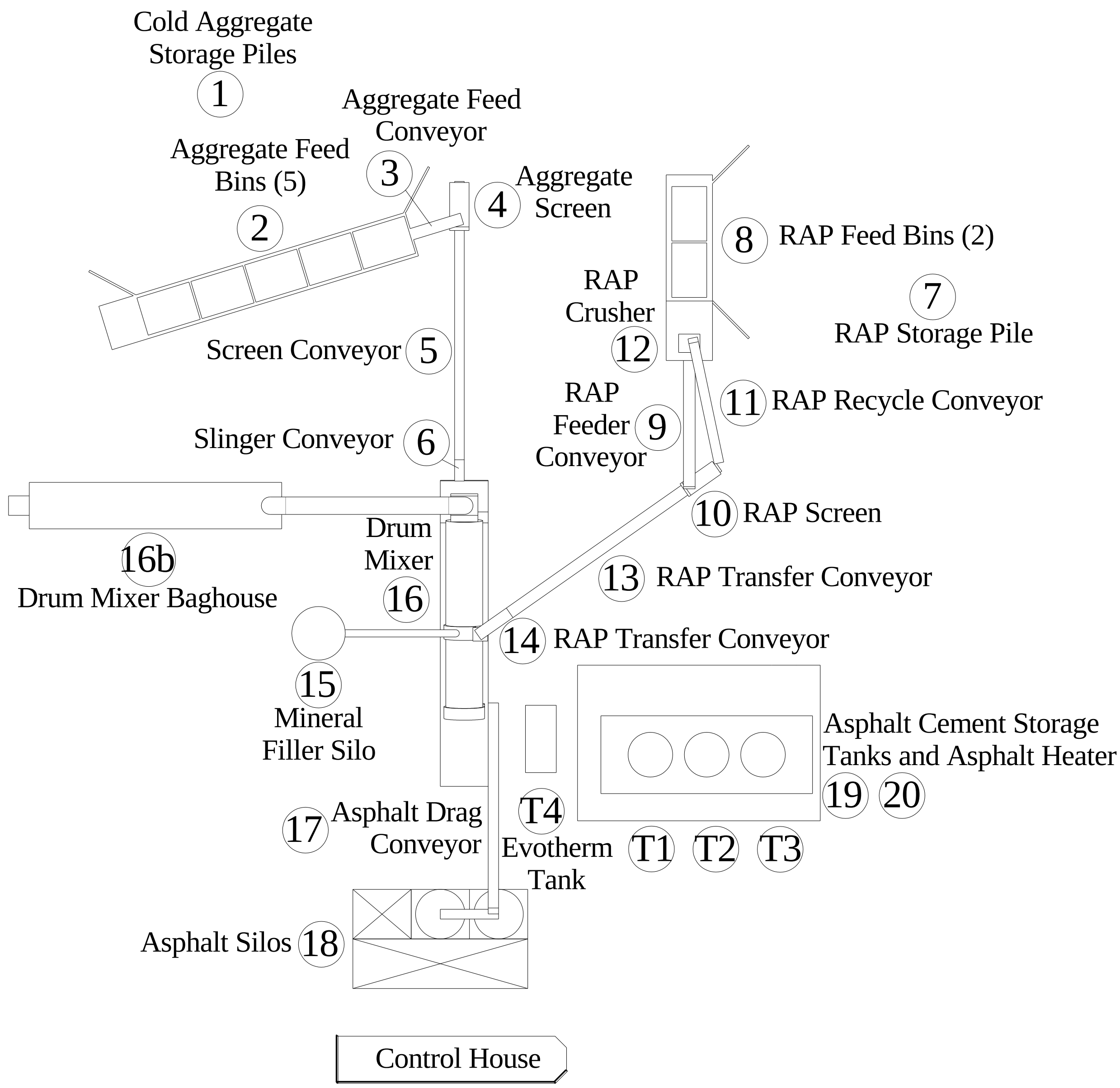

FIGURE 2: Black Rock Services, LLC 400 TPH HMA Layout Plan

2.0 DISPERSION MODELING PROTOCOL

This section identifies the technical approach and dispersion model inputs that will be used for the Class II federal and State ambient air quality standards for this source. AEHD AQP requires that all applicable criteria pollutant emissions be modeled using the most recent versions of US EPA's approved models and be compared with National Ambient Air Quality Standards (NAAQS), and New Mexico Ambient Air Quality Standards (NMAAQS). Table 1 shows the NAAQS and NMAAQS that the source's ambient impacts must meet in order to demonstrate compliance. Table 1 also lists the Class II Significant Impact Levels (SILs) which are used to assess whether a source has a significant impact at downwind receptors.

The dispersion modeling analysis will be performed to estimate concentrations resulting from the operation of the Black Rock HMA sources using the proposed maximum permitted emission rates while all emission sources are operating. The modeling will determine the maximum off-site concentrations for nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), and particulate matter; both 10 microns or less (PM_{10}) and 2.5 microns or less ($PM_{2.5}$), for comparison with modeling significance levels, national/Bernalillo County ambient air quality standards (AAQS). The modeling will follow the guidance and protocols outlined in the "Permit Modeling Guidelines, Albuquerque Environmental Health Department", revised 10/10/2019, "New Mexico Air Pollution Control Bureau, Dispersion Modeling Guidelines", revised 10/26/2020, and the most up to date EPA's *Guideline on Air Quality Models*.

Initial modeling will be performed with Black Rock HMA sources only to determine pollutant and averaging periods that exceeds pollutant SILs. For the particulate initial modeling, the highest emission rates from material handling for an aggregate input of 370 tph and a RAP input of 140 tph was used. This cannot happen because the maximum rated asphalt production is 400 tph, but it will generate the largest radius of impact and be very conservative.

If initial modeling for any pollutant and averaging period exceeds SILs, then cumulative modeling will be performed for those pollutants and averaging periods for all receptors that exceeds the SILs and will include any identified neighboring sources and background ambient concentrations. Table 1 lists the SILs, NAAQS and NMAAQS for each pollutant averaging period. Table 2 lists ambient air quality standards in which modeling is not required by NMED AQB.

TABLE 1: National and New Mexico Ambient Air Quality Standard Summary

Pollutant	Avg. Period	Sig. Lev. (μg/m³)	Class I Sig. Lev. (μg/m³)	NAAQS	NMAAQS	PSD Increment Class I	PSD Increment Class II
CO	8-hour	500		9,000 ppb(1)	8,700 ppb(2)		
	1-hour	2,000		35,000 ppb(1)	13,100 ppb(2)		
NO_2	annual	1.0	0.1	53 ppb(3)	50 ppb(2)	2.5 μg/m³	25 μg/m³
	24-hour	5.0			100 ppb(2)		
	1-hour	7.52		100 ppb(4)			
$PM_{2.5}$	annual	0.2	0.05	12 μg/m³(5)		1 μg/m³	4 μg/m³
	24-hour	1.2	0.27	35 μg/m³(6)		2 μg/m³	9 μg/m³
PM_{10}	annual	1.0	0.2			4 μg/m³	17 μg/m³
	24-hour	5.0	0.3	150 μg/m³(7)		8 μg/m³	30 μg/m³
SO_2	annual	1.0	0.1		20 ppb(2)	2 μg/m³	20 μg/m³
	24-hour	5.0	0.2		100 ppb(2)	5 μg/m³	91 μg/m³
	3-hour	25.0	1.0	500 ppb(1)		25 μg/m³	512 μg/m³
	1-hour	7.8		75 ppb(8)			

Standards converted from ppb to μg/m³ use a reference temperature of 25° C and a reference pressure of 760 millimeters of mercury.
(1) Not to be exceeded more than once each year.
(2) Not to be exceeded.
(3) Annual mean.
(4) 98th percentile of 1-hour daily maximum concentrations, averaged over 3 years.
(5) Annual mean, averaged over 3 years.
(6) 98th percentile, averaged over 3 years.
(7) Not to be exceeded more than once per year on average over 3 years.
(8) 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years.

TABLE 2: Standards for Which Modeling Is Not Required by NMED AQB

Standard not Modeled	Surrogate that Demonstrates Compliance
CO 8-hour NAAQS	CO 8-hour NMAAQS
CO 1-hour NAAQS	CO 1-hour NMAAQS
NO_2 annual NAAQS	NO_2 annual NMAAQS
NO_2 24-hour NMAAQS	NO_2 1-hour NAAQS
O_3 8-hour	Regional modeling
SO_2 annual NMAAQS	SO_2 1-hour NAAQS
SO_2 24-hour NMAAQS	SO_2 1-hour NAAQS
SO_2 3-hour NAAQS	SO_2 1-hour NAAQS

2.1 DISPERSION MODEL SELECTION

The dispersion modeling will be conducted using the American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee Dispersion Model (AERMOD), Version 21112. This model is recommended by EPA for determining Class II impacts within 50 km of the source being assessed. Additionally, AERMOD was developed to handle complex terrain. In this analysis, AERMOD will be used to estimate pollutant ambient air concentrations for nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), and particulate matter; both 10 microns or less (PM_{10}) and 2.5 microns or less ($PM_{2.5}$), from Black Rock's HMA plant emission sources.

AERMOD is a Gaussian plume dispersion model that is based on planetary boundary layer principles for characterizing atmospheric stability. The model evaluates the non-Gaussian vertical behavior of plumes during convective conditions with the probability density function and the superposition of several Gaussian plumes. The AERMOD modeling system has three components: AERMAP, AERMET, and AERMOD. AERMAP is the terrain preprocessor program. AERMET is the meteorological data preprocessor. AERMOD includes the dispersion modeling algorithms and was developed to handle simple and complex terrain issues using improved algorithms. AERMOD uses the dividing streamline concept to address plume interactions with elevated terrain. AERMOD will be run using all the regulatory default options.

2.2 BUILDING WAKE EFFECTS

Drum mixer dust collector structure, mineral filler silo, asphalt cement (3) tanks, and asphalt storage (6) silos are located at the site. These structures, silos, and tanks located near point sources will be included in building downwash calculations.

2.3 METEOROLOGICAL DATA

Dispersion model meteorological input file to be used in this modeling analysis are years 2014 - 2018 Albuquerque met data (AERMET version 19191 dated 01/31/2020) available from the AEHD AQP.

2.4 RECEPTORS AND TOPOGRAPHY

Modeling will be completed using as many receptor locations to ensure that the maximum estimated impacts are identified. Initial combustion source radius of impact modeling will be performed with receptors within 20 kilometers of the model boundary. Initial particulate matter source radius of impact modeling will be performed with receptors within 3 kilometers of the model boundary. Because of the nature of the emissions from the site, it is expected the maximum concentrations will be on or near the site fenceline.

The refined receptor grid will include receptors located at 50 meters spacing from the model boundary out to 500 meters from the property line, 100 meters spacing from 500 meters out to 1000 meters, 250 meters spacing from 1000 meters out to 3000 meters, 500 meters spacing from

3000 meters out to 5000 meters, and 1000 meters spacing from 5000 meters out to 20000 meters. Fenceline receptor spacing will be 25 meters.

All refined model receptors will be preprocessed using the AERMAP software (version 18081) associated with AERMOD. The AERMAP software establishes a base elevation and a height scale for each receptor location. The height scale is a measure of the receptor's location and base elevation and its relation to the terrain feature that has the greatest influence in dispersion for that receptor. AERMAP will be run using U.S. Geological Survey (USGS) national elevation data (NED) processed with AERSURFACE (version 20060). Output from AERMAP will be used as input to the AERMOD runstream file for each model run.

2.5 MODELED EMISSION SOURCES INPUTS

For this new permit application, the proposed operating time for the HMA plant production will be daylight hours for the months of December and January, 5 AM to 10 PM for the months of February, October, and November, and 24 hours per day for the months of March through September. Black Rock will take site-specific conditions on daily HMA operating throughput. For the months of December and January, the daily throughput will be limited to 4000 tons (10 hours maximum at 400 tph during daylight hours). For the months of October, November, and February, the daily throughput will be limited to 4000 tons (10 hours maximum at 400 tph from 5 AM to 10 PM). For the months of March and September, the daily throughput will be limited to 4800 tons (12 hours maximum at 400 tph for 24 hours per day). For the months of April through August, the daily throughput will be limited to 6000 tons (15 hours maximum at 400 tph for 24 hours per day). Total asphalt production hours of operation of the HMA plant are presented in Table 3. For modeling, the hourly blocks vary starting from midnight then shifting on 2-hour intervals for the 24-hour period or 12 separate model runs as summarized in Tables 4 and 5.

For annual averaging period $PM_{2.5}$ dispersion modeling, the HMA plant hourly emission factor included in the model is based on the annual throughput limit. The HMA plant will limit throughput to 400 tons per hour and 1,450,000 tons per year. If the HMA plant were run 365 days per year at the daily limits discussed above, that would be equivalent to 1,814,800 tons per year. For HMA annual model, the hourly emission factor reduces the hourly emission factor to 0.799 (1,450,000/1,814,800) for all throughput-based emission rate sources.

TABLE 3: HMA Asphalt Production Hours of Operation (MST)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
12:00 AM	0	0	1	1	1	1	1	1	1	0	0	0
1:00 AM	0	0	1	1	1	1	1	1	1	0	0	0
2:00 AM	0	0	1	1	1	1	1	1	1	0	0	0
3:00 AM	0	0	1	1	1	1	1	1	1	0	0	0
4:00 AM	0	0	1	1	1	1	1	1	1	0	0	0
5:00 AM	0	1	1	1	1	1	1	1	1	1	1	0
6:00 AM	0	1	1	1	1	1	1	1	1	1	1	0
7:00 AM	1	1	1	1	1	1	1	1	1	1	1	1
8:00 AM	1	1	1	1	1	1	1	1	1	1	1	1
9:00 AM	1	1	1	1	1	1	1	1	1	1	1	1
10:00 AM	1	1	1	1	1	1	1	1	1	1	1	1
11:00 AM	1	1	1	1	1	1	1	1	1	1	1	1
12:00 PM	1	1	1	1	1	1	1	1	1	1	1	1
1:00 PM	1	1	1	1	1	1	1	1	1	1	1	1
2:00 PM	1	1	1	1	1	1	1	1	1	1	1	1
3:00 PM	1	1	1	1	1	1	1	1	1	1	1	1
4:00 PM	1	1	1	1	1	1	1	1	1	1	1	1
5:00 PM	0.5	1	1	1	1	1	1	1	1	1	1	0
6:00 PM	0	1	1	1	1	1	1	1	1	1	1	0
7:00 PM	0	1	1	1	1	1	1	1	1	1	1	0
8:00 PM	0	1	1	1	1	1	1	1	1	1	1	0
9:00 PM	0	1	1	1	1	1	1	1	1	1	1	0
10:00 PM	0	0	1	1	1	1	1	1	1	0	0	0
11:00 PM	0	0	1	1	1	1	1	1	1	0	0	0
Total	10.5	17	24	24	24	24	24	24	24	17	17	10

TABLE 4: HMA Model Scenario Time Segments

Model Scenario	Time Segments 10-Hour Blocks December	Time Segments 10-Hour Blocks January	Time Segments 10-Hour Blocks February, October & November
1	7 AM to 5 PM	7 AM to 5 PM	5 AM to 3 PM
2	7 AM to 5 PM	7 AM to 5 PM	7 AM to 5 PM
3	7 AM to 5 PM	7 AM to 5 PM	9 AM to 7 PM
4	7 AM to 5 PM	7 AM to 5 PM	11 AM to 9 PM
5	7 AM to 5 PM	7 AM to 5 PM	12 PM to 10 PM
6	7 AM to 5 PM	7 AM to 5 PM	5 AM to 3 PM
7	7 AM to 5 PM	7:30 AM to 5:30 PM	5 AM to 3 PM
8	7 AM to 5 PM	7:30 AM to 5:30 PM	5 AM to 3 PM
9	7 AM to 5 PM	7:30 AM to 5:30 PM	5 AM to 3 PM
10	7 AM to 5 PM	7:30 AM to 5:30 PM	5 AM to 3 PM
11	7 AM to 5 PM	7:30 AM to 5:30 PM	5 AM to 3 PM
12	7 AM to 5 PM	7:30 AM to 5:30 PM	5 AM to 3 PM

TABLE 5: HMA Model Scenario Time Segments

Model Scenario	Time Segments 12-Hour Blocks March & September	Time Segments 15-Hour Blocks April - August
1	12 AM to 12 PM	12 AM to 3 PM
2	2 AM to 2 PM	2 AM to 5 PM
3	4 AM to 4 PM	4 AM to 7 PM
4	6 AM to 6 PM	6 AM to 9 PM
5	8 AM to 8 PM	8 AM to 11 PM
6	10 AM to 10 PM	10 AM to 1 AM
7	12 PM to 12 AM	12 PM to 3 AM
8	2 PM to 2 AM	2 PM to 5 AM
9	4 PM to 4 AM	4 PM to 7 AM
10	6 PM to 6 AM	6 PM to 9 AM
11	8 PM to 8 AM	8 PM to 11 AM
12	10 PM to 10 AM	10 PM to 1 PM

2.5.1 Black Rock HP-2 HMA Road Vehicle Traffic Model Inputs

The access road fugitive dust for truck traffic will be modeled as a line of volume sources. The NMED AQB's approved procedure for Modeling Haul Roads will be followed to develop modeling input parameters for haul roads. Volume source characterization followed the steps described in the Air Quality Bureau's Guidelines.

2.5.2 Black Rock HP-2 HMA Material Handling Volume Source Model Inputs

Particulate emissions from material handling and process from both HMA and RAP/Concrete plants will be modeled as volume sources. Model input parameters for feeders, crushers, screens, and transfer points follow the NMED AQB model guidelines Table 27. Model input parameters for storage piles will be based on site conditions (release height 8 feet, pile width 60 feet) and AERMOD volume source methodologies.

2.5.3 Black Rock HP-2 HMA Point Source Model Inputs

Emissions from exhaust stacks from both HMA plants will be modeled as point sources. Model input parameters are based on actual release height, release diameter, release velocity or flow rate, and release temperature. For exhaust releases at ambient temperature, the modeled temperature input will be zero Kelvin. For horizontal or raincap releases, the AERMOD option for horizontal and raincap releases will be used with actual release parameters. For Black Rock mineral filler silo (Unit 15), it will be modeled as a horizontal release. For Black Rock asphalt heater (Unit 20), it will be modeled as a raincap release.

Tables 6, 7, 8 and 9 summarize the model inputs for the Black Rock 400 TPH HMA Plant operating with 35% RAP input. Table 10 summarizes the material handling and traffic particulate emission rates with the plant operating at 0% RAP input.

TABLE 6: Summary of Model Inputs for Point Sources at the Black Rock HMA Plant – Combustion

Source Description	Model ID	Stack Height (m)	Stack Temp. (K)	Exit Vel. (m/s)	Stack Dia. (m)	NOx Emission Rate (lb/hr)	CO Emission Rate (lb/hr)	SO2 Emission Rate (lb/hr)
Black Rock HMA Baghouse Stack Unit 16	HMASTK	7.0676	388.7056	22.8262	1.4051	10.40000	52.00000	1.36000
Black Rock HMA Asphalt Cement Heater Unit 20	HMAHEAT	3.6576	588.7100	6.3128	0.3048	0.26000	0.21840	0.00557

TABLE 7: Summary of Model Inputs for Point Sources at the Black Rock HMA Plant - Particulate

Source Description	Model ID	Stack Height (m)	Stack Temp. (K)	Exit Vel. (m/s)	Stack Dia. (m)	PM10 Emission Rate (lb/hr)	PM2.5 Emission Rate (lb/hr)
BR HMA Baghouse Stack Unit 16	HMASTK	7.0676	388.7056	22.8262	1.4051	9.20000	9.20000
BR HMA Asphalt Cement Heater Unit 20	HMAHEAT	3.6576	588.7100	6.3128	0.3048	0.01976	0.01976
BR HMA Mineral Filler Silo Loading Unit 15	HMAFILL	14.3256	0.0000	12.9361	0.1524	0.11750	0.02712

TABLE 8: Summary of Model Inputs at the Black Rock HMA Plant – Asphalt Fumes – Asphalt Cement Storage Tanks

Source Description	Model ID	Stack Height (m)	Stack Temp. (K)	Exit Vel. (m/s)	Stack Dia. (m)	Asphalt Fumes Emission Rate (lb/hr)
BR Asphalt Cement Storage Tank #1 Unit 19	ASPHTNK1	18.7452	449.8200	0.0010	0.0010	0.00031
BR Asphalt Cement Storage Tank #2 Unit 19	ASPHTNK2	18.7452	449.8200	0.0010	0.0010	0.00031
BR Asphalt Cement Storage Tank #3 Unit 19	ASPHTNK3	18.7452	449.8200	0.0010	0.0010	0.00031

TABLE 9: Summary of Model Inputs for Volume Sources at the Black Rock HMA Plant – Particulate for 35% RAP Input -140 tph

Source Description	Model ID	Release Height (meter)	Horizontal Dimension (meters)	Vertical Dimension (meters)	PM10 Emission Rate (lb/hr)	PM2.5 Emission Rate (lb/hr)	CO Emission Rate (lb/hr)
BR HMA Asphalt Silo Loading Unit 17	DRUMUNL	2.0000	0.4700	0.9300	0.09374	0.09374	0.18880
BR HMA Asphalt Silo Unloading Unit 18	HMASILO	4.0000	0.4700	0.9300	0.11648	0.11648	0.17443
BR HMA Storage Pile Handling 1 Unit 1	HMAPILE1	2.4384	4.2500	2.2677	0.10270	0.01555	
BR HMA Storage Pile Handling 2 Unit 1	HMAPILE2	2.4384	4.2500	2.2677	0.10270	0.01555	
BR HMA Storage Pile Handling 3 Unit 1	HMAPILE3	2.4384	4.2500	2.2677	0.10270	0.01555	
BR HMA Storage Pile Handling 4 Unit 1	HMAPILE4	2.4384	4.2500	2.2677	0.10270	0.01555	
BR HMA Storage Pile Handling 5 Unit 1	HMAPILE5	2.4384	4.2500	2.2677	0.10270	0.01555	
BR HMA Bin Loading Bin 1 Unit 2	HMABIN1	6.0000	1.1600	2.3300	0.10270	0.01555	
BR HMA Bin Loading Bin 2 Unit 2	HMABIN2	6.0000	1.1600	2.3300	0.10270	0.01555	
BR HMA Bin Loading Bin 3 Unit 2	HMABIN3	6.0000	1.1600	2.3300	0.10270	0.01555	
BR HMA Bin Loading Bin 4 Unit 2	HMABIN4	6.0000	1.1600	2.3300	0.10270	0.01555	
BR HMA Bin Loading Bin 5 Unit 2	HMABIN5	6.0000	1.1600	2.3300	0.10270	0.01555	
BR HMA Bin Unloading Unit 3	HMATP1	2.0000	0.4700	0.9300	0.01058	0.00299	
BR HMA Scalping Screen Unit 4	HMASCR	4.0000	1.1600	2.3300	0.17020	0.01150	
BR HMA Scalping Screen Unloading Unit 5	HMATP2	2.0000	0.4700	0.9300	0.01058	0.00299	
BR HMA Conveyor to Sling Conveyor Unit 6	HMATP3	2.0000	0.4700	0.9300	0.01058	0.00299	
BR HMA RAP Storage Pile Handling Unit 7	RAPPILE	2.4384	4.2500	2.2677	0.09377	0.01420	

Source Description	Model ID	Release Height (meter)	Horizontal Dimension (meters)	Vertical Dimension (meters)	PM10 Emission Rate (lb/hr)	PM2.5 Emission Rate (lb/hr)	CO Emission Rate (lb/hr)
BR HMA RAP Bin 1 Loading Unit 8	RAPBIN1	6.0000	1.1600	2.3300	0.04688	0.00710	
BR HMA RAP Bin 2 Loading Unit 8	RAPBIN2	6.0000	1.1600	2.3300	0.04688	0.00710	
BR HMA RAP Bin Unloading Unit 9	RAPTP1	2.0000	0.4700	0.9300	0.00644	0.00182	
BR HMA RAP Screen Unit 10	RAPSCR	4.0000	1.1600	2.3300	0.10360	0.00700	
BR HMA RAP Screen Recycle Unloading Unit 11	RAPTP2	2.0000	0.4700	0.9300	0.00644	0.00182	
BR HMA RAP Crusher Unit 12	RAPCRH	6.0000	1.1600	2.3300	0.07560	0.01400	
BR HMA RAP Screen Unloading Unit 13	RAPTP3	2.0000	0.4700	0.9300	0.00644	0.00182	
BR HMA RAP Transfer Point Unit 14	RAPTP4	2.0000	0.4700	0.9300	0.00644	0.00182	
Black Rock HMA Haul Road Paved Asphalt Volume 1-12 (each source)	AS_0001-12	3.4000	6.0500	3.1600	0.00551	0.00135	
Black Rock HMA Haul Road Paved Asphalt Volume 7-12 (each source)	AS_0007-11	3.4000	6.0500	3.1600			0.02347
Black Rock HMA Haul Road Paved Evotherm, Mineral Filler, Asphalt Cement, RAP Volume 1-17 (each source)	CM_0001-17	3.4000	6.0500	3.1600	0.00222	0.00055	
Black Rock HMA Haul Road Paved Mineral Filler Volume 1-14 (each source)	MF_0001-14	3.4000	6.0500	3.1600	0.00008	0.00002	
Black Rock HMA Haul Road Paved Aggregate Volume 1-8 (each source)	AG_0001-8	3.4000	6.0500	3.1600	0.00598	0.00147	

TABLE 10: Summary of Model Inputs for Volume Sources at the Black Rock HMA Plant – Particulate for 0% RAP Input

Source Description	Model ID	Release Height (meter)	Horizontal Dimension (meters)	Vertical Dimension (meters)	PM10 Emission Rate (lb/hr)	PM2.5 Emission Rate (lb/hr)	CO Emission Rate (lb/hr)
BR HMA Asphalt Silo Loading Unit 17	DRUMUNL	2.0000	0.4700	0.9300	0.09374	0.09374	0.18880
BR HMA Asphalt Silo Unloading Unit 18	HMASILO	4.0000	0.4700	0.9300	0.11648	0.11648	0.17443
BR HMA Storage Pile Handling 1 Unit 1	HMAPILE1	2.4384	4.2500	2.2677	0.16521	0.02502	
BR HMA Storage Pile Handling 2 Unit 1	HMAPILE2	2.4384	4.2500	2.2677	0.16521	0.02502	
BR HMA Storage Pile Handling 3 Unit 1	HMAPILE3	2.4384	4.2500	2.2677	0.16521	0.02502	
BR HMA Storage Pile Handling 4 Unit 1	HMAPILE4	2.4384	4.2500	2.2677	0.16521	0.02502	
BR HMA Storage Pile Handling 5 Unit 1	HMAPILE5	2.4384	4.2500	2.2677	0.16521	0.02502	
BR HMA Bin Loading Bin 1 Unit 2	HMABIN1	6.0000	1.1600	2.3300	0.16521	0.02502	
BR HMA Bin Loading Bin 2 Unit 2	HMABIN2	6.0000	1.1600	2.3300	0.16521	0.02502	
BR HMA Bin Loading Bin 3 Unit 2	HMABIN3	6.0000	1.1600	2.3300	0.16521	0.02502	
BR HMA Bin Loading Bin 4 Unit 2	HMABIN4	6.0000	1.1600	2.3300	0.16521	0.02502	
BR HMA Bin Loading Bin 5 Unit 2	HMABIN5	6.0000	1.1600	2.3300	0.16521	0.02502	
BR HMA Bin Unloading Unit 3	HMATP1	2.0000	0.4700	0.9300	0.01702	0.00481	
BR HMA Scalping Screen Unit 4	HMASCR	4.0000	1.1600	2.3300	0.27380	0.01850	
BR HMA Scalping Screen Unloading Unit 5	HMATP2	2.0000	0.4700	0.9300	0.01702	0.00481	
BR HMA Conveyor to Sling Conveyor Unit 6	HMATP3	2.0000	0.4700	0.9300	0.01702	0.00481	
BR HMA RAP Storage Pile Handling Unit 7	RAPPILE	2.4384	4.2500	2.2677	0.00000	0.00000	
BR HMA RAP Bin 1 Loading Unit 8	RAPBIN1	6.0000	1.1600	2.3300	0.00000	0.00000	

Source Description	Model ID	Release Height (meter)	Horizontal Dimension (meters)	Vertical Dimension (meters)	PM10 Emission Rate (lb/hr)	PM2.5 Emission Rate (lb/hr)	CO Emission Rate (lb/hr)
BR HMA RAP Bin 2 Loading Unit 8	RAPBIN2	6.0000	1.1600	2.3300	0.00000	0.00000	
BR HMA RAP Bin Unloading Unit 9	RAPTP1	2.0000	0.4700	0.9300	0.00000	0.00000	
BR HMA RAP Screen Unit 10	RAPSCR	4.0000	1.1600	2.3300	0.00000	0.00000	
BR HMA RAP Screen Recycle Unloading Unit 11	RAPTP2	2.0000	0.4700	0.9300	0.00000	0.00000	
BR HMA RAP Crusher Unit 12	RAPCRH	6.0000	1.1600	2.3300	0.00000	0.00000	
BR HMA RAP Screen Unloading Unit 13	RAPTP3	2.0000	0.4700	0.9300	0.00000	0.00000	
BR HMA RAP Transfer Point Unit 14	RAPTP4	2.0000	0.4700	0.9300	0.00000	0.00000	
Black Rock HMA Haul Road Paved Asphalt Volume 1-12 (each source)	AS_0001-12	3.4000	6.0500	3.1600	0.00551	0.00135	
Black Rock HMA Haul Road Paved Asphalt Volume 7-12 (each source)	AS_0007-12	3.4000	6.0500	3.1600			0.02347
Black Rock HMA Haul Road Paved Evotherm, Mineral Filler, Asphalt Cement, RAP Volume 1-17 (each source)	CM_0001-17	3.4000	6.0500	3.1600	0.00033	0.00008	
Black Rock HMA Haul Road Paved Mineral Filler Volume 1-14 (each source)	MF_0001-14	3.4000	6.0500	3.1600	0.00008	0.00002	
Black Rock HMA Haul Road Paved Aggregate Volume 1-8 (each source)	AG_0001-8	3.4000	6.0500	3.1600	0.00963	0.00236	

2.6 NO_2 DISPERSION MODELING ANALYSIS

The AERMOD model predicts ground-level concentrations of any generic pollutant without chemical transformations. Thus, the modeled NO_X emission rate will give ground-level modeled concentrations of NO_X. NAAQS values are presented as NO_2.

EPA has a three-tier approach to modeling NO_2 concentrations.

- Tier I – total conversion, or all $NOx = NO_2$
- Tier II –Ambient Ratio Method 2 (ARM2)
- Tier III – case-by-case detailed screening methods, such as OLM and Plume Volume Molar Ratio Method (PVMRM) and NO_2/NO_X in-stack ratio

Initial modeling will be performed using both Tier I or Tier II methodologies. If these modeling iterations demonstrate that less conservative methods for determining 1-hour and annual NO_2 compliance would be needed for this project, then ambient impact of 1-hour and annual NOx predicted by the model will use Tier III – OLM or PVMRM.

For ARM2, two inputs can be selected in the model. For this modeling analysis, EPA default minimum and maximum ambient NO_2/NO_X ratio for the ambient air of 0.5 and 0.9, respectively were selected. For OLM or PVMRM, three inputs can be selected in the model, the ISR, the NO_2/NO_X equilibrium ratio for the ambient air, and the ambient ozone concentration. The ISR will be determined for each source or group of sources. The NO_2/NO_X equilibrium ratio will be the EPA default of 0.90. Ozone input will be from monitored ozone data collected from city monitoring station.

No data could be found for a hot mix asphalt drum, so to be conservative, the EPA default ISR of 0.50 will be used. For heater natural gas combustion, to be conservative, the EPA default ISR of 0.50 will be used. For neighboring sources, since the ISR has a diminishing impact on ambient NO_2/NO_X ratios as a plume is transported farther downwind due to mixing and reaction towards background ambient NO_2/NO_X ratios, an ISR of 0.20[1] in lieu of source specific data will be used for sources more than a kilometer away, an ISR of 0.30 for sources within 1 kilometer, and source specific ISR for adjacent property sources.

Model Ozone Data

For OLM or PVMRM, modeling of the project-generated 1-hour NO_2 concentrations requires use of ambient monitored O_3 concentrations. This ozone data was provided by the AEHD AQP from Del Norte monitoring station data.

[1] Technical support document (TSD) for NO2-related AERMOD modifications, EPA- 454/B-15-004, July 2015

2.7 $PM_{2.5}$ SECONDARY EMISSIONS MODELING

Particulate matter includes both "primary" PM, which is directly emitted into the air, and "secondary" PM, which forms indirectly from fuel combustion and other sources. Primary PM consists of carbon (soot)—emitted from cars, trucks, heavy equipment, forest fires, and burning waste—and crustal material from unpaved roads, stone crushing, construction sites, and metallurgical operations. Secondary PM forms in the atmosphere from gases. Some of these reactions require sunlight and/or water vapor. Secondary PM includes:

- Sulfates formed from sulfur dioxide emissions from power plants and industrial facilities;
- Nitrates formed from nitrogen oxide emissions from cars, trucks, industrial facilities, and power plants; and
- Carbon formed from reactive organic gas emissions from cars, trucks, industrial facilities, forest fires, and biogenic sources such as trees.

AERMOD does not account for secondary formation of $PM_{2.5}$ for near-field modeling. Any secondary contribution of the Black Rock HMA source emissions is not explicitly accounted for in the model results. While representative background monitoring data for $PM_{2.5}$ should adequately account for secondary contribution from existing background sources, the Black Rock assessment of their potential contribution to cumulative impacts as secondary $PM_{2.5}$ was performed based on guidance from the NMED Modeling Section. The permit application for Black Rock HMA emissions of precursors include:

- Nitrogen Oxides (NO_X) – 20.0 tons per year (above SER)
- Sulfur Dioxides (SO_2) – 2.49 tons per year (below SER)
- Volatile Organic Carbon (VOC) – 28.9 tons per year (below SER)
- Particulate 2.5 micron or less ($PM_{2.5}$) – 17.6 tons per year (above SER).

$PM_{2.5}$ secondary emission concentration analysis will follow EPA and NMED AQB guidelines. Following recent EPA guidelines for conversion of NO_X and SO_2 emission rates to secondary $PM_{2.5}$ emissions, Black Rock HMA emissions are compared to appropriate western MERPs values (NO_X 24 Hr – 1155 tpy; NO_X Annual – 3184 tpy; SO_2 24 Hr – 225 tpy; SO_2 Annual – 2289 tpy). The following equation, found in NMED AQB modeling guidance document on MERPs, will be added to determine if secondary emission would cause violation with $PM_{2.5}$ NAAQS.

$$PM_{2.5}\ \text{annual} = ((NO_X\ \text{emission rate (tpy)}/3184 + (SO_2\ \text{emission rate (tpy)}/2289)) \times 0.2\ \mu g/m^3$$

$$PM_{2.5}\ \text{annual} = ((20.0/3184) + (2.49/2289)) \times 0.2\ \mu g/m^3 = \mathbf{0.0015\ \mu g/m^3}$$

$$PM_{2.5}\ \text{24 hour} = ((NO_X\ \text{emission rate (tpy)}/1155 + (SO_2\ \text{emission rate (tpy)}/225)) \times 1.2\ \mu g/m^3$$

$$PM_{2.5}\ \text{24 hour} = ((20.0/1155) + (2.49/225)) \times 1.2\ \mu g/m^3 = \mathbf{0.034\ \mu g/m^3}$$

2.8 AMBIENT MODELING BACKGROUND

Ambient background concentrations, based on the Del Norte Monitoring Station for CO, NO_2, SO_2, and $PM_{2.5}$, and Jefferson for PM_{10}, will be added to the dispersion modeling results and compared to the NAAQS and NMAAQS. Background concentrations were obtained from the AEHD AQP Modeling Section and 2021 Annual Monitoring Report.

CO 1-hr:	2366 micrograms per cubic meter
CO 8-hr:	1450 micrograms per cubic meter
NO_2 Annual:	30 micrograms per cubic meter
SO_2 1-hr:	13.1 micrograms per cubic meter
PM_{10} 24-hr:	28 micrograms per cubic meter
$PM_{2.5}$ 24-hr:	16 micrograms per cubic meter
$PM_{2.5}$ annual:	5.8 micrograms per cubic meter

NO_2 1-hour Background data

NO_2 1-hour background data was developed by the AEHD AQP based on the Tier 2 procedure found in EPA guidance documents[2] for determining background concentrations.

> *"Based on this guidance, we believe that an appropriate methodology for incorporating background concentrations in the cumulative impact assessment for the 1-hour NO_2 standard would be to use multiyear averages of the 98th-percentile of the available background concentrations by season and hour-of-day, excluding periods when the source in question is expected to impact the monitored concentration (which is only relevant for modified sources). For situations involving a significant mobile source component to the background monitored concentrations, inclusion of a day-of-week component to the temporal variability may also be appropriate. The rank associated with the 98th-percentile of daily maximum 1-hour values should be generally consistent with the number of "samples" within that distribution for each combination based on the temporal resolution but also account for the number of samples "ignored" in specifying the 98th-percentile based on the annual distribution. For example, Table 1 in Section 5 of Appendix S specifies the rank associated with the 98th-percentile value based on the annual number of days with valid data. Since the number of days per season will range from 90 to 92, Table 1 would indicate that the 2nd-highest value from the seasonal distribution should be used to represent the 98th-percentile. On the other hand, use of the 2nd-highest value for each season would effectively "ignore" only 4 values for the year rather than the 7 values "ignored" from the annual distribution. Balancing these considerations, we recommend that background values by season and hour-of-day used in this context should be based on the 3rd-highest value for each season and hour-of-day combination, whereas the 8th-highest value should be used if values vary by hour-of-day only. For more detailed temporal pairing, such as season by hour-of- day and day-of-week or month by hour-of-day, the 1st-highest values from the distribution for each temporal combination should be used."*

[2] Memo: "Additional Clarification Regarding Application of Appendix W Modeling Guidance for 1-hour N02 National Ambient Air Quality Standard" Tyler Fox, Leader, Air Quality Modeling Group, C439-01, dated March 1, 2011.

The NO_2 background data was provided by the AEHD AQP Modeling Section and is presented below in Table 11.

TABLE 11: Monitored Seasonal NO_2 Background – 3rd Highest Hourly µg/m^3

Hour	Winter	Spring	Summer	Fall
1	72.1	47.6	29.3	65.6
2	67.8	48.3	27.7	59.7
3	67.7	46.0	26.4	57.9
4	68.4	48.9	26.6	58.9
5	69.1	51.7	32.7	58.0
6	69.7	63.9	39.3	57.8
7	72.8	70.7	46.4	63.5
8	77.6	71.8	48.5	64.5
9	80.0	61.1	34.2	65.9
10	71.4	48.0	27.3	55.0
11	62.0	28.6	24.3	47.3
12	48.1	18.9	19.9	35.4
13	36.9	17.6	17.0	28.2
14	35.1	15.7	15.9	25.3
15	33.6	14.8	17.4	24.2
16	37.2	15.3	19.4	28.0
17	48.4	17.1	20.4	38.0
18	73.0	19.4	19.3	69.6
19	79.3	38.5	21.7	79.1
20	78.1	53.2	30.9	77.1
21	77.3	48.0	34.1	73.4
22	76.5	56.3	30.8	70.4
23	75.0	58.8	34.9	69.7
24	72.4	57.9	33.6	70.9

3.0 MODEL SUMMARY

This section summarizes the model results, following the technical approach discussed in Section 2 of this report for Class II federal ambient air quality standards for this facility. Model results show for each criteria pollutant and applicable averaging periods for nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), and particulate matter with aerodynamic diameter less than 10 micrometers (PM_{10}) and particulate matter with aerodynamic diameter less than 2.5 micrometers ($PM_{2.5}$), the proposed HP-2 hot mix asphalt plant does not contribute to an exceedance of the national/New Mexico ambient air quality standards (AAQS). The modeling followed the guidance and protocols outlined in the protocol found in Section 2 of this report, the modeling procedures outlined in "Permit Modeling Guidelines, Albuquerque Environmental Health Department", revised 10/10/2019, "New Mexico Air Pollution Control Bureau, Dispersion Modeling Guidelines", revised 10/26/2020, and the most up to date EPA's *Guideline on Air Quality Models*.

The following modeling restrictions are requested for this permit application. These limits are included in the dispersion modeling analysis. The following is a list of these restrictions used in the dispersion modeling analysis:

1. The HMA plant limits daily throughput to the following;

Month	Tons Per Day	Hours Per Day at Maximum Hourly Process Rate
January	4000	10
February	4000	10
March	4800	12
April	6000	15
May	6000	15
June	6000	15
July	6000	15
August	6000	15
September	4800	12
October	4000	10
November	4000	10
December	4000	10

2. With the daily limits discussed above, the maximum annual production could be 1,814,800 tons per year. The requested annual permit limit is 1,450,000 tons per year. The annual modeled hourly factor is then 1,450,000/1,814,800 = 0.799.

3. Daily operating hours are limited to daylight hours for the months of December and January.

4. Daily operating hours for the months of February, October, and November are limited to 5 AM to 10 PM.

5. Daily operating hours for the months of March through September are 24 hours per day.

Total hours of operation of the HMA plant production are presented in Table 12. For modeling, the hourly blocks vary starting from midnight then shifting on 2-hour intervals for the 24-hour period or 12 separate model runs are summarized in Tables 13 and 14.

TABLE 12: HMA Asphalt Production Hours of Operation (MST)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
12:00 AM	0	0	1	1	1	1	1	1	1	0	0	0
1:00 AM	0	0	1	1	1	1	1	1	1	0	0	0
2:00 AM	0	0	1	1	1	1	1	1	1	0	0	0
3:00 AM	0	0	1	1	1	1	1	1	1	0	0	0
4:00 AM	0	0	1	1	1	1	1	1	1	0	0	0
5:00 AM	0	1	1	1	1	1	1	1	1	1	1	0
6:00 AM	0	1	1	1	1	1	1	1	1	1	1	0
7:00 AM	1	1	1	1	1	1	1	1	1	1	1	1
8:00 AM	1	1	1	1	1	1	1	1	1	1	1	1
9:00 AM	1	1	1	1	1	1	1	1	1	1	1	1
10:00 AM	1	1	1	1	1	1	1	1	1	1	1	1
11:00 AM	1	1	1	1	1	1	1	1	1	1	1	1
12:00 PM	1	1	1	1	1	1	1	1	1	1	1	1
1:00 PM	1	1	1	1	1	1	1	1	1	1	1	1
2:00 PM	1	1	1	1	1	1	1	1	1	1	1	1
3:00 PM	1	1	1	1	1	1	1	1	1	1	1	1
4:00 PM	1	1	1	1	1	1	1	1	1	1	1	1
5:00 PM	0.5	1	1	1	1	1	1	1	1	1	1	0
6:00 PM	0	1	1	1	1	1	1	1	1	1	1	0
7:00 PM	0	1	1	1	1	1	1	1	1	1	1	0
8:00 PM	0	1	1	1	1	1	1	1	1	1	1	0
9:00 PM	0	1	1	1	1	1	1	1	1	1	1	0
10:00 PM	0	0	1	1	1	1	1	1	1	0	0	0
11:00 PM	0	0	1	1	1	1	1	1	1	0	0	0
Total	10.5	17	24	24	24	24	24	24	24	17	17	10

TABLE 13: HMA Model Scenario Time Segments

Model Scenario	Time Segments 10-Hour Blocks December	Time Segments 10-Hour Blocks January	Time Segments 10-Hour Blocks February, October & November
1	7 AM to 5 PM	7 AM to 5 PM	5 AM to 3 PM
2	7 AM to 5 PM	7 AM to 5 PM	7 AM to 5 PM
3	7 AM to 5 PM	7 AM to 5 PM	9 AM to 7 PM
4	7 AM to 5 PM	7 AM to 5 PM	11 AM to 9 PM
5	7 AM to 5 PM	7 AM to 5 PM	12 PM to 10 PM
6	7 AM to 5 PM	7 AM to 5 PM	5 AM to 3 PM
7	7 AM to 5 PM	7:30 AM to 5:30 PM	5 AM to 3 PM
8	7 AM to 5 PM	7:30 AM to 5:30 PM	5 AM to 3 PM
9	7 AM to 5 PM	7:30 AM to 5:30 PM	5 AM to 3 PM
10	7 AM to 5 PM	7:30 AM to 5:30 PM	5 AM to 3 PM
11	7 AM to 5 PM	7:30 AM to 5:30 PM	5 AM to 3 PM
12	7 AM to 5 PM	7:30 AM to 5:30 PM	5 AM to 3 PM

TABLE 14: HMA Model Scenario Time Segments

Model Scenario	Time Segments 12-Hour Blocks March & September	Time Segments 15-Hour Blocks April - August
1	12 AM to 12 PM	12 AM to 3 PM
2	2 AM to 2 PM	2 AM to 5 PM
3	4 AM to 4 PM	4 AM to 7 PM
4	6 AM to 6 PM	6 AM to 9 PM
5	8 AM to 8 PM	8 AM to 11 PM
6	10 AM to 10 PM	10 AM to 1 AM
7	12 PM to 12 AM	12 PM to 3 AM
8	2 PM to 2 AM	2 PM to 5 AM
9	4 PM to 4 AM	4 PM to 7 AM
10	6 PM to 6 AM	6 PM to 9 AM
11	8 PM to 8 AM	8 PM to 11 AM
12	10 PM to 10 AM	10 PM to 1 PM

Neighboring sources included in the $PM_{2.5}$, NO_2, and SO_2 CIA modeling are: Holly Frontier (#0559-M3), Bimbo Bakeries (#2095-M1), Vulcan Big-I HMA (#1479), Osuna HMA Plant (#0104), Vulcan RAP Plant (#1626-7AR), WUA Stockpile Scrng (#3278-M1), and GCC Terminal (#0902-M3-RV2). TLC Permit #2814 will be canceled before startup of the Black Rock HP-2.

3.1 SIGNIFICANT IMPACT LEVEL (SILs) MODELING ANALYSIS

Significant impact level AERMOD dispersion modeling was completed for PM_{10}, $PM_{2.5}$, NO_X, CO, and SO_2. All significant impact models were run in terrain mode and building downwash with HP-2 HMA emission sources only. Table 15 lists the results of the modeling for pollutant and averaging period that falls below the applicable SILs.

TABLE 15: Summary of Air Dispersion Modeling Results below SILs

Parameter	Maximum Modeled Concentration ($\mu g/m^3$)	Significant Impact Level ($\mu g/m^3$)	% of SIL
CO 1 Hr.	507	2000	25.4
CO 8 Hr.	299	500	59.8
SO2 Annual	0.19	1	19.0

For CO, the results show impacts below the NAAQS SILs for the 1-hour averaging period of 2000 $\mu g/m^3$ and for the 8-hour averaging period of 500 $\mu g/m^3$, so no further CO modeling was performed. For SO_2, the results show impacts below the NAAQS SILs for the annual averaging period of 1 $\mu g/m^3$, so no further SO_2 annual averaging period modeling was performed.

3.2 CUMULATIVE IMPACT ANALYSIS (CIA) MODEL RESULTS

The following CIA dispersion models were used to show compliance with all applicable state and national AAQS. The list in Table 16 discussed which standards are the most stringent.

TABLE 16: Standards for Which Modeling Is Not Required

Standard not Modeled	Surrogate that Demonstrates Compliance
NO_2 annual NAAQS	NO_2 annual NMAAQS
NO_2 24-hour NMAAQS	NO_2 1-hour NAAQS

The model results using the maximum operation at Black Rock's HP-2 HMA, significant neighboring sources, approved ambient background (see Section 2.8), and $PM_{2.5}$ secondary emissions (see Section 2.7) are summarized below in Table 17. Dispersion modeling analysis followed the modeling protocol outline in Section 2 of this report.

TABLE 17: Summary of CIA Modeling Results Including all Applicable Neighboring Sources, Approved Ambient Background, and for $PM_{2.5}$ Secondary Emissions

Parameter	Maximum Modeled Concentration (μg/m³)	Significant Impact Level (μg/m³)	Maximum Modeled Concentration With Background (μg/m³)	Lowest Applicable Standard (μg/m³)	% of Standard
NO_2 1 Hr. 8th highest 1-hour daily maximum	23.5	7.54	131.2	188.1	69.8
NO_2 Annual	3.5	1.0	33.5	94.0	35.6
SO_2 1 Hr. 4th highest 1-hour daily maximum	10.2	7.8	23.3	196.4	11.9
$PM_{2.5}$ 24 Hr. High 8th High	17.2	1.2	33.4	35	95.4
$PM_{2.5}$ Annual	4.25	0.2	10.26	12	85.5
PM_{10} 24 Hr. High 6nd High	114.1	5	142.1	150	94.7

Note: Background concentrations are found in Section 2.8 of the modeling protocol. $PM_{2.5}$ secondary emission concentrations are found in Section 2.7 of the modeling protocol. Dispersion modeling inputs and settings are presented in Section 2.

3.2.1 NO_2 Cumulative Impact Analysis Modeling Results

NO_2 modeling was performed with terrain elevations and building downwash for Black Rock's proposed HP-2 HMA and neighboring sources. NO_X emission rates represented the maximum hourly rate for Black Rock's proposed point sources and significant neighboring sources.

Dispersion modeling meteorology for this analysis included 5 years of data, 2014–2018 Albuquerque Meteorological data, was obtained from the AEHD AQP.

For NO_2 1-hour and annual modeling, the Tier 2 ARM2 approach found in Section 2.6 of this report was used for the analysis.

The seasonal NO_2 background – 3rd highest hourly, 1-hour NO_2 background concentrations found in Section 2.8 of this report was added to the modeled results and compared to the lowest applicable ambient standard.

The maximum modeled NO_2 1-Hour 8th highest 1-hour daily is located 985 meters east of the site at receptor 353,100E and 3,888,500N. For this receptor the impact from Black Rock HP-2 HMA sources is less than the NO_2 1-hour SILs. The highest modeled receptor where Black Rock HP-2 HMA sources is greater than the NO_2 1-hour SIL is 352,013E and 3,888,440N, on the Black Rock HP-2 HMA facility east boundary.

Table 18 shows the NO_2 1-Hour 8th highest 1-hour daily maximum and annual model results and locations where Black Rock's proposed HP-2 HMA is above the SILs.

TABLE 18: NO_2 CIA Maximum Model Results

	Modeled Concentration ($\mu g/m^3$)	Modeled Concentration With Background ($\mu g/m^3$)	Location UTMs E/N	
NO_2 1 Hr. Highest 8th high 1-hour daily maximum	23.5	131.2	351971.0	3888452.0
NO_2 Annual	3.5	33.5	352034.0	3888434.0

Figure 3 shows an aerial map of the NO_2 highest 8th high 1-hour daily maximum concentration and the location of the maximum concentration which includes background where Black Rock sources contribute above the 1-hour NO_2 SIL.

Figure 3: Aerial Map of NO_2 1 Hour Model Result (μg/m^3)

Figure 4 shows an aerial map of the NO_2 annual average concentration and the location of the maximum concentration which includes background where Black Rock sources contribute above the Annual NO_2 SIL.

Figure 4: Aerial Map of NO_2 Annual Model Result ($\mu g/m^3$)

3.2.2 SO_2 Cumulative Impact Analysis Modeling Results

SO_2 1-hour modeling was performed with terrain elevations and building downwash for Black Rock proposed HP-2 HMA and neighboring sources. SO_2 emission rates represented the maximum hourly rate for Black Rock permitted point sources and significant neighboring sources.

Table 19 shows the SO_2 4th highest 1-hour daily maximum model result and location.

TABLE 19: SO_2 CIA Maximum Model Results

	Modeled Concentration (µg/m^3)	Modeled Concentration With Background (µg/m^3)	Location UTMs E/N	
SO_2 1 Hr. 4th highest 1-hour daily maximum	10.2	23.3	351993.8	3888622.4

For SO_2 1-hour modeling, dispersion modeling meteorology for this analysis included 5 years of data, 2014 – 2018 Albuquerque Meteorological data, obtained from the AEHD AQP.

SO_2 1-hour background concentration, found in Section 2.8 of this report, was added to the 4th highest 1 hour daily maximum modeled results and compared to the lowest applicable ambient standard.

Figure 5 shows a contour map of the highest 4th high 1-hour SO_2 daily maximum concentration and the location of the maximum concentration including background where Black Rock sources contribute above the 1-hour SO_2 SIL.

Figure 5: Aerial Map of SO_2 1 Hour Model Results (µg/m^3)

3.2.3 $PM_{2.5}$ Direct and Secondary Formation CIA Modeling Results

Particulate matter includes both "primary" PM, which is directly emitted into the air, and "secondary" PM, which forms indirectly from fuel combustion and other sources. Primary PM consists of carbon (soot)—emitted from cars, trucks, heavy equipment, forest fires, and burning waste—and crustal material from unpaved roads, stone crushing, construction sites, and metallurgical operations. Secondary PM forms in the atmosphere from gases. Some of these reactions require sunlight and/or water vapor. Secondary PM includes:

- Sulfates formed from sulfur dioxide emissions from power plants and industrial facilities;
- Nitrates formed from nitrogen oxide emissions from cars, trucks, industrial facilities, and power plants; and
- Carbon formed from reactive organic gas emissions from cars, trucks, industrial facilities, forest fires, and biogenic sources such as trees.

AERMOD does not account for secondary formation of $PM_{2.5}$ for near-field modeling. Any secondary contribution of the Black Rock HP-2 HMA source emissions is not explicitly accounted for in the model results. While representative background monitoring data for $PM_{2.5}$ should adequately account for secondary contribution from existing background sources, the Black Rock assessment of their potential contribution to cumulative impacts as secondary $PM_{2.5}$ was performed based on guidance from the NMED Modeling Section. The permit application for Black Rock HP-2 HMA emissions of precursors include:

- Nitrogen Oxides (NO_X) – 20.0 tons per year (above SER)
- Sulfur Dioxides (SO_2) – 2.49 tons per year (below SER)
- Volatile Organic Carbon (VOC) – 28.9 tons per year (below SER)
- Particulate 2.5 micron or less ($PM_{2.5}$) – 17.6 tons per year (above SER).

$PM_{2.5}$ secondary emission concentration analysis will follow EPA and NMED AQB guidelines. Following recent EPA guidelines for conversion of NO_X and SO_2 emission rates to secondary $PM_{2.5}$ emissions, Black Rock HMA emissions are compared to appropriate western MERPs values (NO_X 24 Hr – 1155 tpy; NO_X Annual – 3184 tpy; SO_2 24 Hr – 225 tpy; SO_2 Annual – 2289 tpy). The following equation, found in NMED AQB modeling guidance document on MERPs, will be added to determine if secondary emission would cause violation with $PM_{2.5}$ NAAQS.

$$PM_{2.5}\text{ annual} = ((NO_X\text{ emission rate (tpy)}/3184 + (SO_2\text{ emission rate (tpy)}/2289)) \times 0.2\ \mu g/m^3$$

$$PM_{2.5}\text{ annual} = ((20.0/3184) + (2.49/2289)) \times 0.2\ \mu g/m^3 = \mathbf{0.0015\ \mu g/m^3}$$

$$PM_{2.5}\text{ 24 hour} = ((NO_X\text{ emission rate (tpy)}/1155 + (SO_2\text{ emission rate (tpy)}/225)) \times 1.2\ \mu g/m^3$$

$$PM_{2.5}\text{ 24 hour} = ((20.0/1155) + (2.49/225)) \times 1.2\ \mu g/m^3 = \mathbf{0.034\ \mu g/m^3}$$

$PM_{2.5}$ annual and 24-hour dispersion modeling was performed for both the plant operating at a RAP input of 35% and 0%. The initial CIA $PM_{2.5}$ modeling with 35% RAP input for all 12 modeling scenarios was used to determine the 3 or 4 model scenarios that produced the highest modeled concentrations. The model was then rerun for these 3 or 4 model scenarios using material handling and traffic emission rates if the RAP input was 0%.

Results of the secondary formation from the facility were added to the modeled value.

Annual $PM_{2.5}$ model results show the highest 5-year annual average occurred near neighboring source Holly Frontier at receptor location 351,200E and 3,888,700N (10.79 µg/m^3). At this receptor, the contribution from Black Rock HP-2 HMA sources less than the $PM_{2.5}$ annual SILs. Annual $PM_{2.5}$ model results show the highest 5-year annual average occurred during modeling scenario 11 and a RAP input of 0%. All model scenarios are summarized in Tables 20 and 21.

TABLE 20: Results $PM_{2.5}$ Annual Model Scenario Time Segments – RAP Input 35%

Model Scenario	$PM_{2.5}$ Modeled Contribution with Background (µg/m^3)	$PM_{2.5}$ Secondary Contribution (µg/m^3)	$PM_{2.5}$ 5-Year Annual Average High (µg/m^3)
1	10.05	0.0015	10.05
2	9.84	0.0015	9.84
3	9.86	0.0015	9.86
4	9.76	0.0015	9.76
5	9.72	0.0015	9.72
6	9.63	0.0015	9.63
7	9.58	0.0015	9.58
8	9.58	0.0015	9.58
9	9.59	0.0015	9.59
10	9.66	0.0015	9.66
11	9.72	0.0015	9.72
12	**9.81**	**0.0015**	**9.81**

TABLE 21: Results $PM_{2.5}$ Annual Model Scenario Time Segments – RAP Input 0%

Model Scenario	$PM_{2.5}$ Modeled Contribution with Background (µg/m^3)	$PM_{2.5}$ Secondary Contribution (µg/m^3)	$PM_{2.5}$ 5-Year Annual Average High (µg/m^3)
9	9.85	0.0015	9.85
10	10.14	0.0015	10.14
11	**10.26**	**0.0015**	**10.26**
12	10.20	0.0015	10.20

$PM_{2.5}$ 5-Year 24 Hr. High 8th High model results show the highest 5-year 24-hour average occurred during modeling scenario 11 and a RAP input of 0%. All model scenarios are summarized in Tables 22 and 23.

TABLE 22: Results $PM_{2.5}$ 24 Hour Model Scenario Time Segments – RAP Input 35%

Model Scenario	$PM_{2.5}$ Modeled Contribution with Background (µg/m³)	$PM_{2.5}$ Secondary Contribution (µg/m³)	$PM_{2.5}$ 5-Year Annual Average High (µg/m³)
1	32.51	0.034	32.55
2	30.22	0.034	30.25
3	28.62	0.034	28.66
4	28.66	0.034	28.69
5	28.65	0.034	28.68
6	28.66	0.034	28.69
7	28.65	0.034	28.68
8	29.75	0.034	29.79
9	31.46	0.034	31.49
10	32.42	0.034	32.45
11	**32.83**	**0.034**	**32.87**
12	32.83	0.034	32.86

TABLE 23: Results $PM_{2.5}$ 24 Hour Model Scenario Time Segments – RAP Input 0%

Model Scenario	$PM_{2.5}$ Modeled Contribution with Background (µg/m³)	$PM_{2.5}$ Secondary Contribution (µg/m³)	$PM_{2.5}$ 5-Year Annual Average High (µg/m³)
9	31.92	0.034	31.95
10	33.11	0.034	33.14
11	**33.40**	**0.034**	**33.43**
12	33.31	0.034	33.35

Results showed that direct "primary" $PM_{2.5}$ from Black Rock HP-2 HMA sources are located on the south facility boundary. The result from direct "primary" $PM_{2.5}$ emissions dispersion modeling, secondary PM emissions, plus a representative $PM_{2.5}$ background concentrations from Section 2.7 of this report, which includes monitored secondary $PM_{2.5}$ concentrations, were used to show compliance with national $PM_{2.5}$ annual and 24-hour average AAQS. The highest model results are summarized in Table 24.

TABLE 24: $PM_{2.5}$ CIA Maximum Model Results

	Modeled Concentration with Secondary PM ($\mu g/m^3$)	Modeled Concentration With Background ($\mu g/m^3$)	Location UTMs E/N	
24 Hour Average Highest 8th High	17.2	33.4	352013.0	3888440.0
Annual Average	4.25	10.26	352013.0	3888440.0

Figures 6 and 7 summarize the results of the modeling analysis.

Figure 6: Aerial Map of $PM_{2.5}$ 8th Highest Daily Maximum High 24 Hour Model Result ($\mu g/m^3$)

Figure 7: Aerial Map of $PM_{2.5}$ Annual Model Result (µg/m^3)

3.2.4 PM_{10} Cumulative Impact Analysis Modeling Results

CIA PM_{10} modeling was performed with terrain and meteorology which included 5 years of data, 2014 – 2018 Albuquerque Meteorological data, obtained from the AEHD AQP. Modeling was performed for the 24-hour averaging period. PM_{10} emissions rates represented the maximum hourly rate for all emission sources. Jefferson monitor representative 24-hour PM_{10} background concentrations was added to the modeled results and compared to the lowest applicable ambient standard. The 24-hour background concentrations that were used for PM_{10} 24-hour averaging period is found in Section 2.8 of this report. PM_{10} 24-hour dispersion modeling was performed for both the plant operating at a RAP input of 35% and 0%. The initial CIA PM_{10} modeling with 35% RAP input for all 12 modeling scenarios was used to determine the 3 or 4 model scenarios that produced the highest modeled concentrations. The model was then rerun for these 3 or 4 model scenarios using material handling and traffic emission rates if the RAP input was 0%.

Based on the New Mexico Modeling Guideline "…[W]hen n years are modeled, the $(n+1)^{th}$ highest concentration over the n-year period is the design value, since this represents an average or expected exceedance rate of one per year." For 5 years of modeled met data, the design value is the highest 6^{th} high. PM_{10} 5-Year 24 Hr. Highest 6^{th} High model results show the highest 5-year 24-hour average occurred during modeling scenario 10 and a RAP input of 0%. All model scenarios are summarized in Tables 25 and 26.

TABLE 25: Results PM_{10} 24 Hour Model Scenario Time Segments – RAP Input 35%

Model Scenario	**PM_{10} 5-Year 24 Hr. Highest 6^{th} High ($\mu g/m^3$)**
1	96.9
2	90.2
3	89.5
4	86.0
5	88.0
6	85.8
7	89.9
8	97.2
9	109.6
10	111.7
11	110.1
12	100.2

TABLE 26: Results PM_{10} 24 Hour Model Scenario Time Segments – RAP Input 0%

Model Scenario	PM_{10} 5-Year 24 Hr. Highest 6th High ($\mu g/m^3$)
9	135.4
10	142.1
11	136.5

Table 27 summarizes the 24-hour average highest 6th high and receptor location.

TABLE 27: PM_{10} CIA Maximum Model Results

	Modeled Concentration ($\mu g/m^3$)	Modeled Concentration With Background ($\mu g/m^3$)	Location UTMs E/N	
24 Hour Average Highest 6th High	114.0	142.1	351940.1	3888588.6

Figure 8 summarize the results of the modeling analysis.

Figure 8: Aerial Map of PM_{10} Highest 6^{th} High 24-Hour Model Result ($\mu g/m^3$)

3.2.5 Hydrogen Sulfide (H_2S), Lead, and Asphalt Fumes Impact Analysis Model Results

Three additional dispersion modeling analysis were performed to determine compliance with State of New Mexico ambient limits for H_2S, Lead, and asphalt fumes. H_2S New Mexico 1-hour standard is 13.9 µg/m^3 with a significant level of 1.0 µg/m^3. Lead New Mexico quarterly standard is 0.15 µg/m^3 with a significant level of 0.03 µg/m^3. The New Mexico standard for asphalt fumes (State Toxic Air Pollutant) is 50 µg/m^3. No background was added to any of the model results.

<u>Hydrogen Sulfide</u>
The highest 1-hour model result of H_2S is 1.09 µg/m^3 at receptor 351992E, 3888446N above the significant level , but only 7.8% of the standard. Highest concentration was located on the south facility boundary.

<u>Lead</u>
The model was run on a monthly averaging period instead of quarterly making the results more conservative. The highest monthly average model result of lead is 0.00077 µg/m^3 at receptor 351800E, 3888550N and is below the significant level. Highest concentration was located west of the facility boundary.

<u>Asphalt Fumes</u>
The highest 8-hour model result of asphalt fumes is 27.6 µg/m^3 at receptor 352056E, 3888545N. This is 55.2% of the standard. Highest concentration was located on the north facility boundary.

Modeling File List

Model File Name	Description
BlackRockBrewerHMACombustROIv2	Black Rock HMA Site Only Combustion Sources ROI modeling
BlackRockBrewerHMAPMROIS1-12v2	Black Rock HMA Site Only Sources PM10 24 hour and PM2.5 24 hour and Annual ROI modeling – Scenarios 1 through 12

Model File Name	Description
BlackRockBrewerHMANOxPVMRMCIA1Hrv2	Cumulative NO_2 Modeling – 1-Hour
BlackRockBrewerHMANOxCIAAnnualv2	Cumulative NO_2 Modeling – Annual Average
BlackRockBrewerHMASO2CIA1Hrv2	Cumulative SO_2 Modeling – 1-Hour
BlackRockBrewerHMAPM10CIA24hrS1-12v2	Cumulative PM_{10} Modeling – 24-Hour – Scenarios 1 through 12 – RAP input 35%
BlackRockBrewerHMAPM10CIA24hrS9-11Agg	Cumulative PM_{10} Modeling – 24-Hour – Scenarios 9 through 11 – RAP input 0%
BlackRockBrewerHMAPM25CIA24hrS1-12v2	Cumulative $PM_{2.5}$ Modeling – 24-Hour – Scenarios 1 through 12 – RAP input 35%
BlackRockBrewerHMAPM25CIA24hrS9-12Agg	Cumulative $PM_{2.5}$ Modeling – 24-Hour – Scenarios 1 through 12 – RAP input 0%
BlackRockBrewerHMAPM25CIAAnnS1-12v2	Cumulative $PM_{2.5}$ Modeling – Annual – Scenarios 1 through 12 – RAP input 35%
BlackRockBrewerHMAPM25CIAAnnS9-12Agg	Cumulative $PM_{2.5}$ Modeling – Annual – Scenarios 1 through 12 – RAP input 0%
BlackRockBrewerHMAH2Sv2	H_2S Dispersion Modeling – 1-Hour
BlackRockBrewerHMALead	Lead Dispersion Modeling – Monthly
BlackRockBrewerHMAAsphaltFumesv2	Asphalt Fume Dispersion Modeling 8-Hour Average

Attachment H
Public Notice Documents

Timothy M. Keller,
Mayor

Public Participation

List of Neighborhood Associations
and Neighborhood Coalitions
MEMORANDUM

To: Paul Wade, Senior Engineer, Montrose Environmental Group
From: Elizabeth Pomo, Environmental Health Scientist
Subject: Determination of Neighborhood Associations and Coalitions within 0.5 mile of Black Rock, 352000 Easting; 3888500 Northing; Albuquerque, NM 87107
Date: August 20, 2021

DETERMINATION:

On August 20, 2021 I used the City of Albuquerque Zoning Advanced Map Viewer (http://coagisweb.cabq.gov/) to verify which City of Albuquerque Neighborhood Associations (NA), Homeowner Associations (HOA) and Neighborhood Coalitions (NC) are located within 0.5 mile of Black Rock, 352000 Easting; 3888500 Northing, in Bernalillo County, NM.

I then used the City of Albuquerque Office (COA) of Neighborhood Coordination's Monthly Master NA List dated August 2021 and the Bernalillo County (BC) Monthly Neighborhood Association August 2021 Excel file to determine the contact information for each NA and NC located within 0.5 mile of Black Rock, 352000 Easting; 3888500 Northing, in Bernalillo County, NM.

The table below contains the contact information, which will be used in the City of Albuquerque Environmental Health Department's public notice. Duplicates have been deleted.

COA/BC Association or Coalition	Name	Email or Mailing Address
District 4 Coalition of Neighborhood Associations	Mildred Griffee Daniel Regan Association Email	mgriffee@noreste.org; dlreganabq@gmail.com; sect.dist4@gmail.com;
District 7 Coalition of Neighborhood Associations	Tyler Richter Darcy Bushnell	tyler.richter@gmail.com; dmc793@gmail.com;
North Edith Commercial Corridor Association	Evelyn Harris Christine Benavidez	grumpyeh46@comcast.net; christinebnvdz@aol.com;
North Edith Corridor Association	Christine Benavidez Evelyn Harris	christinebnvdz@aol.com; grumpyeh46@comcast.net;
North Valley Coalition, Inc.	Peggy Norton Doyle Kimbrough Coalition Email	peggynorton@yahoo.com; newmexmba@aol.com; nvcabq@gmail.com;

MONTROSE ENVIRONMENTAL

Paul Wade <pwade@montrose-env.com>

Public Notice for Black Rock Services Proposed HP-2 HMA

1 message

Paul Wade <pwade@montrose-env.com> Tue, Sep 7, 2021 at 10:24 AM
To: mgriffee@noreste.org, dlreganabq@gmail.com, sect.dist4@gmail.com, tyler.richter@gmail.com, dmc793@gmail.com, grumpyeh46@comcast.net, christinebnvdz@aol.com, peggynorton@yahoo.com, newmexmba@aol.com, nvcabq@gmail.com
Cc: Robert Caldwell <rcaldwell@blackrock-services.com>, "Munoz-Dyer, Carina G." <cmunoz-dyer@cabq.gov>

Dear Neighborhood Association/Coalition Representative(s)

This email is sent to you per the requirements of Bernalillo County/City of Albuquerque Air Quality Regulation 20.11.41.B.1 NMAC "Applicant's Public Notice Requirements". The attached revised "Notice of Intent" (NOI) addresses a new "Authority to Construct" Permit for Black Rock Services proposed HP-2 HMA Facility. Attached also is the revised NOI cover letter.

Thank You

--

MEG Logo_Signature

Paul Wade

Principal

Montrose Air Quality Services, LLC

3500 G Comanche Rd. NE, Albuquerque, NM 87107

T: 505.830.9680 x6 | F: 505.830.9678

PWade@montrose-env.com

www.montrose-env.com

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2 attachments

Black Rock NOI.pdf
163K

Black Rock Public Notice Cover Letter.pdf
81K

SUBJECT: **Public Notice of Proposed Air Quality Construction Permit Application**

Dear Neighborhood Association/Coalition Representative(s),

Why did I receive this public notice?

You are receiving this notice in accordance with New Mexico Administrative Code (NMAC) 20.11.41.13.B(1) which requires any applicant seeking an Air Quality Construction Permit pursuant to 20.11.41 NMAC to provide public notice by certified mail or electronic mail to the designated representative(s) of the recognized neighborhood associations and recognized coalitions that are within one-half mile of the exterior boundaries of the property on which the source is or is proposed to be located.

What is the Air Quality Permit application review process?

The City of Albuquerque, Environmental Health Department, Air Quality Program (Program) is responsible for the review and issuance of Air Quality Permits for any stationary source of air contaminants within Bernalillo County. Once the application is received, the Program reviews each application and rules it either complete or incomplete. Complete applications will then go through a 30-day public comment period. Within 90 days after the Program has ruled the application complete, the Program shall issue the permit, issue the permit subject to conditions, or deny the requested permit or permit modification. The Program shall hold a Public Information Hearing pursuant to 20.11.41.15 NMAC if the Director determines there is significant public interest and a significant air quality issue is involved.

What do I need to know about this proposed application?

Applicant Name	Black Rock Services, LLC
Site or Facility Name	Black Rock Services HP-2
Site or Facility Address	Northwest corner of Carmony Ln NE and Alexander Blvd NE
New or Existing Source	New
Anticipated Date of Application Submittal	September 7, 2021
Summary of Proposed Source to Be Permitted	For this permit application, Black Rock Services, LLC is proposing to construct and operate a new typical hot mix asphalt plant. Asphalt concrete production will not exceed 400 tons per hour or 1,450,000 tons per year. In addition, daily production limits will be requested, for the months of October – February 4000 tons per day; for the months of March and September 4800 tons per day; and for the months of April – August 6000 tons per day. Maximum asphalt concrete production hours are limited for the months of December – January to daylight hours; for the months of February, October, and November - 17 hours from 5 am to 10 pm; for the months of March through September - 24 hours per day.

What emission limits and operating schedule are being requested?

See attached Notice of Intent to Construct form for this information.

How do I get additional information regarding this proposed application?

For inquiries regarding the proposed source, contact:

- Robert Caldwell
- rcaldwell@blackrock-services.com
- (505) 206-1101

For inquiries regarding the air quality permitting process, contact:

- City of Albuquerque Environmental Health Department Air Quality Program
- aqd@cabq.gov
- (505) 768-1972

NOTICE FROM THE APPLICANT

Notice of Intent to Apply for Air Quality Construction Permit

You are receiving this notice because the New Mexico Air Quality Control Act (20.11.41.13B NMAC) requires any owner/operator proposing to construct or modify a facility subject to air quality regulations to provide public notice by certified mail or electronic mail to designated representatives of recognized neighborhood associations and coalitions within 0.5-mile of the property on which the source is or is proposed to be located.

This notice indicates that the owner/operator intends to apply for an Air Quality Construction Permit from the Albuquerque – Bernalillo County Joint Air Quality Program. Currently, no application for this proposed project has been submitted to the Air Quality Program. Applicants are required to include a copy of this form and documentation of mailed notices with their Air Quality Construction Permit Application.

Proposed Project Information

Applicant's name and address:
Nombre y domicilio del solicitante: Black Rock Service, LLC, 1040 Bosque Farms Blvd., Bosque Farms, NM 87068

Owner / operator's name and address:
Nombre y domicilio del propietario u operador: Black Rock Service, LLC, 1040 Bosque Farms Blvd., Bosque Farms, NM 87068

Contact for comments and inquires:
Datos actuales para comentarios y preguntas:

Name *(Nombre)*: Robert Caldwell
Address *(Domicilio)*: 1040 Bosque Farms Blvd., Bosque Farms, NM 87068
Phone Number *(Número Telefónico)*: (505) 206-1101
E-mail Address *(Correo Electrónico)*: rcaldwell@blackrock-services.com

Actual or estimated date the application will be submitted to the department:
Fecha actual o estimada en que se entregará la solicitud al departamento: September 7, 2021

Description of the source:
Descripción de la fuente: A new hot mix asphalt plant to produce asphalt concrete at a rate of 400 tons per hour and 1,450,000 tons per year.

Exact location of the source or proposed source:
Ubicación exacta de la fuente o fuente propuesta: Northwest corner of Carmony Ln NE and Alexander Blvd NE; UTM Coord. 352,000E; 3,888,500N Zone 13, NAD 83

Nature of business:
Tipo de negocio: Produce asphalt concrete at a rate of 400 tons per hour and 1,450,000 tons per year.

Process or change for which the permit is requested:
Proceso o cambio para el cuál de solicita el permiso: Produce hot mix asphalt concrete from aggregate, RAP, asphalt cement, and mineral filler

Maximum operating schedule:
Horario máximo de operaciones: Dec-Jan, daylight hrs: Feb, Oct, Nov 17 hrs/day 5 am to 10 pm: Mar-Sep, 24 hrs/day

Normal operating schedule:
Horario normal de operaciones: 5 days per week, 45 weeks per year, 6 am to 5 pm

Preliminary estimate of the maximum quantities of each regulated air contaminant the source will emit:
Estimación preliminar de las cantidades máximas de cada contaminante de aire regulado que la fuente va a emitir:

Air Contaminant *Contaminante de aire*	**Proposed Construction Permit** *Permiso de Construcción Propuesto*		**Net Changes (for permit modification or technical revision)** *Cambio Neto de Emisiones (para modificación de permiso o revisión técnica)*	
	pounds per hour *libras por hora*	tons per year *toneladas por año*	pounds per hour *libras por hora*	tons per year *toneladas por año*
CO	52.7	96.1	***	***
NOx	10.7	20.0	***	***
VOC	15.8	28.9	***	***
SO2	1.37	2.49	***	***
PM10	11.7	21.0	***	***
PM2.5	9.78	17.7	***	***
HAP	2.16	3.92	***	***

Questions or comments regarding this Notice of Intent should be directed to the Applicant. Contact information is provided with the Proposed Project Information on the first page of this notice. To check the status of an Air Quality Construction Permit application, call 311 and provide the Applicant's information, or visit www.cabq.gov/airquality/air-quality-permits.

The Air Quality Program will issue a Public Notice announcing a 30-day public comment period on the permit application for the proposed project when the application is deemed complete. The Air Quality Program does not process or issue notices on applications that are deemed incomplete. More information about the air quality permitting process is attached to this notice.

Air Quality Construction Permitting Overview

This is the typical process to obtain an Air Quality Construction Permit for Synthetic Minor and Minor sources of air pollution from the Albuquerque – Bernalillo County Joint Air Quality Program.

Step 1: Pre-application Meeting: The Applicant and their consultant must request a meeting with the Air Quality Program to discuss the proposed action. If air dispersion modeling is required, Air Quality Program staff discuss the modeling protocol with the Applicant to ensure that all proposed emissions are considered.

> **Notice of Intent from the Applicant:** Before submitting their application, the Applicant is required to notify all nearby neighborhood associations and interested parties that they intend to apply for an air quality permit or modify an existing permit. The Applicant is also required to post a notice sign at the facility location.

Step 2: Administrative Completeness Review and Preliminary Technical Review: The Air Quality Program has 30 days from the day the permit is received to review the permit application to be sure that it is administratively complete. This means that all application forms must be signed and filled out properly, and that all relevant technical information needed to evaluate any proposed impacts is included. If the application is not complete, the permit reviewer will return the application and request more information from the Applicant. Applicants have three opportunities to submit an administratively complete application with all relevant technical information.

> **Public Notice from the Department:** When the application is deemed complete, the Department will issue a Public Notice announcing a 30-day public comment period on the permit application. This notice is distributed to the same nearby neighborhood associations and interested parties that the Applicant sent notices to, and published on the Air Quality Program's website.
>
> During this 30-day comment period, individuals have the opportunity to submit written comments expressing their concerns or support for the proposed project, and/or to request a Public Information Hearing. If approved by the Environmental Health Department Director, Public Information Hearings are held after the technical analysis is complete and the permit has been drafted.

Step 3: Technical Analysis and Draft Permit: Air Quality Program staff review all elements of the proposed operation related to air quality, and review outputs from advanced air dispersion modeling software that considers existing emission levels in the area surrounding the proposed project, emission levels from the proposed project, and meteorological data. The total calculated level of emissions is compared to state and federal air quality standards and informs the decision on whether to approve or deny the Applicant's permit.

Draft Permit: The permit will establish emission limits, standards, monitoring, recordkeeping, and reporting requirements. The draft permit undergoes an internal peer review process to determine if the emissions were properly evaluated, permit limits are appropriate and enforceable, and the permit is clear, concise, and consistent.

> **Public Notice from the Department:** When the technical analysis is complete and the permit has been drafted, the Department will issue a second Public Notice announcing a 30-day public comment period on the technical analysis and draft permit. This second Public Notice, along with the technical analysis documentation and draft permit, will be published on the Air Quality Program's website, and the public notice for availability of the technical analysis and draft permit will only be directly sent to those who requested further information during the first comment period.

During this second 30-day comment period, residents have another opportunity to submit written comments expressing their concerns or support for the proposed project, and/or to request a Public Information Hearing.

Possible Public Information Hearing: The Environmental Health Department Director may decide to hold a Public Information Hearing for a permit application if there is significant public interest and a significant air quality issue. If a Public Information Hearing is held, it will occur after the technical analysis is complete and the permit has been drafted.

Step 4: Public Comment Evaluation and Response: The Air Quality Program evaluates all public comments received during the two 30-day public comment periods and Public Information Hearing, if held, and updates the technical analysis and draft permit as appropriate. The Air Quality Program prepares a response document to address the public comments received, and when a final decision is made on the permit application, the comment response document is published on the Air Quality Program’s website and distributed to the individuals who participated in the permit process. If no comments are received, a response document is not prepared.

Step 5: Final Decision on the Application: After public comments are addressed and the final technical review is completed, the Environmental Health Department makes a final decision on the application. If the permit application meets all applicable requirements set forth by the New Mexico Air Quality Control Act and the federal Clean Air Act, the permit is approved. If the permit application does not meet all applicable requirements, it is denied.

Notifications of the final decision on the permit application and the availability of the comment response document is published on the Air Quality Program’s website and distributed to the individuals who participated in the permit process.

The Department must approve a permit application if the proposed action will meet all applicable requirements and if it demonstrates that it will not result in an exceedance of ambient air quality standards. Permit writers are very careful to ensure that estimated emissions have been appropriately identified or quantified and that the emission data used are acceptable.

The Department must deny a permit application if it is deemed incomplete three times, if the proposed action will not meet applicable requirements, if estimated emissions have not been appropriately identified or quantified, or if the emission data are not acceptable for technical reasons.

For more information about air quality permitting, visit www.cabq.gov/airquality/air-quality-permits

Proposed Air Quality Construction Permit
Permiso de Construcción de Calidad del Aire Propuesto

1. **Applicant's Name:**
Nombre del solicitante: Black Rock Services, LLC
Owner or Operator's Name:
Nombre del Propietario u Operador: Black Rock Services LLC

2. **Actual or Estimated Date the Application will be Submitted to the Department:**
Fecha Actual o Estimada en que se Entragará la Solicitud al Departamento: September 7, 2021

3. **Exact Location of the Source or Proposed Source:**
Ubicación Excata de la Fuente o Fuente Propuesta: NW corner of Carmony Ln NE and Alexander Blvd NE
UTM Coord 352,000 E; 3,888,500 N Zone 13 NAD 83

4. **Description of the Source:**
Descripción del Fuente: A new hot mix asphalt plant to produce asphalt concrete
Nature of Business:
Tipo de Negocio: Produce asphalt concrete at a rate of 400 ton/hr + 1,450,000 ton/yr
Process or change for which a permit is requested:
Proceso o cambio para el cuál se solicita el permiso: Produce hot mix asphalt concrete from aggregate, RAP, asphalt cement, and mineral filler

Preliminary estimate of the maximum quantities of each regulated air contaminant the source will emit:
Estimación preliminar de las cantidades máximas de cada contaminante de aire regulado que la fuente va a emitir:

Air Contaminant *Contaminante de Aire*	Proposed Construction Permit *Permiso de Construcción Propuesto*		Net Change Emissions (for permit modification or technical revision) *Cambio Neto de Emisiones (para modificación de permiso o revisión técnica)*	
	Pounds per hour *libras por hora*	Tons per year *toneladas por año*	Pounds per hour *libras por hora*	Tons per year *toneladas por año*
CO	52.7	96.1	—	—
NOX	10.7	20.0	—	—
SO2	1.37	2.49	—	—
PM10	11.7	21.0	—	—
PM2.5	9.78	17.7	—	—
HAP	2.16	3.92	—	—
VOC	15.8	28.9	—	—

5. **Maximum Operating Schedule:**
Horario Máximo de Operaciones: Dec-Jan, daylight hrs: Feb, Oct, Nov, 17 hrs/day, 5 AM to 10 PM
Mar-Sep, 24 hrs/day
Normal Operation Schedule:
Horario Normal de Operaciones: 5 days/week, 45 weeks/yr, 6 AM to 5 PM

6. **Current Contact Information for Comments and Inquiries**
Datos actuales para Comentarios y Preguntas

Name *(Nombre):* Robert Caldwell
Address *(Domicilio):* 1040 Bosque Farms Blvd., Bosque Farms, NM 87068
Phone Number *(Número Telefónico):* (505) 206-1101
Email Address *(Correo Electrónico):* rcaldwell@blackrock-services.com

Call 311 for additional information concerning this project, the Air Quality Program, or to file a complaint.
Llame al 311 para obtener información adicional sobre este proyecto, del Programa de Calidad del Aire, o para presenter una queja.
Gọi 311 để biết thêm thông tin hoặc để khiếu nại về dự án này, Chương Trình Chất Lượng Không Khí

City of Albuquerque, Environmental Health Department, Air Quality Program – Stationary Source Permitting
Ciudad de Albuquerque, Departamento de Salud Ambiental, Programa de Calidad del Aire - Permisos para Fuentes Inmóviles
(505) 768-1972, aqd@cabq.gov

THIS SIGN SHALL REMAIN POSTED UNTIL THE DEPARTMENT TAKES FINAL ACTION ON THE PERMIT APPLICATION
ESTE AVISO DEBERÁ DE MANTENERSE PUESTO HASTA QUE EL DEPARTAMENTO TOME UNA DECISIÓN SOBRE LA SOLICITUD DE PERMISO

Proposed Air Quality Construction Permit

Permiso de Construcción de Calidad del Aire Propuesto

1. **Applicant's Name:**
Nombre del solicitante: Black Rock Services, LLC
Owner or Operator's Name:
Nombre del Propietario u Operador: Black Rock Services LLC

2. **Actual or Estimated Date the Application will be Submitted to the Department:**
Fecha Actual o Estimada en que se Entragará la Solicitud al Departamento: September 7, 2021

3. **Exact Location of the Source or Proposed Source:**
Ubicación Excata de la Fuente o Fuente Propuesta: NW corner of Carmony Ln NE and Alexander Blvd NE
UTM Coord 352,000E; 3,888,500N Zone 13 NAD 83

4. **Description of the Source:**
Descripción del Fuente: A new hot mix asphalt plant to produce asphalt concrete
Nature of Business:
Tipo de Negocio: Produce asphalt concrete at a rate of 400 ton/hr + 1,450,000 ton/yr
Process or change for which a permit is requested:
Proceso o cambio para el cuál se solicita el permiso: Produce hot mix asphalt concrete from aggregate, RAP, asphalt cement, and mineral filler

Preliminary estimate of the maximum quantities of each regulated air contaminant the source will emit:
Estimación preliminar de las cantidades máximas de cada contaminante de aire regulado que la fuente va a emitir:

Air Contaminant *Contaminante de Aire*	Proposed Construction Permit *Permiso de Construcción Propuesto*		Net Change Emissions (for permit modification or technical revision) *Cambio Neto de Emisiones (para modificación de permiso o revisión técnica)*	
	Pounds per hour *libras por hora*	Tons per year *toneladas por año*	Pounds per hour *libras por hora*	Tons per year *toneladas por año*
CO	52.7	96.1	—	—
NOX	10.7	20.0	—	—
SO2	1.37	2.49	—	—
PM10	11.7	21.0	—	—
PM2.5	9.78	17.7	—	—
HAP	2.16	3.92	—	—
VOC	15.8	28.9	—	—

5. **Maximum Operating Schedule:**
Horario Máximo de Operaciones: Dec-Jan, daylight hrs: Feb, Oct, Nov, 17 hrs/day, 5 AM to 10 PM
Mar-Sep, 24 hrs/day
Normal Operation Schedule:
Horario Normal de Operaciones: 5 days/week, 45 weeks/yr, 6 AM to 5 PM

6. **Current Contact Information for Comments and Inquiries**
Datos actuales para Comentarios y Preguntas
Name *(Nombre):* Robert Caldwell
Address *(Domicilio):* 1040 Bosque Farms Blvd., Bosque Farms, NM 87068
Phone Number *(Número Telefónico):* (505) 206-1101
Email Address *(Correo Electrónico):* rcaldwell@blackrock-services.Com

Call 311 for additional information concerning this project, the Air Quality Program, or to file a complaint.
Llame al 311 para obtener información adicional sobre este proyecto, del Programa de Calidad del Aire, o para presenter una queja.
Gọi 311 để biết thêm thông tin hoặc để khiếu nại về dự án này, Chương Trình Chất Lượng Không Khí

City of Albuquerque, Environmental Health Department, Air Quality Program – Stationary Source Permitting
Ciudad de Albuquerque, Departamento de Salud Ambiental, Programa de Calidad del Aire - Permisos para Fuentes Inmóviles
(505) 768-1972, aqd@cabq.gov

THIS SIGN SHALL REMAIN POSTED UNTIL THE DEPARTMENT TAKES FINAL ACTION ON THE PERMIT APPLICATION
ESTE AVISO DEBERÁ DE MANTENERSE PUESTO HASTA QUE EL DEPARTAMENTO TOME UNA DECISIÓN SOBRE LA SOLICITUD DE PERMISO