20.11.41 NMAC
"AUTHORITY-TO-CONSTRUCT"
AIR QUALITY PERMIT APPLICATION
FOR STAR PAVING SOUTH BROADWAY HMA PLANT

Albuquerque, New Mexico

PREPARED FOR
STAR PAVING COMPANY

OCTOBER 2021

Prepared by

Montrose Air Quality Services, LLC

MONTROSE ENVIRONMENTAL

Introduction

This 20.11.41.2 permit application is for a new 300 tph hot mix asphalt (HMA) plant for Star Paving Company (Star Paving). Star Paving has retained Montrose Air Quality Services, LLC (Montrose) to assist with the new 20.11.41 NMAC "Authority to Construct" permit application. The plant will be identified as Star Paving's South Broadway HMA and will be located west of South Broadway Blvd in Tract B, C, and D Plat of Unit I Lands of B G & W Partnership. The UTM coordinates of the proposed HMA plant will be; 347,775 meters E, 3,869,750 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 (4), cold aggregate scalping screen, RAP feed bin (1), RAP scalping screen, drum dryer/mixer (1), drum dryer/mixer baghouse (1), asphalt storage silos (2), asphalt cement storage tanks (2), asphalt cement oil heater (1), burner fuel tank (1), Evotherm tank, and multiple conveyors (7). 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. Fuel burned in the drum dryer/mixer will be either burner fuel oil (on-specification used oil meeting the specification listed in 40 CFR 279.11) or pipeline quality natural gas. Fuel burned in the asphalt heater will be either diesel or propane.

As part of the operation of the facility, Star Paving 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	3000
February	3300
March	3300
April	4200
May	4200
June	5400
July	5400
August	5400
September	4200
October	4200
November	3300
December	3000

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

TABLE 2: HMA Production Hours of Operation (MST)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
12:00 AM	0	1	1	1	1	1	1	1	1	1	1	0
1:00 AM	0	1	1	1	1	1	1	1	1	1	1	0
2:00 AM	0	1	1	1	1	1	1	1	1	1	1	0
3:00 AM	0	1	1	1	1	1	1	1	1	1	1	0
4:00 AM	0	1	1	1	1	1	1	1	1	1	1	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	1	1	1	1	1	1	1	1	1	1	0
11:00 PM	0	1	1	1	1	1	1	1	1	1	1	0
Total	10.5	24	24	24	24	24	24	24	24	24	24	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 282 tons per hour at any time. This allows a range for aggregate and RAP to be 177 to 282 tons for aggregate and 105 to 0 for RAP. Particulate emission rates were calculated using maximum aggregate (282 tons per hour) and RAP (105 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 a baghouse for the 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.

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

<u>Startup</u>
Prior to the production of asphalt, the drum dryer/mixer 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.

<u>Shutdown</u>
All required control equipment will operate until all asphalt production ceases.

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

<u>Malfunction</u>
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.

If you have any questions regarding this permit application please call Paul Wade of Montrose at (505) 830-9680 x6 or Joseph Cruz of Star Paving at (505) 877-0380.

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: Star Paving's HP-2 HMA Process Flow
Figure A-2: Star Paving'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 Instructions

All source registration, authority-to-construct, and operating permit applications for stationary or portable sources shall be charged an application review fee according to the fee schedule in 20.11.2 NMAC. These filing fees are required for both new construction, reconstruction, and permit modifications applications. Qualified small businesses as defined in 20.11.2 NMAC may be eligible to pay one-half of the application review fees and 100% of all applicable federal program review fees.

Please fill out the permit application review fee checklist and submit with a check or money order payable to the "City of Albuquerque Fund 242" and either:

1. be delivered in person to the Albuquerque Environmental Health Department, 3rd floor, Suite 3023 or Suite 3027, Albuquerque-Bernalillo County Government Center, south building, One Civic Plaza NW, Albuquerque, NM or,

2. mailed to Attn: Air Quality Program, Albuquerque Environmental Health Department, P.O. Box 1293, Albuquerque, NM 87103.

The department will provide a receipt of payment to the applicant. The person delivering or filing a submittal shall attach a copy of the receipt of payment to the submittal as proof of payment Application review fees shall not be refunded without the written approval of the manager. If a refund is requested, a reasonable professional service fee to cover the costs of staff time involved in processing such requests shall be assessed. Please refer to 20.11.2 NMAC (effective January 10, 2011) for more detail concerning the "Fees" regulation as this checklist does not relieve the applicant from any applicable requirement of the regulation.

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	Star Paving Company	
Company Address	3109 Love Rd SW	
Facility Name	South Broadway HMA	
Facility Address	West of South Broadway Blvd in Tract B, C, and D Plat of Unit I Lands of B G & W Partnership	
Contact Person	Joseph Cruz	
Contact Person Phone Number	(505) 877-0380	
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
X	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
	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
X	*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	$4,739
Section III Total	$0
Section IV Total	$0
Section V Total	$0
Total Application Review Fee	**$4,739**

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 20 **day of** MAY **20**21

Joseph Cruz — GENERAL MANAGER

Print Name — **Print Title**

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 25, 2021**

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

Company Name: **Star Paving Services Company**			
Mailing Address: **3109 Love Road SW**	City: **Albuquerque**	State: **NM**	Zip: **87121**
Company Phone: **(505) 877-0380**	Company Contact: **Joseph M Cruz**		
Company Contact Title: **President**	Phone: **(505) 877-0380**	E-mail: **joseph@starpaving.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: **Star Paving South Broadway HMA**			
Facility Physical Address: **West of South Broadway Blvd in Tract B, C, and D Plat of Unit I Lands of B G & W Partnership**	City: **Albuquerque**	State: **NM**	Zip: **87105**
Facility Mailing Address (if different): **None**	City:	State:	Zip:
Facility Contact: **Joseph M Cruz**	Title: **President**		
Phone: **(505) 877-0380**	E-mail: **joseph@starpaving.com**		
Authorized Representative Name[1]: **Joseph M Cruz**	Authorized Representative Title: **President**		

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: **Principle**		
Mailing Address: **3500 Comanche Rd NE Suit 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: **347775E; 3869750N; 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: **July 2022**
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: **December to January: daylight hours only; February to November: 24 hours per day**
List raw materials processed: **Sand, Gravel, Evotherm, 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	177-282 tons/hr	
2	Feed Bin Loading	Astec	7’-0” Portable Double Barrel	TBD	TBD	TBD	N/A	177-282 tons/hr	
3	Feed Bin Unloading Conveyor					TBD	N/A	177-282 tons/hr	
4	Scalping Screen					TBD	N/A	177-282 tons/hr	
5	Scalping Screen Unloading Conveyor					TBD	N/A	177-282 tons/hr	
6	Conveyor Transfer to Slinger Conveyor					TBD	N/A	177-282 tons/hr	
7	RAP Storage Pile	N/A	N/A	N/A	N/A	TBD	N/A	0-105 tons/hr	
8	RAP Bin Loading	Astec	7’-0” Portable Double Barrel	TBD	TBD	TBD	N/A	0-105 tons/hr	
9	RAP Bin Unloading Conveyor					TBD	N/A	0-105 tons/hr	
10	RAP Screen					TBD	N/A	0-105 tons/hr	
11	RAP Screen Recycle Unloading Conveyor					TBD	N/A	0-105 tons/hr	
12	RAP Transfer Conveyor					TBD	N/A	0-105 tons/hr	
13	Drum Dryer/Mixer					TBD	N/A	300 tons/hr	Burner Fuel or Natural Gas
14	Drum Mixer Unloading					TBD	N/A	300 tons/hr	
15	Asphalt Silo Unloading					TBD	N/A	300 tons/hr	
16	Asphalt Heater	HEATEC	HCS-120	TBD	TBD	TBD	N/A	1.2 MMBTU/hr	Diesel or Propane
17	Asphalt Cement Storage Tanks (2)	HEATEC	HTA-30-35	TBD	TBD	TBD	N/A	30,000 gals/tank (each)	
18	Haul Road Traffic	N/A	N/A	N/A	N/A	TBD	N/A	24 truck/hour	
19	Yard	N/A	N/A	N/A	N/A	TBD	N/A	300 tons/hr	

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

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	95.33	AP-42 Table 11.19.2-2	177-282 tph
4b	Additional Moisture Content	4	TBD	TBD | TBD	TBD	PM10, PM2.5	91.20	AP-42 Table 11.19.2-2	177-282 tph
5b	Additional Moisture Content	5	TBD	TBD | TBD	TBD	PM10, PM2.5	95.33	AP-42 Table 11.19.2-2	177-282 tph
6b	Additional Moisture Content	6	TBD	TBD | TBD	TBD	PM10, PM2.5	95.33	AP-42 Table 11.19.2-2	177-282 tph
9b	Additional Moisture Content	9	TBD	TBD | TBD	TBD	PM10, PM2.5	95.33	AP-42 Table 11.19.2-2	0-105 tph
10b	Additional Moisture Content	10	TBD	TBD | TBD	TBD	PM10, PM2.5	91.20	AP-42 Table 11.19.2-2	0-105 tph
11b	Additional Moisture Content	11	TBD	TBD | TBD	TBD	PM10, PM2.5	95.33	AP-42 Table 11.19.2-2	0-105 tph
12b	Additional Moisture Content	12	TBD	TBD | TBD	TBD	PM10, PM2.5	95.33	AP-42 Table 11.19.2-2	0-105 tph
13b	Baghouse	13	TBD	TBD | TBD	TBD	PM10, PM2.5	99.88	AP-42 Section 11.1	300 tph
18b	Unpaved Roads	18	NA	NA | NA	TBD	PM10, PM2.5	90	NMED Default for Surfactants or Asphalt Millings and Water	24 trucks/hr 432 trucks/day

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**
   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
N/A								/	
								/	
								/	
								/	
								/	
								/	
								/	
								/	
								/	
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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% of 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 177 tons per hour.**								0.40	1.73	0.060	0.26			**AP-42 Section 13.2.4**
2									0.40	1.73	0.060	0.26			**AP-42 Section 13.2.4**
3									0.19	0.85	0.029	0.13			**AP-42 Table 11.19.2-2**
4									1.54	6.74	0.23	1.02			**AP-42 Table 11.19.2-2**
5									0.19	0.85	0.029	0.13			**AP-42 Table 11.19.2-2**
6									0.19	0.85	0.029	0.13			**AP-42 Table 11.19.2-2**
7	**Particulate emission rates for Units 7 through 12 were estimated using the maximum input of RAP of 105 tons per hour.**								0.070	0.31	0.011	0.047			**AP-42 13.2.4 and EIIP Volume 2, Chapter 3, Table 3.2-1**
8									0.070	0.31	0.011	0.047			**AP-42 13.2.4 and EIIP Volume 2, Chapter 3, Table 3.2-1**
9									0.12	0.51	0.017	0.077			**AP-42 Table 11.19.2-2**
10									0.91	4.00	0.14	0.61			**AP-42 Table 11.19.2-2**
11									0.12	0.51	0.017	0.077			**AP-42 Table 11.19.2-2**
12									0.12	0.51	0.017	0.077			**AP-42 Table 11.19.2-2**
13	16.5	72.3	39.0	170.8	9.60	42.0	17.4	76.2	1950	8541	470	2056	3.14	13.8	**AP-42 Section 11.1**
14			0.35	1.55	3.66	16.0			0.18	0.77	0.18	0.77			**AP-42 Section 11.1**

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	
15			0.40	1.77	1.25	5.46			0.16	0.69	0.16	0.69			**AP-42 Section 11.1**
16	0.22	0.96	0.10	0.43	0.013	0.057	0.078	0.34	0.022	0.096	0.022	0.096	0.0016	0.0036	**AP-42 1.3, 1.5** **SO_2 - Mass Balance**
17					0.048	0.21									**Tanks 4.0.9d**
18									7.98	29.4	0.83	3.09			**AP-42 13.1 and 13.2**
19			0.11	0.46	0.33	1.45									**AP-42 Section 11.1**
Totals of Uncontrolled Emissions with RAP input of 105 tph into mix	**16.7**	**73.2**	**40.0**	**175.0**	**14.9**	**65.2**	**17.5**	**76.6**	**1963**	**8591**	**471**	**2064**	**3.15**	**13.8**	

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.

Uncontrolled Emissions Table RAP 0% of 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 282 tons per hour.**								0.63	2.76	0.095	0.42			**AP-42 Section 13.2.4**
2									0.63	2.76	0.095	0.42			**AP-42 Section 13.2.4**
3									0.31	1.36	0.047	0.21			**AP-42 Table 11.19.2-2**
4									2.45	10.75	0.37	1.63			**AP-42 Table 11.19.2-2**
5									0.31	1.36	0.047	0.21			**AP-42 Table 11.19.2-2**
6									0.31	1.36	0.047	0.21			**AP-42 Table 11.19.2-2**
7	**Particulate emission rates for Units 7 through 12 were estimated using a RAP input of zero.**								0.000	0.00	0.000	0.000			**AP-42 13.2.4 and EIIP Volume 2, Chapter 3, Table 3.2-1**
8									0.000	0.00	0.000	0.000			**AP-42 13.2.4 and EIIP Volume 2, Chapter 3, Table 3.2-1**
9									0.00	0.00	0.000	0.000			**AP-42 Table 11.19.2-2**
10									0.00	0.00	0.00	0.00			**AP-42 Table 11.19.2-2**
11									0.00	0.00	0.000	0.000			**AP-42 Table 11.19.2-2**
12									0.00	0.00	0.000	0.000			**AP-42 Table 11.19.2-2**
13	16.5	72.3	39.0	170.8	9.60	42.0	17.4	76.2	1950	8541	470	2056	3.14	13.8	**AP-42 Section 11.1**
14			0.35	1.55	3.66	16.0			0.18	0.77	0.18	0.77			**AP-42 Section 11.1**

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	
15			0.40	1.77	1.25	5.46			0.16	0.69	0.16	0.69			**AP-42 Section 11.1**
16	0.22	0.96	0.10	0.43	0.013	0.057	0.078	0.34	0.022	0.096	0.022	0.096	0.0016	0.0036	**AP-42 1.3, 1.5** **SO_2 - Mass Balance**
17					0.048	0.21									**Tanks 4.0.9d**
18									7.98	29.4	0.83	3.09			**AP-42 13.1 and 13.2**
19			0.11	0.46	0.33	1.45									**AP-42 Section 11.1**
Totals of Uncontrolled Emissions with Aggregate input of 282 tph into mix	**16.7**	**73.2**	**40.0**	**175.0**	**14.9**	**65.2**	**17.5**	**76.6**	**1963**	**8592**	**471**	**2064**	**1963**	**8592**	

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.

Controlled Emissions Table RAP 35% of 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									0.40	0.46	0.060	0.070				
2									0.40	0.46	0.060	0.070				
3									0.0081	0.0095	0.0023	0.0027			Additional Moisture Content	95.82
4	**Particulate emission rates for Units 1 through 6 were estimated using the maximum input of aggregate into the plant of 177 tons per hour.**								0.13	0.15	0.0089	0.010			Additional Moisture Content	91.49
5									0.0081	0.0095	0.0023	0.0027			Additional Moisture Content	95.82
6									0.0081	0.0095	0.0023	0.0027			Additional Moisture Content	95.82
7									0.070	0.082	0.011	0.012				
8									0.070	0.082	0.011	0.012				
9									0.0048	0.0056	0.0014	0.0016			Additional Moisture Content	95.82
10	**Particulate emission rates for Units 7 through 12 were estimated using the maximum input of RAP of 105 tons per hour.**								0.078	0.091	0.0053	0.0061			Additional Moisture Content	91.49
11									0.0048	0.0056	0.0014	0.0016			Additional Moisture Content	95.82
12									0.0048	0.0056	0.0014	0.0016			Additional Moisture Content	95.82

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	16.5	19.3	39.0	45.5	9.60	11.2	17.4	20.3	6.90	8.05	6.90	8.05	3.14	3.67	Baghouse	99.65
14			0.35	0.41	3.66	4.27			0.18	0.21	0.18	0.21				
15			0.40	0.47	1.25	1.46			0.16	0.18	0.16	0.18				
16	0.22	0.96	0.10	0.43	0.013	0.057	0.078	0.34	0.022	0.096	0.022	0.096	0.0016	0.0036		
17					0.048	0.21										
18									1.01	1.02	0.14	0.14			Unpaved – Surfactant or Asphalt Millings and Watering	90
19			0.11	0.12	0.33	0.39										
Totals of Controlled Emissions with RAP input of 105 tph into mix	**16.7**	**20.2**	**40.0**	**46.9**	**14.9**	**17.6**	**17.5**	**20.6**	**9.45**	**10.9**	**7.56**	**8.87**	**3.15**	**3.67**		

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.

Controlled Emissions Table RAP 0% of 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 282 tons per hour.**								0.63	0.73	0.095	0.11				
2									0.63	0.73	0.095	0.11				
3									0.013	0.015	0.0037	0.0043			Additional Moisture Content	95.82
4									0.21	0.24	0.0141	0.016			Additional Moisture Content	91.49
5									0.013	0.015	0.0037	0.0043			Additional Moisture Content	95.82
6									0.013	0.015	0.0037	0.0043			Additional Moisture Content	95.82
7	**Particulate emission rates for Units 7 through 12 were estimated using a RAP input of zero.**								0.000	0.000	0.000	0.000				
8									0.000	0.000	0.000	0.000				
9									0.0000	0.0000	0.0000	0.0000			Additional Moisture Content	95.82
10									0.000	0.000	0.0000	0.0000			Additional Moisture Content	91.49
11									0.0000	0.0000	0.0000	0.0000			Additional Moisture Content	95.82
12									0.0000	0.0000	0.0000	0.0000			Additional Moisture Content	95.82

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	16.5	19.3	39.0	45.5	9.60	11.2	17.4	20.3	6.90	8.05	6.90	8.05	3.14	3.67	Baghouse	99.65
14			0.35	0.41	3.66	4.27			0.18	0.21	0.18	0.21				
15			0.40	0.47	1.25	1.46			0.16	0.18	0.16	0.18				
16	0.22	0.96	0.10	0.43	0.013	0.057	0.078	0.34	0.022	0.096	0.022	0.096	0.0016	0.0036		
17					0.048	0.21										
18									1.01	1.02	0.14	0.14			Unpaved – Surfactant or Asphalt Millings and Watering	90
19			0.11	0.12	0.33	0.39										
Totals of Controlled Emissions with Aggregate input of 282 tph into mix	**16.7**	**20.2**	**40.0**	**46.9**	**14.9**	**17.6**	**17.5**	**20.6**	**9.77**	**11.3**	**7.61**	**8.93**	**3.15**	**3.67**		

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		Toluene											
	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
13	3.14	3.67	0.93	1.09	0.87	1.02										
16	0.0016	0.0036														
Totals of HAPs for all units:	**3.15**	**3.67**	**0.93**	**1.09**	**0.87**	**1.02**										

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	1.5 Acres	Above	N/A	TBD	25 tons/truck	177-282 tons/hr	N/A	N/A	N/A	N/A
7	Storage Pile	RAP	0.5 Acres	Above	N/A	TBD	25 tons/truck	0-105 tons/hr	N/A	N/A	N/A	N/A
T1 (17)	Tank 1	Asphalt Cement	30,000 gal. tank	Above	Welded/Silver	TBD	8000 gal/truck	1952 gal/hr	0.035 Psia	N/A	N/A	N/A
T2 (17)	Tank 2	Asphalt Cement	30,000 gal. tank	Above	Welded/Silver	TBD	8000 gal/truck	1952 gal/hr	0.035 Psia	N/A	N/A	N/A
T3	Tank 3	Burner Fuel	30,000 gal. tank	Above	Welded/Silver	TBD	8000 gal/truck	420 gal/hr	0.0062 Psia	N/A	N/A	N/A
T4	Tank 4	Evotherm	5,000 Gal	Above	Welded/White	TBD	5000 gal/truck	72 gal/hr Max	N/A	N/A	N/A	N/A
T5	Tank 5	Water	10,000 Gal	Above	Welded/White	TBD	N/A	N/A	N/A	N/A	N/A	N/A
T6-7	Silos (2)	Asphalt	300 TPH	Above	N/A	TBD	300 TPH	300 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
13	Drum Dryer/Mixer	NOx, CO, SO_2, VOC, PM_{10}, $PM_{2.5}$, H_2S, Lead	347769.7	3869762.6	21.31	240	73.49	75000 ACFM	4.196	Vertical
16	Asphalt Heater	NOx, CO, SO_2, VOC, PM_{10}, $PM_{2.5}$, Lead	347776.5	3869727.2	14.0	600	20.71	976	1.0	Rain Cap

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, 20 21

Joseph M Cruz
Print Name

President
Print Title

Signature

Attachment A
Facility Process Flow Diagram and Plot Plan

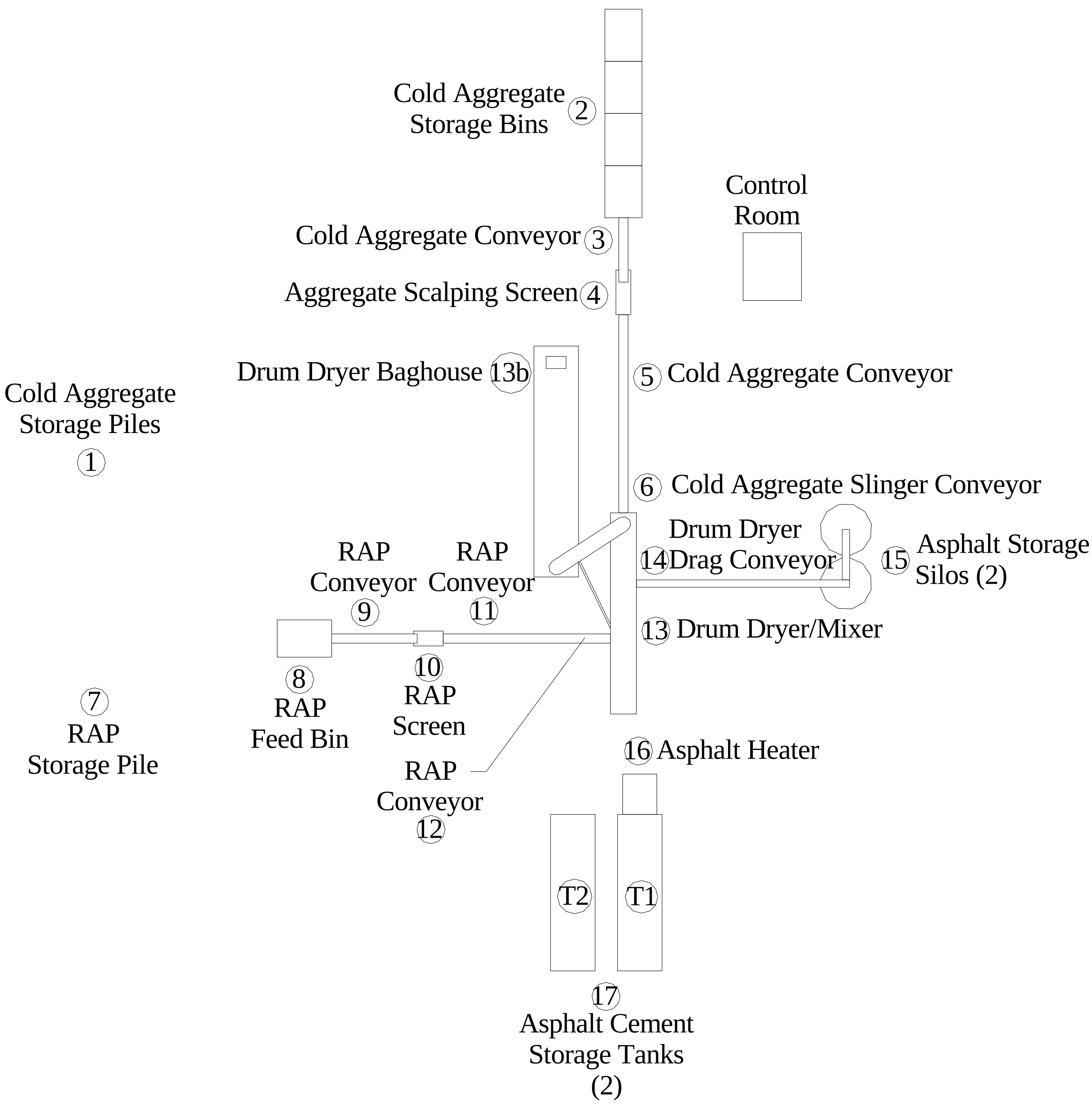

FIGURE A-1: Star Paving South Broadway 300 TPH HMA Layout Plan

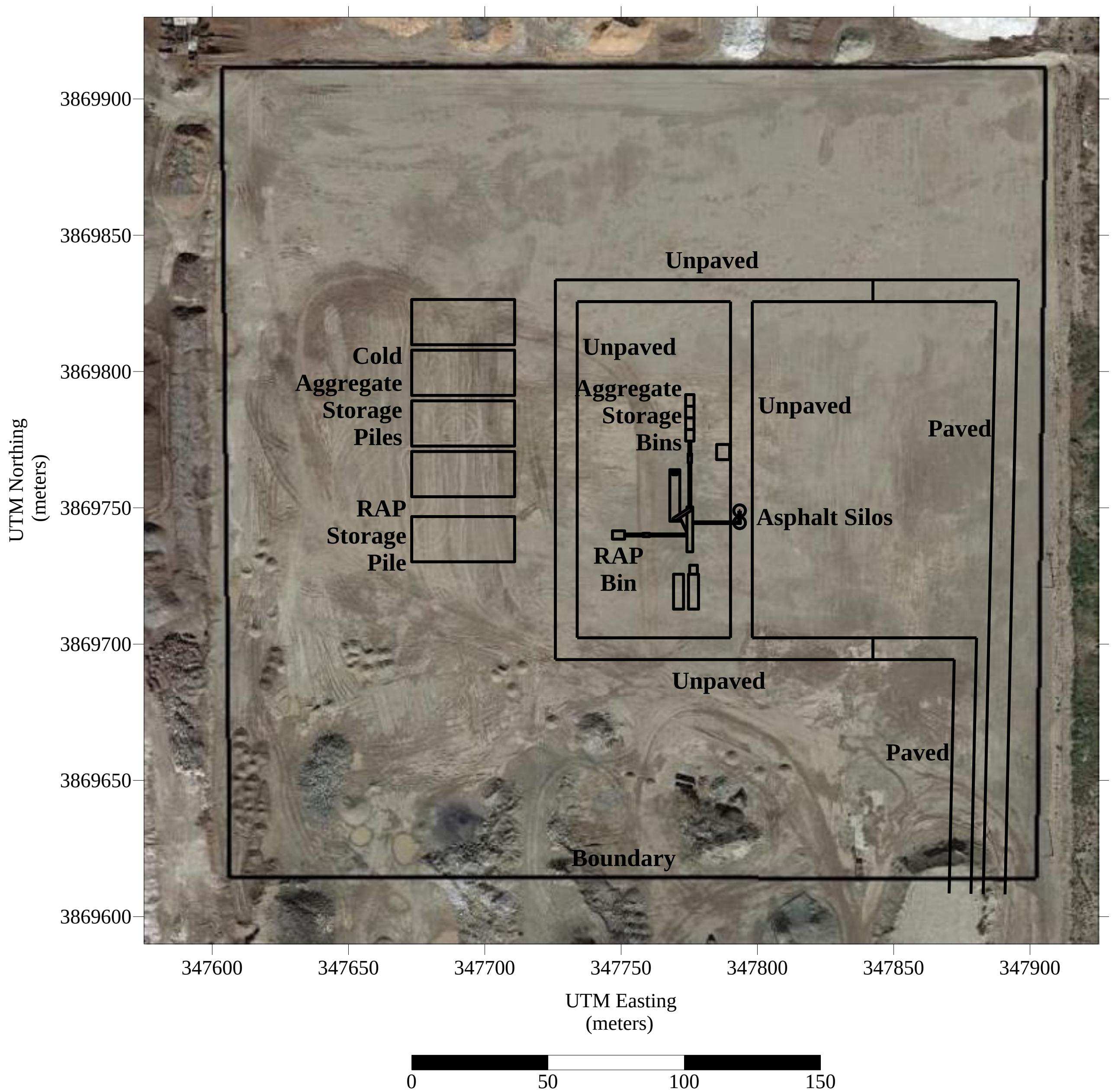

FIGURE A-2: Star Paving South Broadway 300 TPH HMA Site Layout

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, 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 300 tons per hours. Uncontrolled annual emissions are based on operating 8760 hours per year. Virgin aggregate/RAP/Asphalt cement ratios used in estimating material handling particulate emission rates is equal to 59.0/35.0/6.0. If no RAP is allowed in a mix, the Virgin aggregate/RAP/Asphalt cement ratios used in estimating material handling particulate emission rates is equal to 94.0/0.0/6.0. This allows a range for aggregate and RAP to be 177 to 282 tons for aggregate and 105 to 0 for RAP. Normal operations include RAP, so dispersion modeling will be performed 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.

<u>Aggregate Storage Piles and Feed Bin Loading Emission Equation:</u>

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

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

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

<u>AP-42 Emission Factors:</u>

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

Screening = Uncontrolled Screening 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 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

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:

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

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	177	0.84	3.66	0.40	1.73	0.060	0.26
2	Feed Bin Loading	177	0.84	3.66	0.40	1.73	0.060	0.26
3	Feed Bin Unloading Conveyor	177	0.53	2.33	0.19	0.85	0.029	0.13
4	Scalping Screen	177	4.43	19.4	1.54	6.74	0.23	1.02
5	Scalping Screen Unloading Conveyor	177	0.53	2.33	0.19	0.85	0.029	0.13
6	Conveyor Transfer to Slinger Conveyor	177	0.53	2.33	0.19	0.85	0.029	0.13
7	RAP Storage Pile	105	0.15	0.65	0.070	0.31	0.011	0.047
8	RAP Bin Loading	105	0.15	0.65	0.070	0.31	0.011	0.047
9	RAP Bin Unloading Conveyor	105	0.32	1.38	0.12	0.51	0.017	0.077
10	RAP Screen	105	2.63	11.5	0.91	4.00	0.14	0.61
11	RAP Screen Recycle Unloading Conveyor	105	0.32	1.38	0.12	0.51	0.017	0.077
12	RAP Transfer Conveyor	105	0.32	1.38	0.12	0.51	0.017	0.077

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	282	1.33	5.83	0.63	2.76	0.095	0.42
2	Feed Bin Loading	282	1.33	5.83	0.63	2.76	0.095	0.42
3	Feed Bin Unloading Conveyor	282	0.85	3.71	0.31	1.36	0.047	0.21
4	Scalping Screen	282	7.05	30.9	2.45	10.75	0.37	1.63
5	Scalping Screen Unloading Conveyor	282	0.85	3.71	0.31	1.36	0.047	0.21
6	Conveyor Transfer to Slinger Conveyor	282	0.85	3.71	0.31	1.36	0.047	0.21
7	RAP Storage Pile	0	0.00	0.00	0.000	0.00	0.000	0.000
8	RAP Bin Loading	0	0.00	0.00	0.000	0.00	0.000	0.000
9	RAP Bin Unloading Conveyor	0	0.00	0.00	0.00	0.00	0.000	0.000
10	RAP Screen	0	0.00	0.0	0.00	0.00	0.00	0.00
11	RAP Screen Recycle Unloading Conveyor	0	0.00	0.00	0.00	0.00	0.000	0.000
12	RAP Transfer Conveyor	0	0.00	0.00	0.00	0.00	0.000	0.000

HMA HAUL TRUCK TRAVEL

Haul truck travel emissions (Unit 18) were estimated using AP-42, Section 13.2.1 (ver.01/11) "Paved Roads" emission equation for paved roads and AP-42, Section 13.2.2 (ver.12/03) "Unpaved Roads" for unpaved roads when the amount of RAP in mix is 35%. Haul trucks will be used to deliver asphalt cement, RAP (35% of Mix), aggregate material, and transport asphalt product. Table B-3 summarizes the emission rate for haul truck traffic at 35% 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]

k PM	0.011			
k PM10	0.0022			
k PM25	0.00054			
sL	0.6			
P = days with precipitation over 0.01 inches	60			
N = number of days in averaging period	365			
Truck Load Capacity	25	tons		
Truck Unload Weight	15	tons		
Truck weight	27.5	tons		
Haul Truck VMT Paved In	270.4	meter/vehicle	0.16807	miles/vehicle
Haul Truck VMT Paved Out	124.0	meter/vehicle	0.07706	miles/vehicle
Max. RAP Truck/hr	4.2	truck/hr	36792	truck/yr
Max. Asphalt Cement Truck/hr	0.7	truck/hr	6307	truck/yr
Max. Asphalt Truck/hr	12.0	truck/hr	105120	truck/yr
Max Aggregate Truck/hr	7.1	truck/hr	62021	truck/yr
Max. Total Truck into Site	**24.0**	**truck/hr**	**210240**	**truck/yr**

Paved Road In

	Hourly Max		Annual Max	
Haul Truck VMT Paved Asphalt	4.03371	miles/hr	35,335	miles/yr
Max. Truck Emissions Paved Road In	PM Uncontrolled		PM Uncontrolled	
	0.8191	lbs/hr	3.5876	ton/yr
	PM10 Uncontrolled		PM10 Uncontrolled	
	0.1638	lbs/hr	0.7175	ton/yr
	PM2.5 Uncontrolled		PM2.5 Uncontrolled	
	0.0402	lbs/hr	0.1761	ton/yr

Paved Road Out

	Hourly Max		Annual VRT	
Haul Truck VMT Paved Asphalt	1.84935	miles/hr	16200	miles/yr
Max. Truck Emissions Paved Road Out	PM Uncontrolled		PM Uncontrolled	
	0.3755	lbs/hr	1.6448	tons/yr
	PM10 Uncontrolled		PM10 Uncontrolled	
	0.0751	lbs/hr	0.3290	tons/yr
	PM2.5 Uncontrolled		PM2.5 Uncontrolled	
	0.0184	lbs/hr	0.0807	tons/yr

AP-42 13.2 Unpaved Road (12/03) (01/11) 35% RAP in Mix

Equation:			
E = k(s/12)^a*(W/3)^b*[(365-p)/365]	*Annual emissions only include p factor*		
k PM	4.9		
k PM10	1.5		
k PM25	0.15		
a PM	0.7		
a PM10	0.9		
a PM25	0.9		
b PM	0.45		
b PM10	0.45		
b PM25	0.45		
% Silt Content = s	4.8 %		Sand and Gravel (AP-42 13.2.2-1)
p = days with precipitation over 0.01 inches	60		
Vehicle control	90.0	%	Surfactants/Asphalt Millings

Asphalt Unpaved Road

Asphalt Truck VMT Unpaved	227.4	meter vehicle	0.14132	miles/vehicle
Max. Asphalt Truck/hr	12	truck/hr		
	Uncontrolled		Uncontrolled	
Asphalt Truck VMT Unpaved	1.69584	miles/hr	14856	miles/yr
Asphalt Truck weight	27.5	tons		
		PM Uncontrolled		
Max. Asphalt Truck Emissions Unpaved	11.8582	lbs/hr	43.4	tons/yr
		PM10 Uncontrolled		
Max. Asphalt Truck Emissions Unpaved	3.0222	lbs/hr	11.1	tons/yr
		PM2.5 Uncontrolled		
Max. Asphalt Truck Emissions Unpaved	0.3022	lbs/hr	1.11	tons/yr

Aggregate Unpaved Road

Asphalt Cement Truck VMT Unpaved	354.9	meter/vehicle	0.22060	miles/vehicle
Aggregate Truck VMT Unpaved	354.9	meter/vehicle	0. 22060	miles/vehicle
RAP Truck VMT Unpaved	354.9	meter/vehicle	0. 22060	miles/vehicle

Max. Asphalt Cement Truck/hr	0.7	truck/hr
Max Aggregate Truck/hr	7.1	truck/hr
Max. RAP Truck/hr	4.2	truck/hr
Max. Total Truck	**12.0**	**truck/hr**

	Uncontrolled		Uncontrolled	
Asphalt Cement Truck VMT Unpaved	0.15883	miles/hr	1391.4	miles/yr
Aggregate Truck VMT Unpaved	1.56186	miles/hr	13681.9	miles/yr
RAP Truck VMT Unpaved	0.92652	miles/hr	8116.4	miles/yr
	2.647	miles/hr	23189.6	miles/yr

Asphalt Cement Truck weight	27.5	tons
Aggregate Truck weight	27.5	tons
RAP Truck weight	27.5	tons

	PM Uncontrolled		PM Uncontrolled	
Max. Asphalt Cement Truck Emissions Unpaved	1.1106	lbs/hr	4.0649	tons/yr
Max. Aggregate Truck Emissions Unpaved	10.9213	lbs/hr	39.9719	tons/yr
Max. RAP Truck Emissions Unpaved	6.4787	lbs/hr	23.7122	tons/yr
total traffic	**18.5107**	**lbs/hr**	**67.7490**	**tons/yr**

	PM10 Uncontrolled		PM10 Uncontrolled	
Max. Asphalt Cement Truck Emissions Unpaved	0.2831	lbs/hr	1.0360	tons/yr
Max. Aggregate Truck Emissions Unpaved	2.7834	lbs/hr	10.1874	tons/yr
Max. RAP Truck Emissions Unpaved	1.6512	lbs/hr	6.0434	tons/yr
total traffic	**4.7177**	**lbs/hr**	**17.2667**	**tons/yr**

	PM2.5 Uncontrolled		PM2.5 Uncontrolled	
Max. Asphalt Cement Truck Emissions Unpaved	0.0283	lbs/hr	0.1036	tons/yr
Max. Aggregate Truck Emissions Unpaved	0.2783	lbs/hr	1.0187	tons/yr
Max. RAP Truck Emissions Unpaved	0.1651	lbs/hr	0.6043	tons/yr
total traffic	**0.4718**	**lbs/hr**	**1.7267**	**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)
Uncontrolled Paved and Unpaved Road Truck Emissions Unit 18	24 truck/hr	31.6	116.4	7.98	29.4	0.83	3.09

Haul truck travel emissions (Unit 18) were estimated using AP-42, Section 13.2.1 (ver.01/11) "Paved Roads" emission equation for paved roads and AP-42, Section 13.2.2 (ver.12/03) "Unpaved Roads" for unpaved roads when the amount of RAP in mix is zero. Haul trucks will be used to deliver asphalt cement, aggregate material (94% of Mix), and transport asphalt product. Table B-4 summarizes the emission rate for all haul truck traffic at 0% RAP input in the mix.

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

Equation:
E = k(sL)^0.91*(W)^1.02*[1-P/4N]

k PM	0.011			
k PM10	0.0022			
k PM25	0.00054			
sL	0.6			
P = days with precipitation over 0.01 inches	60			
N = number of days in averaging period	365			
Truck Load Capacity	25	tons		
Truck Unload Weight	15	tons		
Truck weight	27.5	tons		
Haul Truck VMT Paved In	270.4	meter/vehicle	0.16807	miles/vehicle
Haul Truck VMT Paved Out	124.0	meter/vehicle	0.07706	miles/vehicle
Max. Asphalt Cement Truck/hr	0.7	truck/hr	6307	truck/yr
Max. Asphalt Truck/hr	12.0	truck/hr	105120	truck/yr
Max Aggregate Truck/hr	11.3	truck/hr	98813	truck/yr
Max. Total Truck into Site	**24.0**	**truck/hr**	**210240**	**truck/yr**

Paved Road In

	Hourly Max		Annual Max	
Haul Truck VMT Paved Asphalt	4.03371	miles/hr	35,335	miles/yr
Max. Truck Emissions Paved Road In	PM Uncontrolled		PM Uncontrolled	
	0.8191	lbs/hr	3.5876	ton/yr
	PM10 Uncontrolled		PM10 Uncontrolled	
	0.1638	lbs/hr	0.7175	ton/yr
	PM2.5 Uncontrolled		PM2.5 Uncontrolled	
	0.0402	lbs/hr	0.1761	ton/yr

Paved Road Out

	Hourly Max		Annual VRT	
Haul Truck VMT Paved Asphalt	1.84935	miles/hr	16200	miles/yr
Max. Truck Emissions Paved Road Out	PM Uncontrolled		PM Uncontrolled	
	0.3755	lbs/hr	1.6448	tons/yr
	PM10 Uncontrolled		PM10 Uncontrolled	
	0.0751	lbs/hr	0.3290	tons/yr
	PM2.5 Uncontrolled		PM2.5 Uncontrolled	
	0.0184	lbs/hr	0.0807	tons/yr

AP-42 13.2 Unpaved Road (12/03) (01/11) 0% RAP in Mix

Equation:			
E = k(s/12)^a*(W/3)^b*[(365-p)/365]	*Annual emissions only include p factor*		
k PM	4.9		
k PM10	1.5		
k PM25	0.15		
a PM	0.7		
a PM10	0.9		
a PM25	0.9		
b PM	0.45		
b PM10	0.45		
b PM25	0.45		
% Silt Content = s	4.8 %	Sand and Gravel (AP-42 13.2.2-1)	
p = days with precipitation over 0.01 inches	60		
Vehicle control	0.0	%	Surfactants/Asphalt Millings

Asphalt Unpaved Road

Asphalt Truck VMT Unpaved	227.4	meter vehicle	0.14132	miles/vehicle
Max. Asphalt Truck/hr	12	truck/hr		
	Uncontrolled		Uncontrolled	
Asphalt Truck VMT Unpaved	1.69584	miles/hr	14856	miles/yr
Asphalt Truck weight	27.5	tons		
		PM Uncontrolled		
Max. Asphalt Truck Emissions Unpaved	11.8582	lbs/hr	43.4	tons/yr
		PM10 Uncontrolled		
Max. Asphalt Truck Emissions Unpaved	3.0222	lbs/hr	11.1	tons/yr
		PM2.5 Uncontrolled		
Max. Asphalt Truck Emissions Unpaved	0.3022	lbs/hr	1.11	tons/yr

Aggregate Unpaved Road

Asphalt Cement Truck VMT Unpaved	354.9	meter/vehicle	0.22060	miles/vehicle
Aggregate Truck VMT Unpaved	354.9	meter/vehicle	0. 22060	miles/vehicle
Max. Asphalt Cement Truck/hr	0.7	truck/hr		
Max Aggregate Truck/hr	11.3	truck/hr		
Max. Total Truck	**12.0**	**truck/hr**		
	Uncontrolled		Uncontrolled	
Asphalt Cement Truck VMT Unpaved	0.15883	miles/hr	1391.4	miles/yr
Aggregate Truck VMT Unpaved	2.48838	miles/hr	21798.2	miles/yr
	2.647	miles/hr	23189.6	miles/yr
Asphalt Cement Truck weight	27.5	tons		
Aggregate Truck weight	27.5	tons		
	PM Uncontrolled		PM Uncontrolled	
Max. Asphalt Cement Truck Emissions Unpaved	1.1106	lbs/hr	4.0649	tons/yr
Max. Aggregate Truck Emissions Unpaved	17.4000	lbs/hr	63.6841	tons/yr
total traffic	**18.5107**	**lbs/hr**	**67.7490**	**tons/yr**
	PM10 Uncontrolled		PM10 Uncontrolled	
Max. Asphalt Cement Truck Emissions Unpaved	0.2831	lbs/hr	1.0360	tons/yr
Max. Aggregate Truck Emissions Unpaved	4.4346	lbs/hr	16.2307	tons/yr
total traffic	**4.7177**	**lbs/hr**	**17.2667**	**tons/yr**
	PM2.5 Uncontrolled		PM2.5 Uncontrolled	
Max. Asphalt Cement Truck Emissions Unpaved	0.0283	lbs/hr	0.1036	tons/yr
Max. Aggregate Truck Emissions Unpaved	0.4435	lbs/hr	1.6231	tons/yr
total traffic	**0.4718**	**lbs/hr**	**1.7267**	**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)
Uncontrolled Paved and Unpaved Road Truck Emissions Unit 18	24 truck/hr	31.6	116.4	7.98	29.4	0.83	3.09

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. Fuel burned in the drum dryer/mixer will be either burner fuel oil (on-specification used oil meeting the specification listed in 40 CFR 279.11) or pipeline quality natural gas. Maximum emission rates will be determined using emission factor for combusting burner fuel oil (called waste oil in AP-42), which will produce the highest combustion emission rate. Hourly emission rates are based on maximum hourly asphalt production (300 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. Percent sulfur content of the burner fuel will not exceed 0.5 percent. 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 temperature of 325˚ 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	0.055
	CO	0.130
	SO_2	0.058
	VOC	0.032
	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	0.001349240
	TOC	0.004158948
	PM	0.000521937
	PM_{10}	0.000521937
	$PM_{2.5}$	0.000521937
Yard	CO	0.000352
	TOC	0.00110

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)
13	Asphalt Drum Dryer	NO_X	300	16.50	72.27
		CO	300	39.00	170.82
		SO_2	300	17.40	76.21
		VOC	300	9.60	42.05
		PM	300	8400	36792
		PM_{10}	300	1950	8541
		$PM_{2.5}$	300	470	2056
14	Drum Mixer Unloading	CO	300	0.35	1.55
		TOC	300	3.66	16.01
		PM	300	0.18	0.77
		PM_{10}	300	0.18	0.77
		$PM_{2.5}$	300	0.18	0.77
15	Asphalt Silo Unloading	CO	300	0.40	1.77
		TOC	300	1.25	5.46
		PM	300	0.16	0.69
		PM_{10}	300	0.16	0.69
		$PM_{2.5}$	300	0.16	0.69
17	Asphalt Cement Storage Tanks	TOC	300	0.048	0.21
19	YARD	CO	300	0.11	0.46
		TOC	300	0.33	1.45

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 13). No controls or emission reductions for emissions from asphalt silo load (Unit 14), asphalt silo unload (Unit 15), asphalt heater (Unit 16), asphalt cement storage tanks, and paved haul road traffic (Unit 18) with the exception of limiting annual production rates for production equipment.

<u>CONTROLLED MATERIAL HANDLING ($PM_{2.5}$, PM_{10}, AND PM)</u>

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 AP-42 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 AP-42 Section 11.19.2, Table 11.19.2-2. Additional emission reductions include limiting annual production rates.

Fugitive dust control for the conveyor transfer from the scalping screen unloading (Unit 5) to the scalping screen conveyor (Units 6) and RAP screen unloading (Unit 11) to the RAP transfer conveyor (Units 12) 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 AP-42 Section 11.19.2, Table 11.19.2-2. Additional emission reductions include limiting annual production rates.

Particulate emissions from the drum dryer/mixer (Unit 13) will be controlled with a baghouse dust collector (Unit 13b) on the exhaust vent. It is estimated that this method will control to a PM_{10} efficiency of 99.65 percent per AP-42 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 <u>Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources</u>, Aug. 2004, Section 11.19.2, Table 11.19.2-2.

To estimate material handling controlled 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 300 tons per hours. Virgin aggregate/RAP/Mineral Filler/Asphalt cement ratios used in estimating material handling particulate emission rates is equal to 59.0/35.0/6.0. 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 94.0/0.0/6.0. This allows a range for aggregate and RAP to be 177 to 282 tons for aggregate and 105 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 700,000 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) = $k \times 0.0032 \times (U/5)^{1.3} / (M/2)^{1.4}$

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

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

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

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 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)
Controlled Aggregate/RAP Screening	0.00220	0.00074	0.00005
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

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	177	0.84	0.97	0.40	0.46	0.060	0.070
2	Feed Bin Loading	177	0.84	0.97	0.40	0.46	0.060	0.070
3	Feed Bin Unloading Conveyor	177	0.025	0.029	0.0081	0.0095	0.0023	0.0027
4	Scalping Screen	177	0.39	0.45	0.13	0.15	0.0089	0.010
5	Scalping Screen Unloading Conveyor	177	0.025	0.029	0.0081	0.0095	0.0023	0.0027
6	Conveyor Transfer to Slinger Conveyor	177	0.025	0.029	0.0081	0.0095	0.0023	0.0027
7	RAP Storage Pile	105	0.15	0.17	0.070	0.082	0.011	0.012
8	RAP Bin Loading	105	0.15	0.17	0.070	0.082	0.011	0.012
9	RAP Bin Unloading Conveyor	105	0.015	0.017	0.0048	0.0056	0.0014	0.0016
10	RAP Screen	105	0.23	0.27	0.078	0.091	0.0053	0.0061
11	RAP Screen Unloading Conveyor	105	0.015	0.017	0.0048	0.0056	0.0014	0.0016
12	RAP Transfer Conveyor	105	0.015	0.017	0.0048	0.0056	0.0014	0.0016

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	282	1.33	1.55	0.63	0.73	0.095	0.11
2	Feed Bin Loading	282	1.33	1.55	0.63	0.73	0.095	0.11
3	Feed Bin Unloading Conveyor	282	0.039	0.046	0.013	0.015	0.0037	0.0043
4	Scalping Screen	282	0.62	0.72	0.21	0.24	0.014	0.016
5	Scalping Screen Unloading Conveyor	282	0.039	0.046	0.013	0.015	0.0037	0.0043
6	Conveyor Transfer to Slinger Conveyor	282	0.039	0.046	0.013	0.015	0.0037	0.0043
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 Conveyor	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 Unloading Conveyor	0	0.0	0.0	0.0	0.0	0.0	0.0
12	RAP Transfer Conveyor	0	0.0	0.0	0.0	0.0	0.0	0.0

CONTROLLED HMA HAUL TRUCK TRAVEL

Haul truck travel emissions (Unit 18) were estimated using AP-42, Section 13.2.1 (ver.01/11) "Paved Roads" emission equation for paved roads and AP-42, Section 13.2.2 (ver.12/03) "Unpaved Roads" for unpaved roads when the amount of RAP in mix is 35%. Haul trucks will be used to deliver asphalt cement, RAP (35% of Mix), aggregate material, and transport asphalt product. Table B-8 summarizes the emission rate for haul truck traffic at 35% RAP input in the mix. Unpaved road fugitive dust will be controlled by surfactants or asphalt milling and watering for a 90% control efficiency.

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

Equation:
E = k(sL)^0.91*(W)^1.02*[1-P/4N]

k PM	0.011			
k PM10	0.0022			
k PM25	0.00054			
sL	0.6			
P = days with precipitation over 0.01 inches	60			
N = number of days in averaging period	365			
Truck Load Capacity	25	tons		
Truck Unload Weight	15	tons		
Truck weight	27.5	tons		
Haul Truck VMT Paved In	270.4	meter/vehicle	0.16807	miles/vehicle
Haul Truck VMT Paved Out	124.0	meter/vehicle	0.07706	miles/vehicle
Max. RAP Truck/hr	4.2	truck/hr	9800	truck/yr
Max. Asphalt Cement Truck/hr	0.7	truck/hr	1680	truck/yr
Max. Asphalt Truck/hr	12.0	truck/hr	28000	truck/yr
Max Aggregate Truck/hr	7.1	truck/hr	16520	truck/yr
Max. Total Truck into Site	**24.0**	**truck/hr**	**56000**	**truck/yr**

Paved Road In

	Hourly Max		Annual Max	
Haul Truck VMT Paved Asphalt	4.03371	miles/hr	9,412	miles/yr
Max. Truck Emissions Paved Road In	PM Controlled		PM Controlled	
	0.8191	lbs/hr	0.9163	ton/yr
	PM10 Controlled		PM10 Controlled	
	0.1638	lbs/hr	0.1833	ton/yr
	PM2.5 Controlled		PM2.5 Controlled	
	0.0402	lbs/hr	0.0450	ton/yr

Paved Road Out

	Hourly Max		Annual VRT	
Haul Truck VMT Paved Asphalt	1.84935	miles/hr	4315	miles/yr
Max. Truck Emissions Paved Road Out	PM Controlled		PM Controlled	
	0.3755	lbs/hr	0.4201	tons/yr
	PM10 Controlled		PM10 Controlled	
	0.0751	lbs/hr	0.0840	tons/yr
	PM2.5 Controlled		PM2.5 Controlled	
	0.0184	lbs/hr	0.0206	tons/yr

AP-42 13.2 Unpaved Road (12/03) (01/11) 35% RAP in Mix

Equation:

E = k(s/12)^a*(W/3)^b*[(365-p)/365]	*Annual emissions only include p factor*	
k PM	4.9	
k PM10	1.5	
k PM25	0.15	
a PM	0.7	
a PM10	0.9	
a PM25	0.9	
b PM	0.45	
b PM10	0.45	
b PM25	0.45	
% Silt Content = s	4.8 %	Sand and Gravel (AP-42 13.2.2-1)
p = days with precipitation over 0.01 inches	60	
Vehicle control	90.0 %	Surfactants/Asphalt Millings and Watering

Asphalt Unpaved Road

Asphalt Truck VMT Unpaved	227.4	meter vehicle	0.14132	miles/vehicle
Max. Asphalt Truck/hr	12	truck/hr		
	Controlled		Controlled	
Asphalt Truck VMT Unpaved	1.69584	miles/hr	3957	miles/yr
Asphalt Truck weight	27.5	tons		
		PM Controlled		
Max. Asphalt Truck Emissions Unpaved	1.1858	lbs/hr	1.16	tons/yr
		PM10 Controlled		
Max. Asphalt Truck Emissions Unpaved	0.3022	lbs/hr	0.29	tons/yr
		PM2.5 Controlled		
Max. Asphalt Truck Emissions Unpaved	0.0302	lbs/hr	0.029	tons/yr

Aggregate Unpaved Road

Asphalt Cement Truck VMT Unpaved	354.9	meter/vehicle	0.22060	miles/vehicle
Aggregate Truck VMT Unpaved	354.9	meter/vehicle	0. 22060	miles/vehicle
RAP Truck VMT Unpaved	354.9	meter/vehicle	0. 22060	miles/vehicle

Max. Asphalt Cement Truck/hr	0.7	truck/hr
Max Aggregate Truck/hr	7.1	truck/hr
Max. RAP Truck/hr	4.2	truck/hr
Max. Total Truck	**12.0**	**truck/hr**

	Controlled		Controlled	
Asphalt Cement Truck VMT Unpaved	0.15883	miles/hr	370.6	miles/yr
Aggregate Truck VMT Unpaved	1.56186	miles/hr	3644.3	miles/yr
RAP Truck VMT Unpaved	0.92652	miles/hr	2161.9	miles/yr
	2.647	miles/hr	6176.8	miles/yr

Asphalt Cement Truck weight	27.5	tons
Aggregate Truck weight	27.5	tons
RAP Truck weight	27.5	tons

	PM Controlled		PM Controlled	
Max. Asphalt Cement Truck Emissions Unpaved	0.1111	lbs/hr	0.1083	tons/yr
Max. Aggregate Truck Emissions Unpaved	1.0921	lbs/hr	1.0647	tons/yr
Max. RAP Truck Emissions Unpaved	0.6479	lbs/hr	0.6316	tons/yr
total traffic	**1.8511**	**lbs/hr**	**1.8046**	**tons/yr**

	PM10 Controlled		PM10 Controlled	
Max. Asphalt Cement Truck Emissions Unpaved	0.0283	lbs/hr	0.0276	tons/yr
Max. Aggregate Truck Emissions Unpaved	0.2783	lbs/hr	0.2714	tons/yr
Max. RAP Truck Emissions Unpaved	0.1651	lbs/hr	0.1610	tons/yr
total traffic	**0.4718**	**lbs/hr**	**0.4599**	**tons/yr**

	PM2.5 Controlled		PM2.5 Controlled	
Max. Asphalt Cement Truck Emissions Unpaved	0.0028	lbs/hr	0.0028	tons/yr
Max. Aggregate Truck Emissions Unpaved	0.0278	lbs/hr	0.0271	tons/yr
Max. RAP Truck Emissions Unpaved	0.0165	lbs/hr	0.0161	tons/yr
total traffic	**0.0472**	**lbs/hr**	**0.0460**	**tons/yr**

Table B-8: Controlled 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)
Controlled Paved and Unpaved Road Truck Emissions Unit 18	24 truck/hr	4.23	4.30	1.01	1.02	0.14	0.14

Haul truck travel emissions (Unit 18) were estimated using AP-42, Section 13.2.1 (ver.01/11) “Paved Roads” emission equation for paved roads and AP-42, Section 13.2.2 (ver.12/03) “Unpaved Roads” for unpaved roads when the amount of RAP in mix is zero. Haul trucks will be used to deliver asphalt cement, aggregate material (94% of Mix), and transport asphalt product. Table B-9 summarizes the emission rate for all haul truck traffic at 0% RAP input in the mix. Unpaved road fugitive dust will be controlled by surfactants or asphalt milling and watering for a 90% control efficiency.

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

Equation:

E = k(sL)^0.91*(W)^1.02*[1-P/4N]

k PM	0.011			
k PM10	0.0022			
k PM25	0.00054			
sL	0.6			
P = days with precipitation over 0.01 inches	60			
N = number of days in averaging period	365			
Truck Load Capacity	25	tons		
Truck Unload Weight	15	tons		
Truck weight	27.5	tons		
Haul Truck VMT Paved In	270.4	meter/vehicle	0.16807	miles/vehicle
Haul Truck VMT Paved Out	124.0	meter/vehicle	0.07706	miles/vehicle
Max. Asphalt Cement Truck/hr	0.7	truck/hr	6307	truck/yr
Max. Asphalt Truck/hr	12.0	truck/hr	105120	truck/yr
Max Aggregate Truck/hr	11.3	truck/hr	98813	truck/yr
Max. Total Truck into Site	**24.0**	**truck/hr**	**210240**	**truck/yr**

Paved Road In

	Hourly Max		Annual Max	
Haul Truck VMT Paved Asphalt	4.03371	miles/hr	9,412	miles/yr
Max. Truck Emissions Paved Road In	PM Controlled		PM Controlled	
	0.8191	lbs/hr	0.9163	ton/yr
	PM10 Controlled		PM10 Controlled	
	0.1638	lbs/hr	0.1833	ton/yr
	PM2.5 Controlled		PM2.5 Controlled	
	0.0402	lbs/hr	0.0450	ton/yr

Paved Road Out

	Hourly Max		Annual VRT	
Haul Truck VMT Paved Asphalt	1.84935	miles/hr	4315	miles/yr
Max. Truck Emissions Paved Road Out	PM Controlled		PM Controlled	
	0.3755	lbs/hr	0.4201	tons/yr
	PM10 Controlled		PM10 Controlled	
	0.0751	lbs/hr	0.0840	tons/yr
	PM2.5 Controlled		PM2.5 Controlled	
	0.0184	lbs/hr	0.0206	tons/yr

AP-42 13.2 Unpaved Road (12/03) (01/11) 0% RAP in Mix

Equation:			
E = k(s/12)^a*(W/3)^b*[(365-p)/365]	*Annual emissions only include p factor*		
k PM	4.9		
k PM10	1.5		
k PM25	0.15		
a PM	0.7		
a PM10	0.9		
a PM25	0.9		
b PM	0.45		
b PM10	0.45		
b PM25	0.45		
% Silt Content = s	4.8 %		Sand and Gravel (AP-42 13.2.2-1)
p = days with precipitation over 0.01 inches	60		
Vehicle control	90.0	%	Surfactants/Asphalt Millings and Watering

Asphalt Unpaved Road

Asphalt Truck VMT Unpaved	227.4	meter vehicle	0.14132	miles/vehicle
Max. Asphalt Truck/hr	12	truck/hr		
	Controlled		Controlled	
Asphalt Truck VMT Unpaved	1.69584	miles/hr	3957	miles/yr
Asphalt Truck weight	27.5	tons		
		PM Controlled		
Max. Asphalt Truck Emissions Unpaved	1.1858	lbs/hr	1.1560	tons/yr
		PM10 Controlled		
Max. Asphalt Truck Emissions Unpaved	0.3022	lbs/hr	0.2946	tons/yr
		PM2.5 Controlled		
Max. Asphalt Truck Emissions Unpaved	0.0302	lbs/hr	0.0295	tons/yr

Aggregate Unpaved Road

Asphalt Cement Truck VMT Unpaved	354.9	meter/vehicle	0.22060	miles/vehicle
Aggregate Truck VMT Unpaved	354.9	meter/vehicle	0. 22060	miles/vehicle

Max. Asphalt Cement Truck/hr	0.7	truck/hr
Max Aggregate Truck/hr	11.3	truck/hr
Max. Total Truck	**12.0**	**truck/hr**

	Controlled		Controlled	
Asphalt Cement Truck VMT Unpaved	0.15883	miles/hr	1391.4	miles/yr
Aggregate Truck VMT Unpaved	2.48838	miles/hr	21798.2	miles/yr
	2.647	miles/hr	23189.6	miles/yr

Asphalt Cement Truck weight	27.5	tons
Aggregate Truck weight	27.5	tons

	PM Controlled		PM Controlled	
Max. Asphalt Cement Truck Emissions Unpaved	0.1111	lbs/hr	0.1083	tons/yr
Max. Aggregate Truck Emissions Unpaved	1.7400	lbs/hr	1.6963	tons/yr
total traffic	**1.8511**	**lbs/hr**	**1.8046**	**tons/yr**

	PM10 Controlled		PM10 Controlled	
Max. Asphalt Cement Truck Emissions Unpaved	0.0283	lbs/hr	0.0276	tons/yr
Max. Aggregate Truck Emissions Unpaved	0.4435	lbs/hr	0.4323	tons/yr
total traffic	**0.4718**	**lbs/hr**	**0.4599**	**tons/yr**

	PM2.5 Controlled		PM2.5 Controlled	
Max. Asphalt Cement Truck Emissions Unpaved	0.0028	lbs/hr	0.0028	tons/yr
Max. Aggregate Truck Emissions Unpaved	0.0443	lbs/hr	0.0432	tons/yr
total traffic	**0.0472**	**lbs/hr**	**0.0460**	**tons/yr**

Table B-9: Controlled 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)
Controlled Paved and Unpaved Road Truck Emissions Unit 18	24 truck/hr	4.23	4.30	1.01	1.02	0.14	0.14

DRUM MIX HOT MIX ASPHALT PLANT – CONTROLLED

Particulate emissions from the drum dryer/mixer (Unit 13) will be controlled with a baghouse dust collector (Unit 13b) 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 99.88 percent per AP-42 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. Fuel burned in the drum dryer/mixer will be either burner fuel oil (on-specification used oil meeting the specification listed in 40 CFR 279.11) or pipeline quality natural gas. Maximum emission rates will be determined using emission factor for combusting burner fuel oil (called waste oil in AP-42), which will produce the highest combustion emission rate. Hourly emission rates are based on maximum hourly asphalt production (300 tph) and maximum annual production rate of 700,000 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 an asphalt silo temperature of 325˚ 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 with 60% control (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 Controlled Emission Factors:

Process Unit	Pollutant	Emission Factor (lbs/ton)
Drum Dryer/Mixer	NO_X	0.055
	CO	0.13
	SO_2	0.058
	VOC	0.032
	PM	0.033
	PM_{10}	0.023
	$PM_{2.5}$	0.023
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	0.001349240
	TOC	0.004158948
	PM	0.000521937
	PM_{10}	0.000521937
	$PM_{2.5}$	0.000521937
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)
13,13b	Asphalt Drum Dryer and Baghouse	NO_X	300	16.50	19.25
		CO	300	39.00	45.50
		SO_2	300	17.40	20.30
		VOC	300	9.60	11.20
		PM	300	9.90	11.55
		PM_{10}	300	6.90	8.05
		$PM_{2.5}$	300	6.90	8.05
14	Drum Mixer Unloading	CO	300	0.35	0.41
		TOC	300	3.66	4.27
		PM	300	0.18	0.21
		PM_{10}	300	0.18	0.21
		$PM_{2.5}$	300	0.18	0.21
15	Asphalt Silo Unloading	CO	300	0.40	0.47
		TOC	300	1.25	1.46
		PM	300	0.16	0.18
		PM_{10}	300	0.16	0.18
		$PM_{2.5}$	300	0.16	0.18
17	Asphalt Cement Storage Tanks	TOC	300	0.048	0.21
19	YARD	CO	300	0.11	0.12
		TOC	300	0.33	0.39

Diesel or Propane Asphalt Heater

One diesel or propane asphalt heater (Unit 16) heats the asphalt oil before it is mixed with the aggregate in the drum dryer/mixer. The unit is rated at 1,200,000 Btu/hr. The estimated hourly diesel fuel usage for the heater is 11 gallons per hour, or propane fuel usage for the heater is approximately 13.1 gallons per hour (91,500 Btu/gal). Review of the emission factors, to determine which fuel combusted will produce the highest emission rate was performed, and these emission factors are highlighted in yellow. Emissions of carbon monoxides (CO), hydrocarbons (VOC), particulate (PM), nitrogen oxides (NO_X) and sulfur dioxide (SO_2) are estimated using AP-42 Section 1.3 "Fuel Oil Combustion" (rev 5/10), and AP-42 Section 1.5 "Liquefied Petroleum Gas Combustion" (rev 7/08). Sulfur content of the diesel fuel and the propane fuel is 0.05% and 15 grain per 100 scf, respectively. No controls are proposed for the fuel 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-7 summarizes the uncontrolled emission rates for the asphalt heater. Table B-8 summarizes the controlled emission rates for the asphalt heater.

<u>AP-42 Emission Factors: Section 1.3</u>

Diesel Fuel Emission Factors

Pollutant	Emission Factor
Nitrogen Oxides	20.00 lbs/1000 gal
Carbon Monoxides	5.00 lbs/1000 gal
Particulate	2.00 lbs/1000 gal
Hydrocarbons	0.34 lbs/1000 gal
Sulfur Dioxides	142S lbs/1000 gal

S = % Fuel Sulfur Content = 0.05%

<u>AP-42 Emission Factors: Section 1.5</u>

Propane Emission Factors

Pollutant	Emission Factor
Nitrogen Oxides	13 lbs/1000 gal
Carbon Monoxides	7.5 lbs/1000 gal
Particulate	0.7 lbs/1000 gal
Hydrocarbons	1.0 lbs/1000 gal
Sulfur Dioxides (S = 15)	0.10S lbs/1000 gal

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)
16	NO_X	11 gal/hr	0.22	0.96
	CO	13.1 gal/hr	0.10	0.43
	VOC	13.1 gal/hr	0.013	0.057
	SO_2	11 gal/hr	0.078	0.34
	PM	11 gal/hr	0.022	0.096

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

Process Unit Number	Pollutant	Fuel Usage	Emission Rate (lbs/hr)	Emission Rate (tons/yr)
16	NO_X	11 gal/hr	0.22	0.96
	CO	13.1 gal/hr	0.10	0.43
	VOC	13.1 gal/hr	0.013	0.057
	SO_2	11 gal/hr	0.078	0.34
	PM	11 gal/hr	0.022	0.096

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									0.84	3.66	0.40	1.73	0.060	0.26
2	Cold Aggregate Storage Bin Loading									0.84	3.66	0.40	1.73	0.060	0.26
3	Cold Aggregate Storage Bin Unloading									0.53	2.33	0.19	0.85	0.029	0.13
4	Aggregate Scalping Screen									4.43	19.4	1.54	6.74	0.23	1.02
5	Aggregate Scalping Screen Unloading									0.53	2.33	0.19	0.85	0.029	0.13
6	Conveyor Transfer to Slinger Conveyor									0.53	2.33	0.19	0.85	0.029	0.13
7	RAP Storage Pile									0.15	0.65	0.070	0.31	0.011	0.047
8	RAP Feed Bin Loading									0.15	0.65	0.070	0.31	0.011	0.047
9	RAP Feed Bin Unloading									0.32	1.38	0.12	0.51	0.017	0.077
10	RAP Screen									2.63	11.5	0.91	4.00	0.14	0.61
11	RAP Screen Unloading									0.32	1.38	0.12	0.51	0.017	0.077
12	RAP Transfer Conveyor									0.32	1.38	0.12	0.51	0.017	0.077
13	Drum Dryer/Mixer	16.5	72.3	39.0	170.8	17.4	76.2	9.60	42.0	8400	36792	1950	8541	470	2056
14	Drum Mixer Unloading			0.35	1.55			3.66	16.0	0.18	0.77	0.18	0.77	0.18	0.77
15	Asphalt Silo Unloading			0.40	1.77			1.25	5.46	0.16	0.69	0.16	0.69	0.16	0.69
16	Asphalt Heater	0.22	0.96	0.10	0.43	0.078	0.34	0.013	0.057	0.022	0.096	0.022	0.096	0.022	0.096
17	Asphalt Cement Storage Tanks (2)							0.048	0.21						

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
18	Haul Road Traffic									31.6	116.4	7.98	29.4	0.83	3.09
19	Yard			0.11	0.46			0.33	1.45						
Total		**16.7**	**73.2**	**40.0**	**175.0**	**17.5**	**76.6**	**14.9**	**65.2**	**8443**	**36961**	**1963**	**8591**	**471**	**2064**

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									0.84	0.97	0.40	0.46	0.060	0.070
2	Cold Aggregate Storage Bin Loading									0.84	0.97	0.40	0.46	0.060	0.070
3	Cold Aggregate Storage Bin Unloading									0.025	0.029	0.0081	0.0095	0.0023	0.0027
4	Aggregate Scalping Screen									0.39	0.45	0.13	0.15	0.0089	0.010
5	Aggregate Scalping Screen Unloading									0.025	0.029	0.0081	0.0095	0.0023	0.0027
6	Conveyor Transfer to Slinger Conveyor									0.025	0.029	0.0081	0.0095	0.0023	0.0027
7	RAP Storage Pile									0.15	0.17	0.070	0.082	0.011	0.012
8	RAP Feed Bin Loading									0.15	0.17	0.070	0.082	0.011	0.012
9	RAP Feed Bin Unloading									0.015	0.017	0.0048	0.0056	0.0014	0.0016
10	RAP Screen									0.23	0.27	0.078	0.091	0.0053	0.0061
11	RAP Screen Unloading									0.015	0.017	0.0048	0.0056	0.0014	0.0016
12	RAP Transfer Conveyor									0.015	0.017	0.0048	0.0056	0.0014	0.0016
13	Drum Dryer/Mixer	16.5	19.3	39.0	45.5	17.4	20.3	9.60	11.2	9.90	11.6	6.90	8.05	6.90	8.05
14	Drum Mixer Unloading			0.35	0.41			3.66	4.27	0.18	0.21	0.18	0.21	0.18	0.21
15	Asphalt Silo Unloading			0.40	0.47			1.25	1.46	0.157	0.18	0.16	0.18	0.157	0.18
16	Asphalt Heater	0.22	0.96	0.10	0.43	0.078	0.34	0.013	0.057	0.022	0.096	0.022	0.096	0.022	0.096
17	Asphalt Cement Storage Tanks (2)							0.048	0.21						
18	Haul Road Traffic									4.23	4.30	1.01	1.02	0.14	0.14

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
19	Yard			0.11	0.12			0.33	0.39						
Total		**16.7**	**20.2**	**40.0**	**46.9**	**17.5**	**20.6**	**14.9**	**17.6**	**17.2**	**19.5**	**9.45**	**10.9**	**7.56**	**8.87**

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									1.33	5.83	0.63	2.76	0.095	0.42
2	Cold Aggregate Storage Bin Loading									1.33	5.83	0.63	2.76	0.095	0.42
3	Cold Aggregate Storage Bin Unloading									0.85	3.71	0.31	1.36	0.047	0.21
4	Aggregate Scalping Screen									7.05	30.9	2.45	10.75	0.37	1.63
5	Aggregate Scalping Screen Unloading									0.85	3.71	0.31	1.36	0.047	0.21
6	Conveyor Transfer to Slinger Conveyor									0.85	3.71	0.31	1.36	0.047	0.21
7	RAP Storage Pile									0.00	0.00	0.000	0.00	0.000	0.000
8	RAP Feed Bin Loading									0.00	0.00	0.000	0.00	0.000	0.000
9	RAP Feed Bin Unloading									0.00	0.00	0.00	0.00	0.000	0.000
10	RAP Screen									0.00	0.0	0.00	0.00	0.00	0.00
11	RAP Screen Unloading									0.00	0.00	0.00	0.00	0.000	0.000
12	RAP Transfer Conveyor									0.00	0.00	0.00	0.00	0.000	0.000
13	Drum Dryer/Mixer	16.5	72.3	39.0	170.8	17.4	76.2	9.60	42.0	8400	36792	1950	8541	470	2056
14	Drum Mixer Unloading			0.35	1.55			3.66	16.0	0.18	0.77	0.18	0.77	0.18	0.77
15	Asphalt Silo Unloading			0.40	1.77			1.25	5.46	0.16	0.69	0.16	0.69	0.16	0.69
16	Asphalt Heater	0.22	0.96	0.10	0.43	0.078	0.34	0.013	0.057	0.022	0.096	0.022	0.096	0.022	0.096
17	Asphalt Cement Storage Tanks (2)							0.048	0.21						

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
18	Haul Road Traffic									31.6	116.4	7.98	29.4	0.83	3.09
19	Yard			0.11	0.46			0.33	1.45						
Total		**16.7**	**73.2**	**40.0**	**175.0**	**17.5**	**76.6**	**14.9**	**65.2**	**8444**	**36964**	**1963**	**8592**	**471**	**2064**

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									1.33	1.55	0.63	0.73	0.095	0.11
2	Cold Aggregate Storage Bin Loading									1.33	1.55	0.63	0.73	0.095	0.11
3	Cold Aggregate Storage Bin Unloading									0.039	0.046	0.013	0.015	0.0037	0.0043
4	Aggregate Scalping Screen									0.62	0.72	0.21	0.24	0.014	0.016
5	Aggregate Scalping Screen Unloading									0.039	0.046	0.013	0.015	0.0037	0.0043
6	Conveyor Transfer to Slinger Conveyor									0.039	0.046	0.013	0.015	0.0037	0.0043
7	RAP Storage Pile									0.0	0.0	0.0	0.0	0.0	0.0
8	RAP Feed Bin Loading									0.0	0.0	0.0	0.0	0.0	0.0
9	RAP Feed 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 Unloading									0.0	0.0	0.0	0.0	0.0	0.0
12	RAP Transfer Conveyor									0.0	0.0	0.0	0.0	0.0	0.0
13	Drum Dryer/Mixer	16.5	19.3	39.0	45.5	17.4	20.3	9.60	11.2	9.90	11.6	6.90	8.05	6.90	8.05
14	Drum Mixer Unloading			0.35	0.41			3.66	4.27	0.18	0.21	0.18	0.21	0.18	0.21
15	Asphalt Silo Unloading			0.40	0.47			1.25	1.46	0.157	0.18	0.16	0.18	0.157	0.18
16	Asphalt Heater	0.22	0.96	0.10	0.43	0.078	0.34	0.013	0.057	0.022	0.096	0.022	0.096	0.022	0.096
17	Asphalt Cement Storage Tanks (2)							0.048	0.21						
18	Haul Road Traffic									4.23	4.30	1.01	1.02	0.14	0.14

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
19	Yard			0.11	0.12			0.33	0.39						
Total		**16.7**	**20.2**	**40.0**	**46.9**	**17.5**	**20.6**	**14.9**	**17.6**	**17.9**	**20.3**	**9.77**	**11.3**	**7.61**	**8.93**

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. From the study the H_2S emission factors from these sources are:

Process Unit Number	Process Unit Description	H_2S Emission Factor
13, 13b	Drum Dryer/Mixer and Baghouse	0.0000518 lbs/ton
14	Drum Mixer Unloading	0.000001460 lbs/ton
15	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)
13, 13b	Drum Dryer/Mixer and Baghouse	H_2S	300	0.016	0.018
14	Drum Mixer Unloading	H_2S	300	0.00044	0.00051
15	Asphalt Silo Unloading	H_2S	300	0.00044	0.00051
			Total H_2S	**0.016**	**0.019**

Estimates for Federal HAPs Air Pollutants

The Hot Mix Asphalt Plant (HMA) drum dryer (Unit 13) and asphalt heater (Unit 16), 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 1.3 and 1.5, combusting either diesel fuel or propane.

The following tables summarize the HAPs emission rates from the drum mixer and asphalt heater. Total combined HAPs emissions from the Star Paving South Broadway HMA is 3.15 pounds per hour or 3.67 tons per year.

Table B-18: HAPs Emission Rates from the Drum Dryer/Mixer

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

Average Hourly Production Rate:	300	tons per hour
Yearly Production Rate:	700000	tons per year

Type of Fuel:	Waste Fuel Oil (Burner Fuel Oil)
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)
Acetaldehyde	75-07-0		1.3E-03	0.390000	0.455000
Acrolein	107-02-8		2.6E-05	0.007800	0.009100
Benzene	71-43-2		3.9E-04	0.117000	0.136500
Ethylbenzene	100-41-4		2.4E-04	0.072000	0.084000
Formaldehyde	50-00-0		3.1E-03	0.930000	1.085000
Hexane	110-54-3		9.2E-04	0.276000	0.322000
Isooctane	540-84-1		4.0E-05	0.012000	0.014000
Methyl Ethyl Ketone	78-93-3		2.0E-05	0.006000	0.007000
Propionaldehyde	123-38-6		1.3E-04	0.039000	0.045500
Quinone	106-51-4		1.6E-04	0.048000	0.056000
Methyl chloroform	71-55-6		4.8E-05	0.014400	0.016800
Toluene	108-88-3		2.9E-03	0.870000	1.015000
Xylene	1330-20-7		2.0E-04	0.060000	0.070000
		Total Non-PAH HAPS	9.5E-03	2.842200	3.315900

PAH HAPS	CAS#		Emission Factor (lbs/ton)	Emission Rate (lbs/hr)	Emission Rate (ton/yr)
2-Methylnaphthalene	91-57-6		1.7E-04	0.051000	0.059500
Acenaphthene	83-32-9		1.4E-06	0.000420	0.000490
Acenaphthylene	208-96-8		2.2E-05	0.006600	0.007700
Anthracene	120-12-7		3.1E-06	0.000930	0.001085
Benzo(a)anthracene	56-55-3		2.1E-07	0.000063	0.000074
Benzo(a)pyrene	50-32-8		9.8E-09	0.000003	0.000003
Benzo(b)fluoranthene	205-99-2		1.0E-07	0.000030	0.000035
Benzo(b)pyrene	192-97-2		1.1E-07	0.000033	0.000039
Benzo(g,h,I)perylene	191-24-2		4.0E-08	0.000012	0.000014
Benzo(k)fluoranthene	207-08-9		4.1E-08	0.000012	0.000014
Chrysene	218-01-9		1.8E-07	0.000054	0.000063
Fluoranthene	206-44-0		6.1E-07	0.000183	0.000214
Fluorene	86-73-7		1.1E-05	0.003300	0.003850
Indeno(1,2,3-cd) pyrene	193-39-5		7.0E-09	0.000002	0.000002
Naphthalene	91-20-3		6.5E-04	0.195000	0.227500
Perylene	198-55-0		8.8E-09	0.000003	0.000003
Phenanthrene	85-01-8		2.3E-05	0.006900	0.008050
Pyrene	129-00-0		3.0E-06	0.000900	0.001050
		Total PAH HAPS	8.8E-04	0.265445	0.309686

HAPS Metals		Emission Factor (lbs/ton)	Emission Rate (lbs/hr)	Emission Rate (ton/yr)
Arsenic		5.6E-07	0.000168	0.000196
Beryllium		0.0E+00	0.000000	0.000000
Cadmium		4.1E-07	0.000123	0.000144
Chromium		5.5E-06	0.001650	0.001925
Cobalt		2.6E-08	0.000008	0.000009
Hexavalent Chromium		4.5E-07	0.000135	0.000158
Lead		1.5E-05	0.004500	0.005250
Manganese		7.7E-06	0.002310	0.002695
Mercury		2.6E-06	0.000780	0.000910
Nickel		6.3E-05	0.018900	0.022050
Phosphorus		2.8E-05	0.008400	0.009800
Selenium		3.5E-07	0.000105	0.000123
	Total Metals HAPS	1.2E-04	0.037079	0.043259
	Total HAPS		**3.14472**	**3.66884**

Table B-19: HAPs Emission Rates from the Asphalt Heater

Btu Rating	1.200	MMBtu/hr
Fuel Usage Hourly:	11	gal/hr
Fuel Usage Annual:	0.0000012	Btu x10^-12
Yearly Operating Hours:	8760	hours per year

Type of Fuel:	Diesel
Emission Factors	AP-42 Section 1.3

Organic Compounds	CAS#		Emission Factor (lbs/10^3 gal)	Emission Rate (lbs/hr)	Emission Rate (ton/yr)
Acenaphthene	83-32-9		2.11E-05	0.0000002	0.0000010
Acenaphthylene	208-96-8		2.53E-07	0.0000000	0.0000000
Anthracene	120-12-7		1.22E-06	0.0000000	0.0000001
Benzene	71-43-2		2.14E-04	0.0000024	0.0000103
Benzo(a)anthracene	56-55-3		4.01E-06	0.0000000	0.0000002
Benzo(b,k)fluoranthene	205-99-2		1.48E-06	0.0000000	0.0000001
Benzo(g,h,I)perylene	191-24-2		2.26E-06	0.0000000	0.0000001
Chrysene	218-01-9		2.38E-06	0.0000000	0.0000001
Dibenz(a,h)anthracene			1.67E-06	0.0000000	0.0000001
Ethylbenzene	100-41-4		6.36E-05	0.0000007	0.0000031
Fluoranthene	206-44-0		4.84E-06	0.0000001	0.0000002
Fluorene	86-73-7		4.47E-06	0.0000000	0.0000002
Formaldehyde	50-00-0		6.10E-02	0.0006710	0.0029390
Indeno(1,2,3-cd)pyrene	193-39-5		2.14E-06	0.0000000	0.0000001
Naphthalene	91-20-3		1.13E-03	0.0000124	0.0000544
Phenanthrene	85-01-8		1.05E-05	0.0000001	0.0000005
Pyrene	129-00-0		4.25E-06	0.0000000	0.0000002
Toluene	108-88-3		6.20E-03	0.0000682	0.0002987
Xylene	1330-20-7		1.09E-04	0.0000012	0.0000053
		Total Organic Compounds	6.88E-02	0.0007565	0.0033137

HAPS Metals			Emission Factor (lbs/Btu^12)	Emission Rate (lbs/hr)	Emission Rate (ton/yr)
Arsenic			4	0.0000048	0.0000210
Beryllium			3	0.0000036	0.0000158
Cadmium			3	0.0000036	0.0000158
Chromium			3	0.0000036	0.0000158
Lead			9	0.0000108	0.0000473
Manganese			6	0.0000072	0.0000315
Mercury			3	0.0000036	0.0000158
Nickel			3	0.0000036	0.0000158
Selenium			15	0.0000180	0.0000788
		Total Metals HAPS	49	0.0000588	0.0002575
		Total HAPS		**0.00157**	**0.00357**

Attachment C
Emission Calculations Supporting Documents

AP-42 Section 1.3

1.3 Fuel Oil Combustion

1.3.1 General[1-3]

Two major categories of fuel oil are burned by combustion sources: distillate oils and residual oils. These oils are further distinguished by grade numbers, with Nos. 1 and 2 being distillate oils; Nos. 5 and 6 being residual oils; and No. 4 being either distillate oil or a mixture of distillate and residual oils. No. 6 fuel oil is sometimes referred to as Bunker C. Distillate oils are more volatile and less viscous than residual oils. They have negligible nitrogen and ash contents and usually contain less than 0.3 percent sulfur (by weight). Distillate oils are used mainly in domestic and small commercial applications, and include kerosene and diesel fuels. Being more viscous and less volatile than distillate oils, the heavier residual oils (Nos. 5 and 6) may need to be heated for ease of handling and to facilitate proper atomization. Because residual oils are produced from the residue remaining after the lighter fractions (gasoline, kerosene, and distillate oils) have been removed from the crude oil, they contain significant quantities of ash, nitrogen, and sulfur. Residual oils are used mainly in utility, industrial, and large commercial applications.

1.3.2 Firing Practices[4]

The major boiler configurations for fuel oil-fired combustors are watertube, firetube, cast iron, and tubeless design. Boilers are classified according to design and orientation of heat transfer surfaces, burner configuration, and size. These factors can all strongly influence emissions as well as the potential for controlling emissions.

Watertube boilers are used in a variety of applications ranging from supplying large amounts of process steam to providing space heat for industrial facilities. In a watertube boiler, combustion heat is transferred to water flowing through tubes which line the furnace walls and boiler passes. The tube surfaces in the furnace (which houses the burner flame) absorb heat primarily by radiation from the flames. The tube surfaces in the boiler passes (adjacent to the primary furnace) absorb heat primarily by convective heat transfer.

Firetube boilers are used primarily for heating systems, industrial process steam generators, and portable power boilers. In firetube boilers, the hot combustion gases flow through the tubes while the water being heated circulates outside of the tubes. At high pressures and when subjected to large variations in steam demand, firetube units are more susceptible to structural failure than watertube boilers. This is because the high-pressure steam in firetube units is contained by the boiler walls rather than by multiple small-diameter watertubes, which are inherently stronger. As a consequence, firetube boilers are typically small and are used primarily where boiler loads are relatively constant. Nearly all firetube boilers are sold as packaged units because of their relatively small size.

A cast iron boiler is one in which combustion gases rise through a vertical heat exchanger and out through an exhaust duct. Water in the heat exchanger tubes is heated as it moves upward through the tubes. Cast iron boilers produce low pressure steam or hot water, and generally burn oil or natural gas. They are used primarily in the residential and commercial sectors.

Another type of heat transfer configuration used on smaller boilers is the tubeless design. This design incorporates nested pressure vessels with water in between the shells. Combustion gases are fired into the inner pressure vessel and are then sometimes recirculated outside the second vessel.

Table 1.3-9. EMISSION FACTORS FOR SPECIATED ORGANIC COMPOUNDS FROM FUEL OIL COMBUSTION[a]

Organic Compound	Average Emission Factor[b] ($lb/10^3$ Gal)	EMISSION FACTOR RATING
Benzene	2.14E-04	C
Ethylbenzene	6.36E-05[c]	E
Formaldehyde[d]	3.30E-02	C
Naphthalene	1.13E-03	C
1,1,1-Trichloroethane	2.36E-04[c]	E
Toluene	6.20E-03	D
o-Xylene	1.09E-04[c]	E
Acenaphthene	2.11E-05	C
Acenaphthylene	2.53E-07	D
Anthracene	1.22E-06	C
Benz(a)anthracene	4.01E-06	C
Benzo(b,k)fluoranthene	1.48E-06	C
Benzo(g,h,i)perylene	2.26E-06	C
Chrysene	2.38E-06	C
Dibenzo(a,h) anthracene	1.67E-06	D
Fluoranthene	4.84E-06	C
Fluorene	4.47E-06	C
Indo(1,2,3-cd)pyrene	2.14E-06	C
Phenanthrene	1.05E-05	C
Pyrene	4.25E-06	C
OCDD	3.10E-09[c]	E

[a] Data are for residual oil fired boilers, Source Classification Codes (SCCs) 1-01-004-01/04.
[b] References 64-72. To convert from $lb/10^3$ gal to $kg/10^3$ L, multiply by 0.12.
[c] Based on data from one source test (Reference 67).
[d] The formaldehyde number presented here is based only on data from utilities using No. 6 oil. The number presented in Table 1.3-7 is based on utility, commercial, and industrial boilers.

Table 1.3-10. EMISSION FACTORS FOR TRACE ELEMENTS FROM DISTILLATE FUEL OIL COMBUSTION SOURCES[a]

EMISSION FACTOR RATING: E

Firing Configuration (SCC)	Emission Factor ($lb/10^{12}$ Btu)										
	As	Be	Cd	Cr	Cu	Pb	Hg	Mn	Ni	Se	Zn
Distillate oil fired (1-01-005-01, 1-02-005-01, 1-03-005-01)	4	3	3	3	6	9	3	6	3	15	4

[a] Data are for distillate oil fired boilers, SCC codes 1-01-005-01, 1-02-005-01, and 1-03-005-01. References 29-32, 40-44 and 83. To convert from $lb/10^{12}$ Btu to pg/J, multiply by 0.43.

Table 1.3-11. EMISSION FACTORS FOR METALS FROM UNCONTROLLED NO. 6 FUEL OIL COMBUSTION[a]

Metal	Average Emission Factor[b, d] ($lb/10^3$ Gal)	EMISSION FACTOR RATING
Antimony	5.25E-03[c]	E
Arsenic	1.32E-03	C
Barium	2.57E-03	D
Beryllium	2.78E-05	C
Cadmium	3.98E-04	C
Chloride	3.47E-01	D
Chromium	8.45E-04	C
Chromium VI	2.48E-04	C
Cobalt	6.02E-03	D
Copper	1.76E-03	C
Fluoride	3.73E-02	D
Lead	1.51E-03	C
Manganese	3.00E-03	C
Mercury	1.13E-04	C
Molybdenum	7.87E-04	D
Nickel	8.45E-02	C
Phosphorous	9.46E-03	D
Selenium	6.83E-04	C
Vanadium	3.18E-02	D
Zinc	2.91E-02	D

[a] Data are for residual oil fired boilers, Source Classification Codes (SCCs) 1-01-004-01/04.
[b] References 64-72. 18 of 19 sources were uncontrolled and 1 source was controlled with low efficiency ESP. To convert from $lb/10^3$ gal to $kg/10^3$ L, multiply by 0.12.
[c] References 29-32,40-44.
[d] For oil/water mixture, reduce factors in proportion to water content of the fuel (due to dilution). To adjust the listed values for water content, multiply the listed value by 1-decimal fraction of water (ex: For fuel with 9 percent water by volume, multiply by 1-0.9=.91).

AP-42 Section 1.5

1.5 Liquefied Petroleum Gas Combustion

1.5.1 General[1]

Liquefied petroleum gas (LPG or LP-gas) consists of propane, propylene, butane, and butylenes; the product used for domestic heating is composed primarily of propane. This gas, obtained mostly from gas wells (but also, to a lesser extent, as a refinery by-product) is stored as a liquid under moderate pressures. There are three grades of LPG available as heating fuels: commercial-grade propane, engine fuel-grade propane (also known as HD-5 propane), and commercial-grade butane. In addition, there are high-purity grades of LPG available for laboratory work and for use as aerosol propellants. Specifications for the various LPG grades are available from the American Society for Testing and Materials and the Gas Processors Association. A typical heating value for commercial-grade propane and HD-5 propane is 90,500 British thermal units per gallon (Btu/gal), after vaporization; for commercial-grade butane, the value is 97,400 Btu/gal.

The largest market for LPG is the domestic/commercial market, followed by the chemical industry (where it is used as a petrochemical feedstock) and the agriculture industry. Propane is also used as an engine fuel as an alternative to gasoline and as a standby fuel for facilities that have interruptible natural gas service contracts.

1.5.2 Firing Practices[2]

The combustion processes that use LPG are very similar to those that use natural gas. Use of LPG in commercial and industrial applications may require a vaporizer to provide the burner with the proper mix of air and fuel. The burner itself will usually have different fuel injector tips as well as different fuel-to-air ratio controller settings than a natural gas burner since the LPG stoichiometric requirements are different than natural gas requirements. LPG is fired as a primary and backup fuel in small commercial and industrial boilers and space heating equipment and can be used to generate heat and process steam for industrial facilities and in most domestic appliances that typically use natural gas.

1.5.3 Emissions[1,3-5]

1.5.3.1 Criteria Pollutants -

LPG is considered a "clean" fuel because it does not produce visible emissions. However, gaseous pollutants such as nitrogen oxides (NO_x), carbon monoxide (CO), and organic compounds are produced as are small amounts of sulfur dioxide (SO_2) and particulate matter (PM). The most significant factors affecting NO_x, CO, and organic emissions are burner design, burner adjustment, boiler operating parameters, and flue gas venting. Improper design, blocking and clogging of the flue vent, and insufficient combustion air result in improper combustion and the emission of aldehydes, CO, hydrocarbons, and other organics. NO_x emissions are a function of a number of variables, including temperature, excess air, fuel and air mixing, and residence time in the combustion zone. The amount of SO_2 emitted is directly proportional to the amount of sulfur in the fuel. PM emissions are very low and result from soot, aerosols formed by condensable emitted species, or boiler scale dislodged during combustion. Emission factors for LPG combustion are presented in Table 1.5-1.

Table 1.5-1 presents emission factors on a volume basis ($lb/10^3gal$). To convert to an energy basis (lb/MMBtu), divide by a heating value of 91.5 $MMBtu/10^3gal$ for propane and 102 $MMBtu/10^3gal$ for butane.

1.5.3.2 Greenhouse Gases[6-11] -

Carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) emissions are all produced during LPG combustion. Nearly all of the fuel carbon (99.5 percent) in LPG is converted to CO_2 during the combustion process. This conversion is relatively independent of firing configuration. Although the formation of CO acts to reduce CO_2 emissions, the amount of CO produced is insignificant compared to the amount of CO_2 produced. The majority of the 0.5 percent of fuel carbon not converted to CO_2 is due to incomplete combustion in the fuel stream.

Formation of N_2O during the combustion process is governed by a complex series of reactions and its formation is dependent upon many factors. Formation of N_2O is minimized when combustion temperatures are kept high (above 1475°F) and excess air is kept to a minimum (less than 1 percent).

Methane emissions are highest during periods of 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 CH_4.

1.5.4 Controls

The only controls developed for LPG combustion are to reduce NO_x emissions. NO_x controls have been developed for firetube and watertube boilers firing propane or butane. Vendors are now guaranteeing retrofit systems to levels as low as 30 to 40 ppm (based on 3 percent oxygen). These systems use a combination of low-NO_x burners and flue gas recirculation (FGR). Some burner vendors use water or steam injection into the flame zone for NO_x reduction. This is a trimming technique which may be necessary during backup fuel periods because LPG typically has a higher NO_x-forming potential than natural gas; conventional natural gas emission control systems may not be sufficient to reduce LPG emissions to mandated levels. Also, LPG burners are more prone to sooting under the modified combustion conditions required for low NO_x emissions. The extent of allowable combustion modifications for LPG may be more limited than for natural gas.

One NO_x control system that has been demonstrated on small commercial boilers is FGR. NO_x emissions from propane combustion can be reduced by as much as 50 percent by recirculating about 16 percent of the flue gas. NO_x emission reductions of over 60 percent have been achieved with FGR and low-NO_x burners used in combination.

1.5.5 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 memoranda describing each supplement or the background report for this section.

Supplement A, February 1996

No changes.

Supplement B, October 1996

- Text was added concerning firing practices.
- The CO_2 emission factor was updated.
- Emission factors were added for N_2O and CH_4.

July 2008

The PM filterable, NOx, CO and TOC emissions factors were updated and the PM condensable and PM total emissions factors were added using the revised PM, NOx, CO and TOC emissions factors for natural gas combustion for small boilers (see July 1998 revisions to section 1.4, Natural Gas Combustion).

Table 1.5-1. EMISSION FACTORS FOR LPG COMBUSTION[a]

EMISSION FACTOR RATING: E

Pollutant	Butane Emission Factor ($lb/10^3$ gal)		Propane Emission Factor ($lb/10^3$ gal)	
	Industrial Boilers[b] (SCC 1-02-010-01)	Commercial Boilers[c] (SCC 1-03-010-01)	Industrial Boilers[b] (SCC 1-02-010-02)	Commercial Boilers[c] (SCC 1-03-010-02)
PM, Filterable [d]	0.2	0.2	0.2	0.2
PM, Condensable	0.6	0.6	0.5	0.5
PM, Total	0.8	0.8	0.7	0.7
SO_2 [e]	0.09S	0.09S	0.10S	0.10S
NO_x [f]	15	15	13	13
N_2O [g]	0.9	0.9	0.9	0.9
CO_2 [h,j]	14,300	14,300	12,500	12,500
CO	8.4	8.4	7.5	7.5
TOC	1.1	1.1	1.0	1.0
CH_4 [k]	0.2	0.2	0.2	0.2

[a] Assumes PM, CO, and TOC emissions are the same, on a heat input basis, as for natural gas combustion. Use heat contents of 91.5 x 10^6 Btu/10^3 gallon for propane, 102 x 10^6 Btu/10^3 gallon for butane, 1020 x 10^6 Btu/10^6 scf for methane when calculating an equivalent heat input basis. For example, the equation for converting from methane's emissions factors to propane's emissions factors is as follows: lb pollutant/10^3 gallons of propane = (lb pollutant /10^6 ft^3 methane) * (91.5 x 10^6 Btu/10^3 gallons of propane) / (1020 x 10^6 Btu/10^6 scf of methane). The NO_x emission factors have been multiplied by a correction factor of 1.5, which is the approximate ratio of propane/butane NO_x emissions to natural gas NO_x emissions. To convert from lb/10^3 gal to kg/10^3 L, multiply by 0.12. SCC = Source Classification Code.

[b] Heat input capacities generally between 10 and 100 million Btu/hour.

[c] Heat input capacities generally between 0.3 and 10 million Btu/hour.

[d] Filterable particulate matter (PM) is that PM collected on or prior to the filter of an EPA Method 5 (or equivalent) sampling train. For natural gas, a fuel with similar combustion characteristics, all PM is less than 10 μm in aerodynamic equivalent diameter (PM-10).

[e] S equals the sulfur content expressed in gr/100 ft^3 gas vapor. For example, if the butane sulfur content is 0.18 gr/100 ft^3, the emission factor would be (0.09 x 0.18) = 0.016 lb of SO_2/10^3 gal butane burned.

[f] Expressed as NO_2.

[g] Reference 12.

[h] Assuming 99.5% conversion of fuel carbon to CO_2.

[j] EMISSION FACTOR RATING = C.

[k] Reference 13.

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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 (≤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.

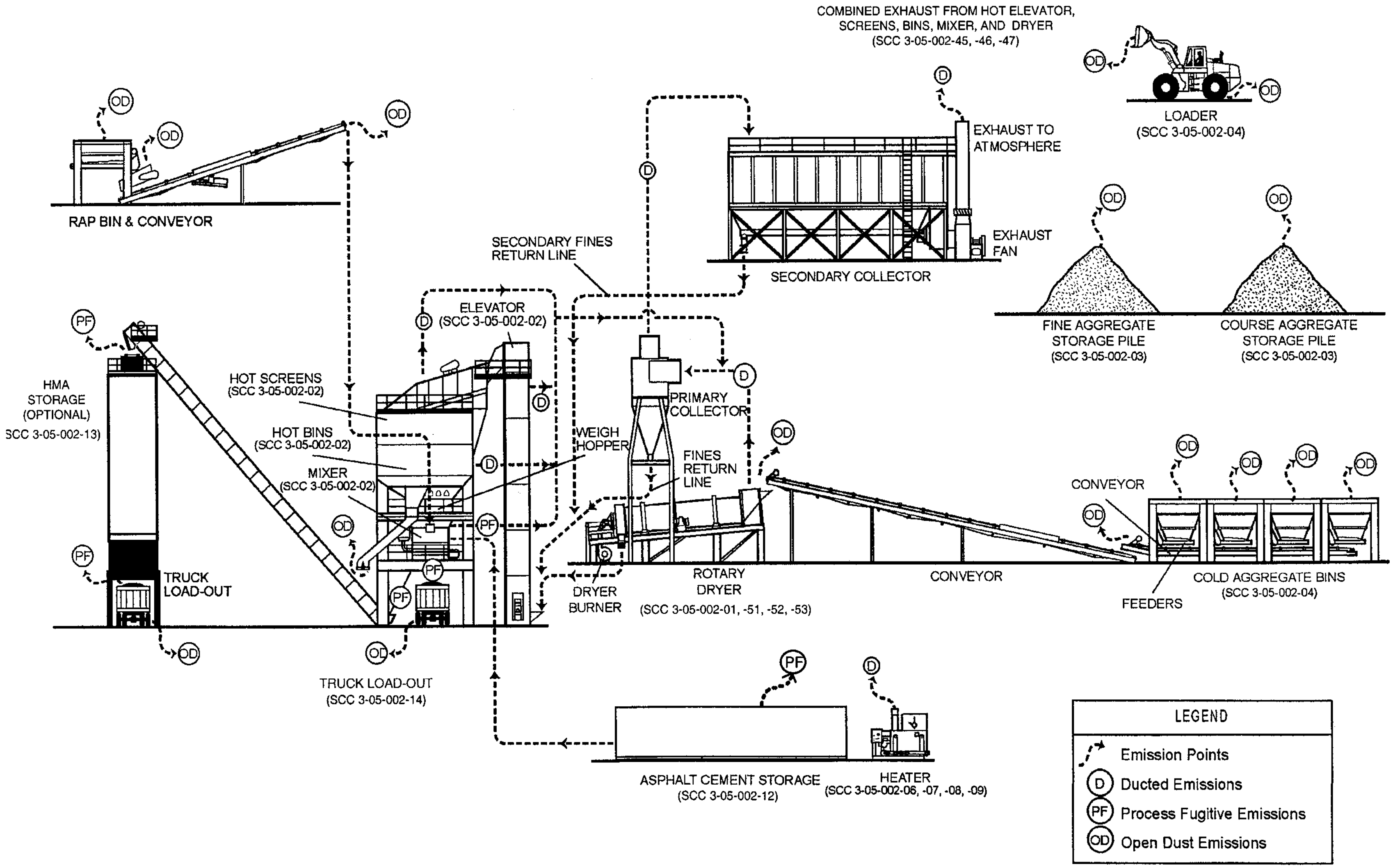

Figure 11.1-1. General process flow diagram for batch mix asphalt plants (source classification codes in parentheses).[3]

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.

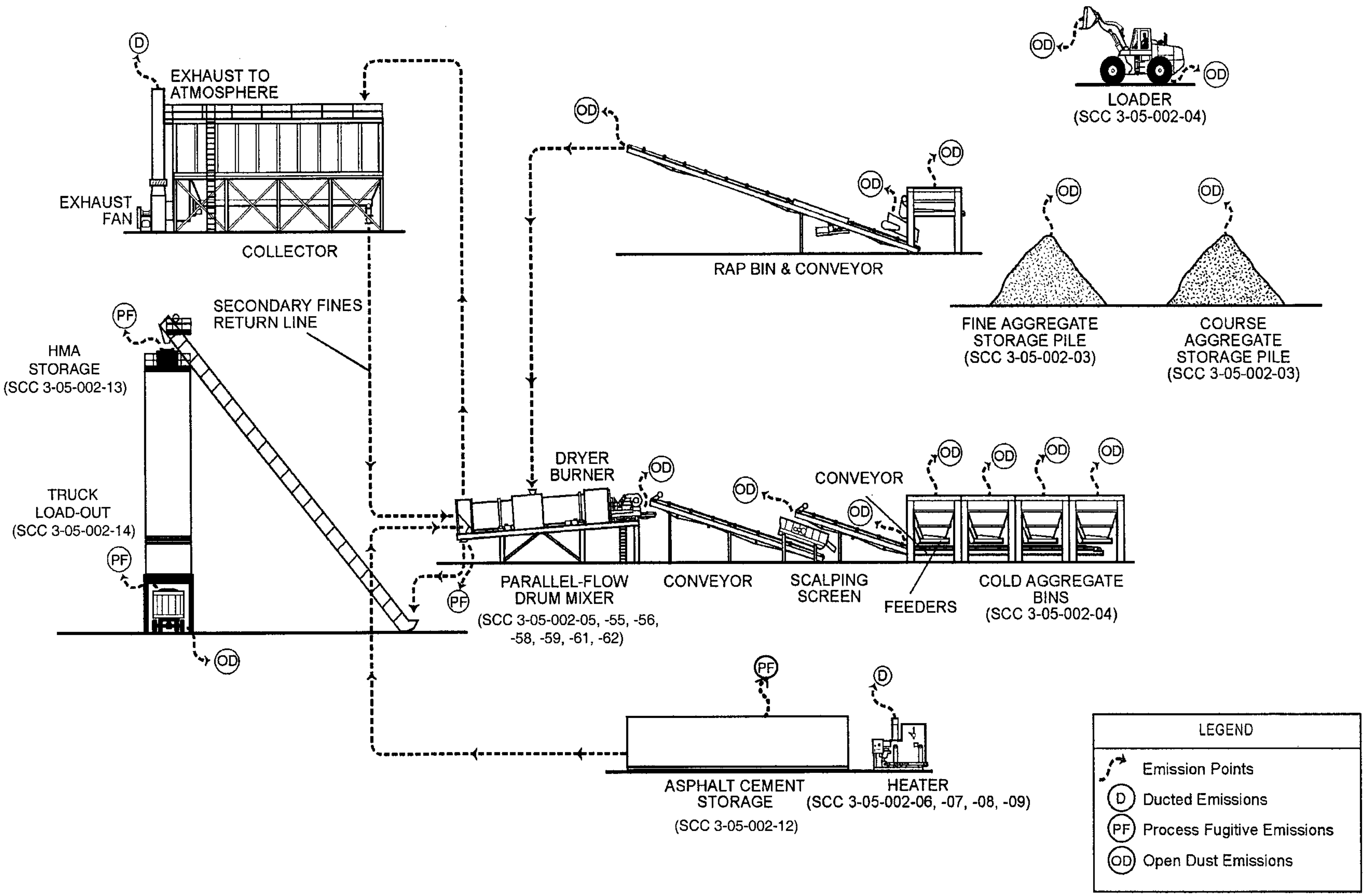

Figure 11.1-2. General process flow diagram for parallel-flow drum mix asphalt plants (source classification codes in parentheses).[3]

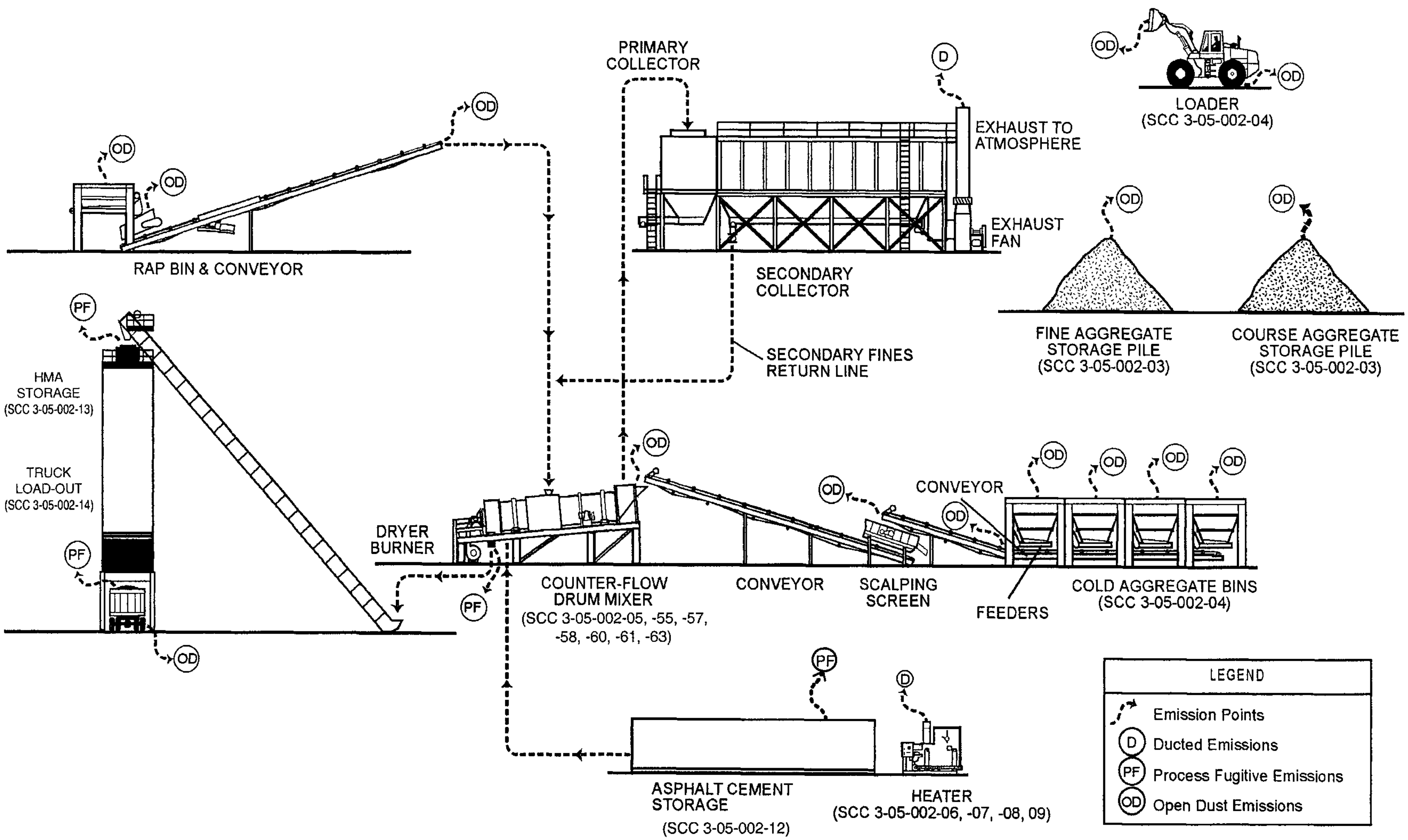

Figure 11.1-3. General process flow diagram for counter-flow drum mix asphalt plants (source classification codes in parentheses).[3]

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]

	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[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 CASRN	Pollutant Name	Emission Factor, lb/ton	Emission Factor Rating	Ref. Nos.
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]	$7.1x10^{-5}$	D	24,47,49
	83-32-9	Acenaphthene[c]	$9.0x10^{-7}$	D	34,46,226
	208-96-8	Acenaphthylene[c]	$5.8x10^{-7}$	D	34,46,226
	120-12-7	Anthracene[c]	$2.1x10^{-7}$	D	34,46,226
	56-55-3	Benzo(a)anthracene[c]	$4.6x10^{-9}$	E	46,226
	50-32-8	Benzo(a)pyrene[c]	$3.1x10^{-10}$	E	226
	205-99-2	Benzo(b)fluoranthene[c]	$9.4x10^{-9}$	D	34,46,226
	191-24-2	Benzo(g,h,i)perylene[c]	$5.0x10^{-10}$	E	226
	207-08-9	Benzo(k)fluoranthene[c]	$1.3x10^{-8}$	E	34,226
	218-01-9	Chrysene[c]	$3.8x10^{-9}$	E	46,226
	53-70-3	Dibenz(a,h)anthracene[c]	$9.5x10^{-11}$	E	226
	206-44-0	Fluoranthene[c]	$1.6x10^{-7}$	D	34,46,47,226
	86-73-7	Fluorene[c]	$1.6x10^{-6}$	D	34,46,47,226
	193-39-5	Indeno(1,2,3-cd)pyrene[c]	$3.0x10^{-10}$	E	226
	91-20-3	Naphthalene	$3.6x10^{-5}$	D	34,46,47,49,226
	85-01-8	Phenanthrene[c]	$2.6x10^{-6}$	D	34,46,47,226
	129-00-0	Pyrene[c]	$6.2x10^{-8}$	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	$3.0x10^{-5}$	E	24
	4170-30-3	Crotonaldehyde	$2.9x10^{-5}$	E	24
	66-25-1	Hexanal	$2.4x10^{-5}$	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 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) (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]	$4.0x10^{-8}$	E	48
	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	0.0087		
	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	$2.6x10^{-5}$	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)	$4.0x10^{-5}$	E	339-340
	78-93-3	Methyl Ethyl Ketone	$2.0x10^{-5}$	E	25
	123-38-6	Propionaldehyde	0.00013	E	25
	106-51-4	Quinone	0.00016	E	25
	71-55-6	Methyl chloroform[f]	$4.8x10^{-5}$	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]	$1.4x10^{-6}$	E	48
	208-96-8	Acenaphthylene[g]	$2.2x10^{-5}$	E	50
	120-12-7	Anthracene[g]	$3.1x10^{-6}$	E	50,162
	56-55-3	Benzo(a)anthracene[g]	$2.1x10^{-7}$	E	48
	50-32-8	Benzo(a)pyrene[g]	$9.8x10^{-9}$	E	48
	205-99-2	Benzo(b)fluoranthene[g]	$1.0x10^{-7}$	E	35,48
	192-97-2	Benzo(e)pyrene[g]	$1.1x10^{-7}$	E	48
	191-24-2	Benzo(g,h,i)perylene[g]	$4.0x10^{-8}$	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]	1.3×10^{-6}	E	340
	Barium	0.00025	E	340
	Beryllium[b]	0.0	E	340
	Cadmium[b]	4.2×10^{-6}	E	340
	Chromium[b]	2.4×10^{-5}	E	340
	Cobalt[b]	1.5×10^{-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]	2.4×10^{-6}	E	340
	Thallium	2.2×10^{-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	1.8×10^{-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]	6.2×10^{-7}	E	35
	Manganese[b]	7.7×10^{-6}	D	25, 162-164, 339-340
	Mercury[b]	2.4×10^{-7}	E	35, 163
	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

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	$1.8x10^{-7}$	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]	$1.5x10^{-5}$	C	25, 162, 164, 178-179, 183, 301, 315, 339-340
	Manganese[b]	$7.7x10^{-6}$	D	25, 162-164, 339-340
	Mercury[b]	$2.6x10^{-6}$	D	162, 164, 339-340
	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

[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	8.9×10^{-6}	lb/ft^3	C	395
	124-38-9	Carbon dioxide	0.20	lb/ft^3	C	395
	50-00-0	Formaldehyde	2.6×10^{-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	3.5×10^{-6}	lb/gal	C	395
	83-32-9	Acenaphthene[b]	5.3×10^{-7}	lb/gal	E	35
	208-96-8	Acenaphthylene[b]	2.0×10^{-7}	lb/gal	E	35
	120-12-7	Anthracene[b]	1.8×10^{-7}	lb/gal	E	35
	205-99-2	Benzo(b)fluoranthene[b]	1.0×10^{-7}	lb/gal	E	35
	206-44-0	Fluoranthene[b]	4.4×10^{-8}	lb/gal	E	35
	86-73-7	Fluorene[b]	3.2×10^{-8}	lb/gal	E	35
	91-20-3	Naphthalene[b]	1.7×10^{-5}	lb/gal	E	35
	85-01-8	Phenanthrene[b]	4.9×10^{-6}	lb/gal	E	35
	129-00-0	Pyrene[b]	3.2×10^{-8}	lb/gal	E	35
	Dioxins					
	19408-74-3	1,2,3,7,8,9-HxCDD[b]	7.6×10^{-13}	lb/gal	E	35
	39227-28-6	1,2,3,4,7,8-HxCDD[b]	6.9×10^{-13}	lb/gal	E	35
		HxCDD[b]	6.2×10^{-12}	lb/gal	E	35
	35822-46-9	1,2,3,4,6,7,8-HpCDD[b]	1.5×10^{-11}	lb/gal	E	35
		HpCDD[b]	2.0×10^{-11}	lb/gal	E	35
	3268-87-9	OCDD[b]	1.6×10^{-10}	lb/gal	E	35
		Total PCDD	2.0×10^{-10}	lb/gal	E	35
	Furans					
		TCDF[b]	3.3×10^{-12}	lb/gal	E	35
		PeCDF[b]	4.8×10^{-13}	lb/gal	E	35
		HxCDF[b]	2.0×10^{-12}	lb/gal	E	35
		HpCDF[b]	9.7×10^{-12}	lb/gal	E	35
	67562-39-4	1,2,3,4,6,7,8-HpCDF[b]	3.5×10^{-12}	lb/gal	E	35
	39001-02-0	OCDF[b]	1.2×10^{-11}	lb/gal	E	35
		Total PCDF	3.1×10^{-11}	lb/gal	E	35
		Total PCDD/PCDF	2.3×10^{-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 11.19.2

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.

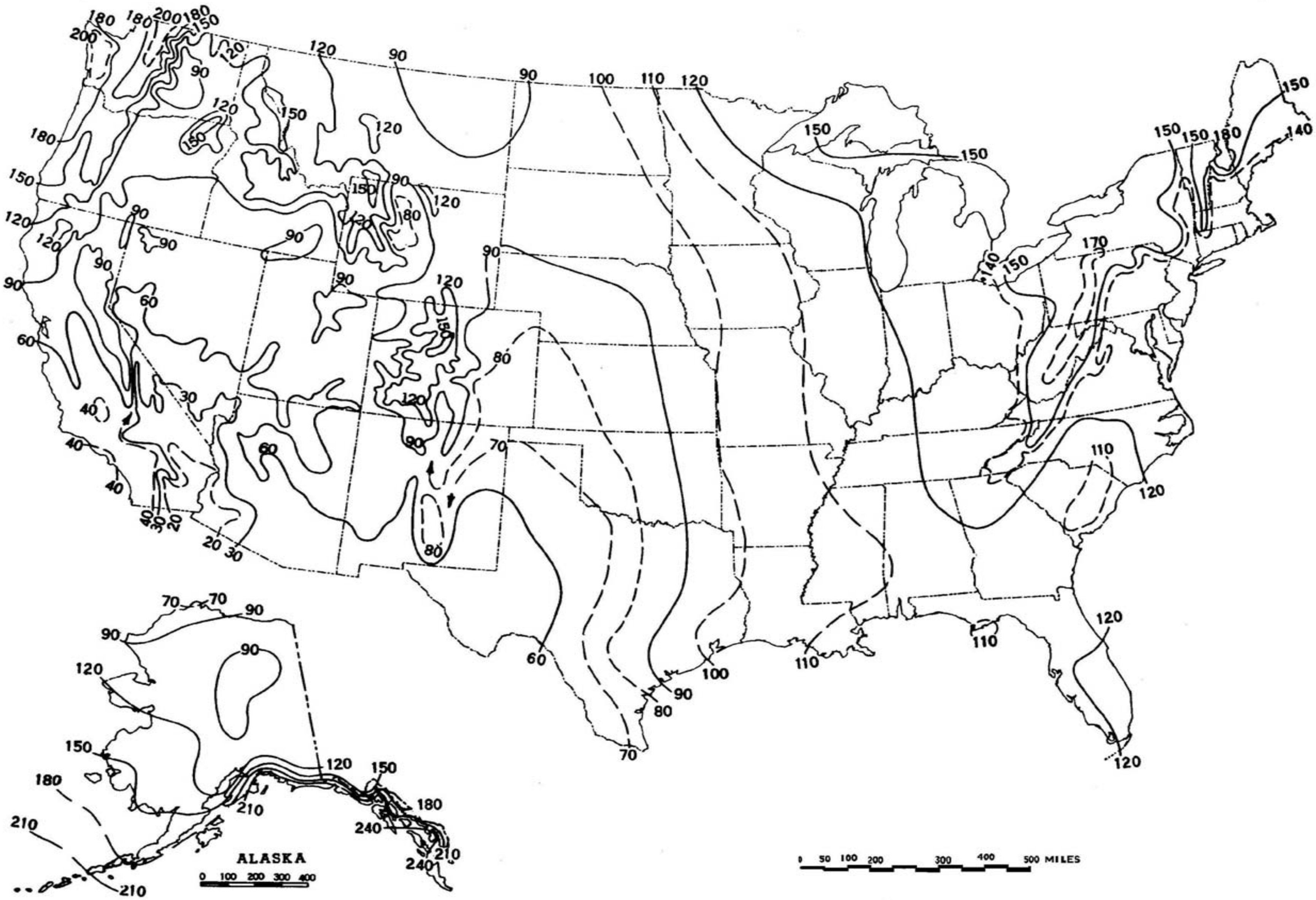

Figure 13.2.1-2. Mean number of days with 0.01 inch or more of precipitation in the United States.

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 13.2.2

13.2.2 Unpaved Roads

13.2.2.1 General

When a vehicle travels an unpaved road, the force of the wheels on the road surface causes pulverization of surface material. Particles are lifted and dropped from the rolling wheels, and the road surface is exposed to strong air currents in turbulent shear with the surface. The turbulent wake behind the vehicle continues to act on the road surface after the vehicle has passed.

The particulate emission factors presented in the previous draft version of this section of AP-42, dated October 2001, implicitly included the emissions from vehicles in the form of exhaust, brake wear, and tire wear as well as resuspended road surface material[25]. EPA included these sources in the emission factor equation for unpaved public roads (equation 1b in this section) 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 unpaved public road emission factor equation only estimates particulate emissions from resuspended road surface material [23, 26]. The particulate emissions from vehicle exhaust, brake wear, and tire wear are now estimated separately using EPA's MOBILE6.2 [24]. 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 MOBILE6.2 to estimate particulate emissions from vehicle traffic on unpaved public roads. It also incorporates the decrease in exhaust emissions that has occurred since the unpaved public road emission factor equation was developed. The previous version of the unpaved public 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.

13.2.2.2 Emissions Calculation And Correction Parameters[1-6]

The quantity of dust emissions from a given segment of unpaved road varies linearly with the volume of traffic. Field investigations also have shown that emissions depend on source parameters that characterize the condition of a particular road and the associated vehicle traffic. Characterization of these source parameters allow for "correction" of emission estimates to specific road and traffic conditions present on public and industrial roadways.

Dust emissions from unpaved roads have been found to vary directly with the fraction of silt (particles smaller than 75 micrometers [µm] in diameter) in the road surface materials.[1] The silt fraction is determined by measuring the proportion of loose dry surface dust that passes a 200-mesh screen, using the ASTM-C-136 method. A summary of this method is contained in Appendix C of AP-42. Table 13.2.2-1 summarizes measured silt values for industrial unpaved roads. Table 13.2.2-2 summarizes measured silt values for public unpaved roads. It should be noted that the ranges of silt content vary over two orders of magnitude. Therefore, the use of data from this table can potentially introduce considerable error. Use of this data is strongly discouraged when it is feasible to obtain locally gathered data.

Since the silt content of a rural dirt road will vary with geographic location, it should be measured for use in projecting emissions. As a conservative approximation, the silt content of the parent soil in the area can be used. Tests, however, show that road silt content is normally lower than in the surrounding parent soil, because the fines are continually removed by the vehicle traffic, leaving a higher percentage of coarse particles.

Table 13.2.2-1. TYPICAL SILT CONTENT VALUES OF SURFACE MATERIAL ON INDUSTRIAL UNPAVED ROADS[a]

Industry	Road Use Or Surface Material	Plant Sites	No. Of Samples	Silt Content (%)	
				Range	Mean
Copper smelting	Plant road	1	3	16 - 19	17
Iron and steel production	Plant road	19	135	0.2 - 19	6.0
Sand and gravel processing	Plant road	1	3	4.1 - 6.0	4.8
	Material storage area	1	1	-	7.1
Stone quarrying and processing	Plant road	2	10	2.4 - 16	10
	Haul road to/from pit	4	20	5.0-15	8.3
Taconite mining and processing	Service road	1	8	2.4 - 7.1	4.3
	Haul road to/from pit	1	12	3.9 - 9.7	5.8
Western surface coal mining	Haul road to/from pit	3	21	2.8 - 18	8.4
	Plant road	2	2	4.9 - 5.3	5.1
	Scraper route	3	10	7.2 - 25	17
	Haul road (freshly graded)	2	5	18 - 29	24
Construction sites	Scraper routes	7	20	0.56-23	8.5
Lumber sawmills	Log yards	2	2	4.8-12	8.4
Municipal solid waste landfills	Disposal routes	4	20	2.2 - 21	6.4

[a]References 1,5-15.

The following empirical expressions may be used to estimate the quantity in pounds (lb) of size-specific particulate emissions from an unpaved road, per vehicle mile traveled (VMT):

For vehicles traveling on unpaved surfaces at industrial sites, emissions are estimated from the following equation:

$$E = k\,(s/12)^a (W/3)^b \tag{1a}$$

and, for vehicles traveling on publicly accessible roads, dominated by light duty vehicles, emissions may be estimated from the following:

$$E = \frac{k\,(s/12)^a (S/30)^d}{(M/0.5)^c} - C \tag{1b}$$

where k, a, b, c and d are empirical constants (Reference 6) given below and

E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
M = surface material moisture content (%)
S = mean vehicle speed (mph)
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.

The source characteristics s, W and M are referred to as correction parameters for adjusting the emission estimates to local conditions. The metric conversion from lb/VMT to grams (g) per vehicle kilometer traveled (VKT) is as follows:

1 lb/VMT = 281.9 g/VKT

The constants for Equations 1a and 1b based on the stated aerodynamic particle sizes are shown in Tables 13.2.2-2 and 13.2.2-4. The PM-2.5 particle size multipliers (k-factors) are taken from Reference 27.

Table 13.2.2-2. CONSTANTS FOR EQUATIONS 1a AND 1b

Constant	Industrial Roads (Equation 1a)			Public Roads (Equation 1b)		
	PM-2.5	PM-10	PM-30*	PM-2.5	PM-10	PM-30*
k (lb/VMT)	0.15	1.5	4.9	0.18	1.8	6.0
a	0.9	0.9	0.7	1	1	1
b	0.45	0.45	0.45	-	-	-
c	-	-	-	0.2	0.2	0.3
d	-	-	-	0.5	0.5	0.3
Quality Rating	B	B	B	B	B	B

*Assumed equivalent to total suspended particulate matter (TSP)
"-" = not used in the emission factor equation

Table 13.2.2-2 also contains the quality ratings for the various size-specific versions of Equation 1a and 1b. The equation retains the assigned quality rating, if applied within the ranges of source conditions, shown in Table 13.2.2-3, that were tested in developing the equation:

Table 13.2.2-3. RANGE OF SOURCE CONDITIONS USED IN DEVELOPING EQUATION 1a AND 1b

Emission Factor	Surface Silt Content, %	Mean Vehicle Weight		Mean Vehicle Speed		Mean No. of Wheels	Surface Moisture Content, %
		Mg	ton	km/hr	mph		
Industrial Roads (Equation 1a)	1.8-25.2	1.8-260	2-290	8-69	5-43	4-17[a]	0.03-13
Public Roads (Equation 1b)	1.8-35	1.4-2.7	1.5-3	16-88	10-55	4-4.8	0.03-13

[a] See discussion in text.

As noted earlier, the models presented as Equations 1a and 1b were developed from tests of traffic on unpaved surfaces. Unpaved roads have a hard, generally nonporous surface that usually dries quickly after a rainfall or watering, because of traffic-enhanced natural evaporation. (Factors influencing how fast a road dries are discussed in Section 13.2.2.3, below.) The quality ratings given above pertain to the mid-range of the measured source conditions for the equation. A higher mean vehicle weight and a higher than normal traffic rate may be justified when performing a worst-case analysis of emissions from unpaved roads.

The emission factors for the exhaust, brake wear and tire wear of a 1980's vehicle fleet (*C*) was obtained from EPA's MOBILE6.2 model [23]. The emission factor also varies with aerodynamic size range average uncontrolled conditions (but including natural mitigation) under the simplifying assumption that annual average emissions are inversely proportional to the number of days with measurable (more than 0.254 mm [0.01 inch]) precipitation:

$$E_{ext} = E\ [(365 - P)/365] \qquad (2)$$

where:

E_{ext} = annual size-specific emission factor extrapolated for natural mitigation, lb/VMT

E = emission factor from Equation 1a or 1b

P = number of days in a year with at least 0.254 mm (0.01 in) of precipitation (see below)

Figure 13.2.2-1 gives the geographical distribution for the mean annual number of "wet" days for the United States.

Equation 2 provides an estimate that accounts for precipitation on an annual average basis for the purpose of inventorying emissions. It should be noted that Equation 2 does not account for differences in the temporal distributions of the rain events, the quantity of rain during any event, or the potential for the rain to evaporate from the road surface. In the event that a finer temporal and spatial resolution is desired for inventories of public unpaved roads, estimates can be based on a more complex set of assumptions. These assumptions include:

1. The moisture content of the road surface material is increased in proportion to the quantity of water added;
2. The moisture content of the road surface material is reduced in proportion to the Class A pan evaporation rate;
3. The moisture content of the road surface material is reduced in proportion to the traffic volume; and
4. The moisture content of the road surface material varies between the extremes observed in the area. The CHIEF Web site (http://www.epa.gov/ttn/chief/ap42/ch13/related/c13s02-2.html) has a file which contains a spreadsheet program for calculating emission factors which are temporally and spatially resolved. Information required for use of the spreadsheet program includes monthly Class A pan evaporation values, hourly meteorological data for precipitation, humidity and snow cover, vehicle traffic information, and road surface material information.

It is emphasized that <u>the simple assumption underlying Equation 2 and the more complex set of assumptions underlying the use of the procedure which produces a finer temporal and spatial resolution</u> have not been verified in any rigorous manner. For this reason, the quality ratings for either approach should be downgraded one letter from the rating that would be applied to Equation 1.

13.2.2.3 Controls[18-22]

A wide variety of options exist to control emissions from unpaved roads. Options fall into the following three groupings:

1. <u>Vehicle restrictions</u> that limit the speed, weight or number of vehicles on the road;

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

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

Final Report

July 1996

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Prepared for:
Point Sources Committee
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:	StarPavingT2
City:	Albuquerque
State:	New Mexico
Company:	Star Paving Company
Type of Tank:	Horizontal Tank
Description:	Star Paving Asphalt Cement Storage Tank #1
Tank Dimensions	
Shell Length (ft):	53.00
Diameter (ft):	10.00
Volume (gallons):	30,000.00
Turnovers:	303.69
Net Throughput(gal/yr):	9,110,629.00
Is Tank Heated (y/n):	Y
Is Tank Underground (y/n):	N
Paint Characteristics	
Shell Color/Shade:	Aluminum/Specular
Shell Condition	Good
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

StarPavingT2 - Horizontal 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)

StarPavingT2 - Horizontal Tank
Albuquerque, New Mexico

Annual Emission Calculations	
Standing Losses (lb):	0.0000
Vapor Space Volume (cu ft):	2,651.3441
Vapor Density (lb/cu ft):	0.0004
Vapor Space Expansion Factor:	0.0000
Vented Vapor Saturation Factor:	0.9909
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	2,651.3441
Tank Diameter (ft):	10.0000
Effective Diameter (ft):	25.9838
Vapor Space Outage (ft):	5.0000
Tank Shell Length (ft):	53.0000
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
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:	0.9909
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0347
Vapor Space Outage (ft):	5.0000
Working Losses (lb):	209.9548
Vapor Molecular Weight (lb/lb-mole):	105.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0347
Annual Net Throughput (gal/yr.):	9,110,629.0000
Annual Turnovers:	303.6876
Turnover Factor:	0.2655
Tank Diameter (ft):	10.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	209.9548

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

Emissions Report for: Annual

StarPavingT2 - Horizontal Tank
Albuquerque, New Mexico

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Asphalt Cement	209.95	0.00	209.95

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

Identification	
User Identification:	StarPavingT2
City:	Albuquerque
State:	New Mexico
Company:	Star Paving Company
Type of Tank:	Horizontal Tank
Description:	Star Paving Asphalt Cement Storage Tank #1
Tank Dimensions	
Shell Length (ft):	53.00
Diameter (ft):	10.00
Volume (gallons):	30,000.00
Turnovers:	303.69
Net Throughput(gal/yr):	9,110,629.00
Is Tank Heated (y/n):	Y
Is Tank Underground (y/n):	N
Paint Characteristics	
Shell Color/Shade:	Aluminum/Specular
Shell Condition	Good
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

StarPavingT2 - Horizontal 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)

StarPavingT2 - Horizontal Tank
Albuquerque, New Mexico

Annual Emission Calculations	
Standing Losses (lb):	0.0000
Vapor Space Volume (cu ft):	2,651.3441
Vapor Density (lb/cu ft):	0.0004
Vapor Space Expansion Factor:	0.0000
Vented Vapor Saturation Factor:	0.9909
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	2,651.3441
Tank Diameter (ft):	10.0000
Effective Diameter (ft):	25.9838
Vapor Space Outage (ft):	5.0000
Tank Shell Length (ft):	53.0000
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
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:	0.9909
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0347
Vapor Space Outage (ft):	5.0000
Working Losses (lb):	209.9548
Vapor Molecular Weight (lb/lb-mole):	105.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0347
Annual Net Throughput (gal/yr.):	9,110,629.0000
Annual Turnovers:	303.6876
Turnover Factor:	0.2655
Tank Diameter (ft):	10.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	209.9548

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

Emissions Report for: Annual

StarPavingT2 - Horizontal Tank
Albuquerque, New Mexico

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Asphalt Cement	209.95	0.00	209.95

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.

NOTE: Fireye and BurnerLogix are trademarks of Fireye, Inc.

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

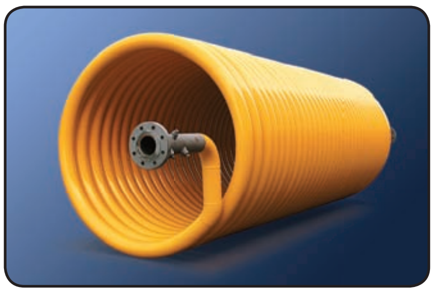
BASIC MODEL	MAXIMUM OUTPUT	FUEL USED PER HOUR		RECIRCULATION PUMP		EXPANSION TANK	APPROXIMATE OVERALL SIZE			NET WEIGHT
	Btu/Hour	No. 2 Fuel Oil Gallons	Natural Gas Cubic feet/hour	Hp	GPM	Gallons	Length	Width	Height	Pounds
SINGLE CIRCUIT HEATERS										
HCS-70	700,000	6	910	10	100	100	10’-5”	5’-7”	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.



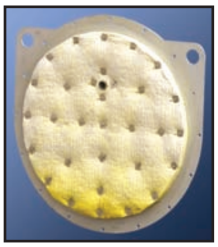
Helical coils

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

Publication 8-09-229

HEATEC, INC. an Astec Industries Company

ASTE NASDAQ LISTED

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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 Star Paving Company's South Broadway HMA Plant produces hot mix asphalt concrete. The operation is typical of a continuous double-barrel drum mix HMA operation. Aggregate from storage piles (Unit 1) is loaded into the Cold Aggregate Feed (4) Bins (Unit 2), where it is metered onto the Feed Bin Conveyor (Unit 3). From the Feed Bin Conveyor, the aggregate is sent to the Scalping Screen and Scalping Screen Conveyor (Units 4 and 5). From the Scalping Screen Conveyor material is transferred to the Slinger Conveyor (Unit 6), then loaded into the Drum Dryer/Mixer (Unit 13). 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, material is sent to the RAP Screen Conveyor (Unit 11) and the RAP Transfer Conveyor (Unit 12) that transports RAP to the Drum Dryer/Mixer (Unit 13). There the material is dried and asphalt cement form the Asphalt Cement Tanks (Unit 17) is added to make asphalt concrete. From the Drum Dryer/Mixer the asphalt concrete is sent by the Asphalt Drag Conveyor (Unit 14) to the Asphalt (2) Silos (Unit 15). Control units include a Drum Dryer/Mixer Dust Collector (Unit 13b), that captures particulates generated from the Drum Dryer/Mixer. 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.

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 enters and exits the Scalping Screen (Unit 4), and RAP Screen (Unit 10) with the addition of water on the material at the Scalping Screen, and RAP Screen.

Baghouse fines that are captured in the Drum Dryer/Mixer Dust Collector are recycled back to the Drum Dryer/Mixer using an enclosed loop.

There are no pollution controls for the Aggregate or RAP Storage Piles (Units 1, 7), Aggregate or RAP Feed Bin (Units 2, 8), Asphalt Drag Conveyor (Unit 14), Asphalt Silos (Unit 15), Asphalt Heater (Unit 16), or Hot Oil Asphalt Cement Storage Tanks (Unit 17).

Truck traffic into and out of the HMA Plant site will travel on paved roads. Paved roads will be periodically swept to reduce the buildup of silt on the road surface. Additionally, plant roads around the HMA Plant site will be unpaved roads. The unpaved roads will be controlled with either surfactants or asphalt millings and watered. 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 Star Paving

Albuquerque/Bernalillo County Regulations

20.11.1 NMAC– General Provisions: Applicable to Star Paving

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 Star Paving

Requirement: A one-time permit application fee will be assessed by the Albuquerque/Bernalillo County Environmental Department.

Compliance: Star Paving will pay all required permit revision application fees applicable to their facility.

20.11.5 NMAC– Visible Air Contaminants: Applicable to Star Paving

Requirement: Places limits of 20 percent opacity on stationary combustion equipment.

Compliance: Star Paving 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 Star Paving

Requirement: Compliance with all federal, state and local ambient air quality standards.

Compliance: Star Paving's South Broadway HMA 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 Star Paving

Requirement: Requires the facility to obtain a permit prior to start of surface disturbances.

Compliance: Star Paving will apply for a 20.11.20 NMAC permit prior to start of surface disturbances.

20.11.41 NMAC– Authority to Construct: Applicable to Star Paving

Requirement: Requires the facility to obtain a permit prior to start of construction.

Compliance: Star Paving is applying for a new 20.11.41 NMAC permit with this application.

20.11.49 NMAC– Excess Emissions: Applicable to Star Paving

Requirement: To implement requirements for the reporting of excess emissions and establish affirmative defense provisions for facility owners and operators for excess emissions.

Compliance: Star Paving will report all excess emissions following 20.11.49 NMAC guidelines.

20.11.63 NMAC– New Source Performance Standards: Applicable to Star Paving

Requirement: Adoption of all federal 40 CFR Part 60 new source performance standards.

Compliance: Star Paving 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 applicable standard.

20.11.64 NMAC– Emission Standards for Hazardous Air Pollutants for Stationary Sources: Not applicable to Star Paving

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 Star Paving

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, Star Paving 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 Star Paving

Requirement: General requirement on record keeping and data submission. Star Paving 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 Star Paving. It is expected the 20.11.41 NMAC permit issued to Star Paving will contain specific methods for determining compliance with each specific emission limitation. Star Paving's South Broadway HMA 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 Star Paving

Requirement: Compliance with federal ambient air quality standards.

Compliance: Star Paving's South Broadway HMA 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 Star Paving

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, Star Paving 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 Star Paving

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: Star Paving will perform any required Method 5 stack testing to show compliance with the 0.04 gr/dscf emission standard. Star Paving 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 STAR PAVING COMPANY
SOUTH BROADWAY HMA
NEW PERMIT APPICATION

Albuquerque, New Mexico

PREPARED FOR
STAR PAVING SERVICES, LLC

October, 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 Star Paving Company (Star Paving), to evaluate ambient air quality impacts for a new 300 ton per hour (tph) hot mix asphalt (HMA) plant to be sited west of South Broadway Blvd in Tract B, C, and D Plat of Unit I Lands of B G & W Partnership. Star Paving is applying for a 20.11.41 NMAC Permit. The new plant will be identified as "South Broadway HMA". The UTM coordinates of the proposed HMA plant will be; 347,775 meters E, 3,869,750 meters N, 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 (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 ($PM_{2.5}$); 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, respectively.

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 from the Star Paving's South Broadway 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, and asphalt heater, will be input into the model as point sources. Model input parameters for feeders, screens, 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.

Star Paving will model any additional neighboring sources identified by the AEHD ADP Modeling Section including New Mexico Terminal Services HMA, New Mexico Terminal Services Transload, New Mexico Aggregate, Western Organics, Brown-Minn Tank, and Onate.

The following limits will be requested for this permit application and will be included in the dispersion modeling analysis:

1. The new HMA plant will limit daily throughput to the following;

Month	Tons Per Day
January	3000
February	3300
March	3300
April	4200
May	4200
June	5400
July	5400
August	5400
September	4200
October	4200
November	3300
December	3000

2. With the daily limits discussed above, the maximum annual production is 1,488,900 tons per year. The requested annual permit limit is 700,000 tons per year. The annual modeled hourly factor is then 700,000/1,488,900 = 0.470.

3. Daily operating hours will be daylight hours only for the months of December and January, and 24 hours per day for the months of February through November.

4. Virgin aggregate/RAP/Asphalt cement ratios used in estimating material handling particulate emission rates is equal to 59.0/35.0/6.0. If no RAP is allowed in a mix, the Virgin aggregate/RAP/Asphalt cement ratios used in estimating material handling particulate emission rates is equal to 94.0/0.0/6.0. The maximum plant input for combined aggregate/RAP is 282 tons per hour at any time. This allows a range for aggregate and RAP to be 177 to 282 tons for aggregate, and 105 to 0 for RAP. Particulate emission rates were calculated using maximum aggregate (282 tons per hour) and RAP (105 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 highest results from the 12 modeling scenarios were rerun using a maximum aggregate input of 282 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.

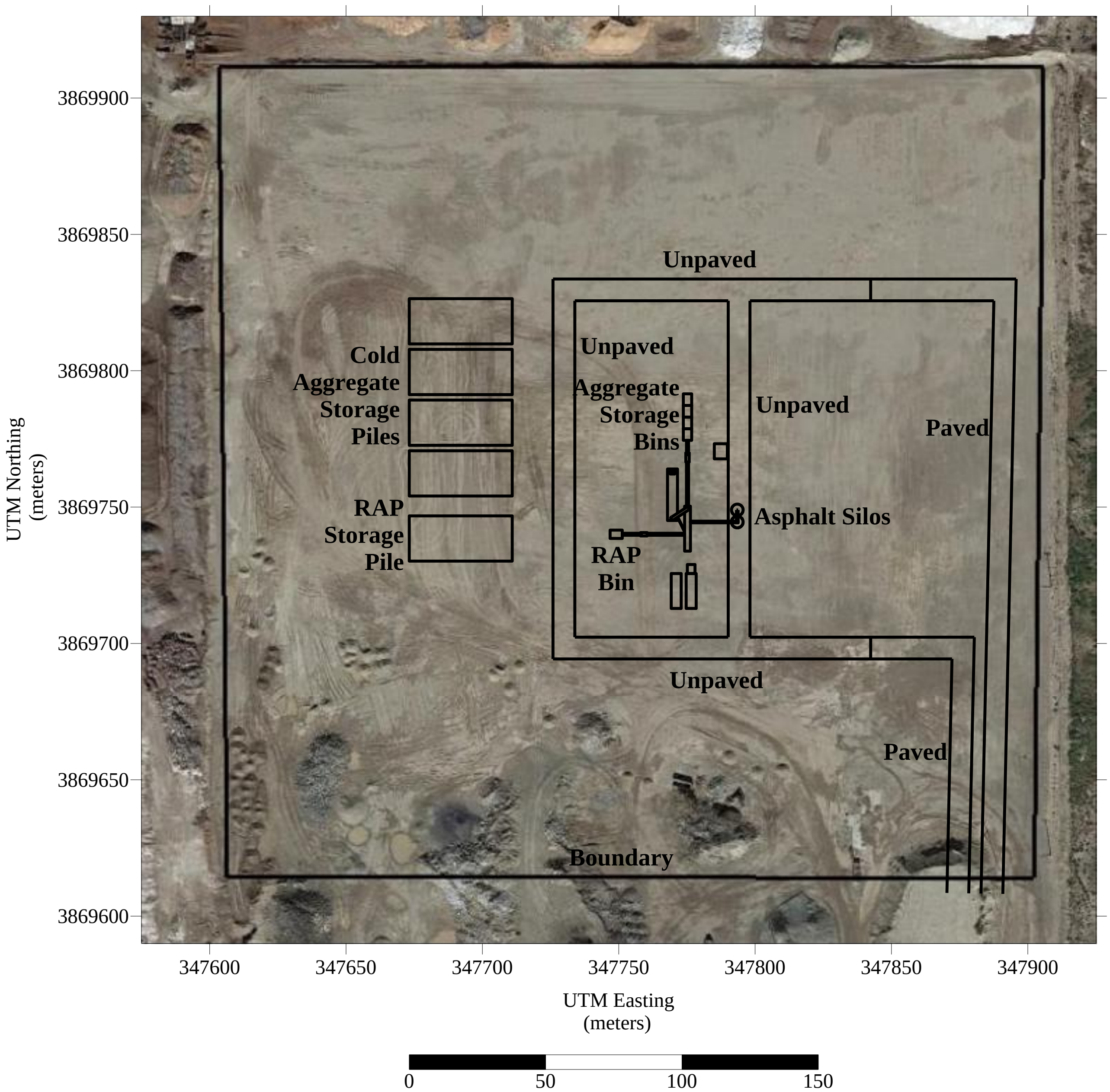

FIGURE 1: Star Paving South Broadway 300 TPH HMA Site Layout

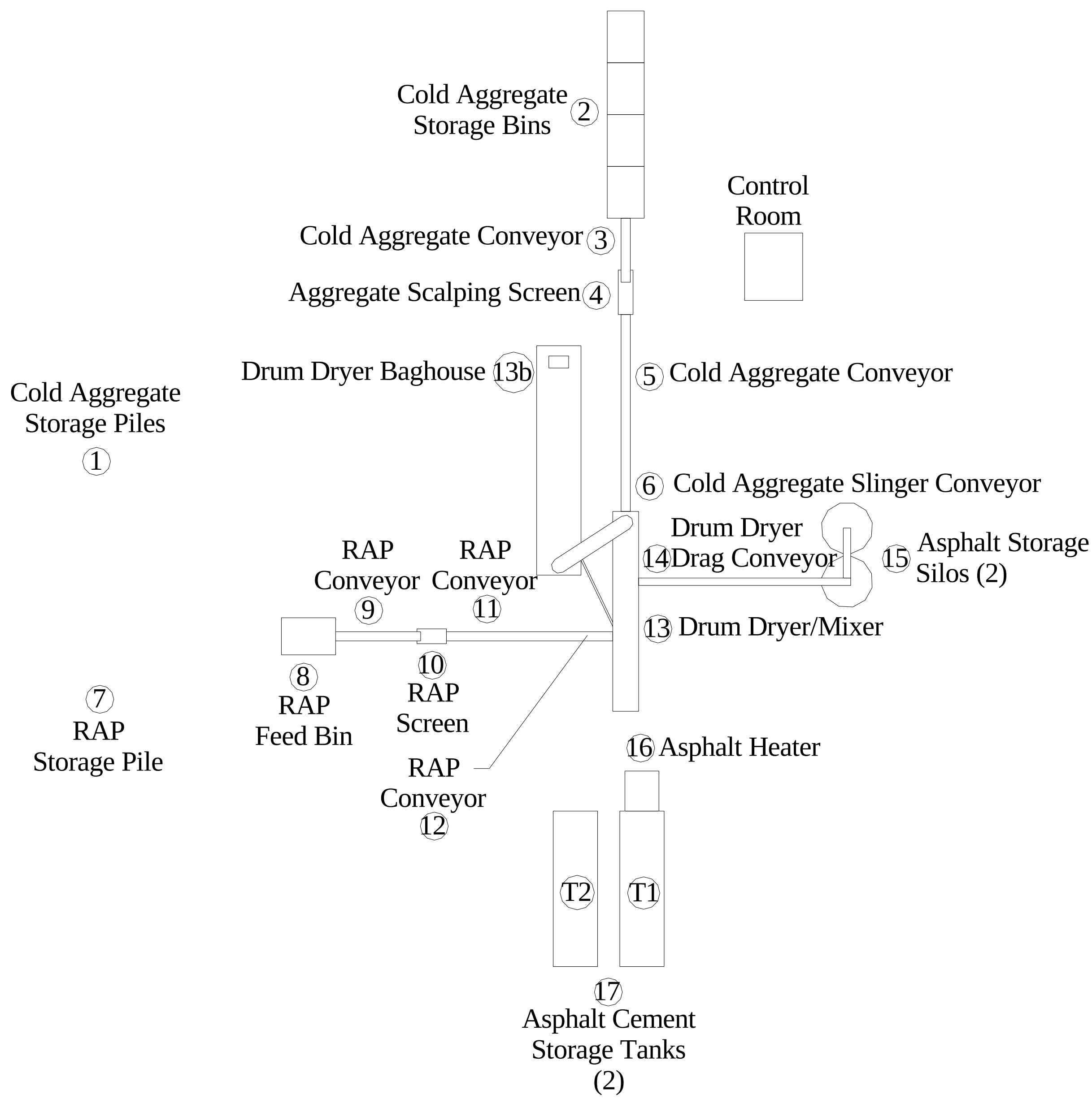

FIGURE 2: Star Paving South Broadway 300 TPH HMA Layout Plan

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 Star Paving's South Broadway 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 NO_2, CO, SO_2, PM_{10} and $PM_{2.5}$, for comparison with modeling significance levels, national/New Mexico/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 01/01/2019, and the most up to date EPA's *Guideline on Air Quality Models*.

Initial modeling will be performed with Star Paving's South Broadway HMA sources only to determine pollutants and averaging periods that exceed SILs. If initial modeling for any pollutant and averaging period exceeds SILs, then cumulative modeling will be performed for those pollutants and averaging periods. The cumulative impacts model will include all receptors for which the initial model indicates that the SILs are exceeded and will include any identified neighboring emission sources and will incorporate background ambient concentrations. Table 1 lists the SILs, NAAQS and NMAAQS for each pollutant averaging period. Table 2 lists ambient air quality standards for which modeling is not required by NMED AQB, when an approved surrogate standard is modeled.

TABLE 1: National and New Mexico Ambient Air Quality Standard Summary

Pollutant	Avg. Period	Sig. Lev. (μg/m^3)	Class I Sig. Lev. (μg/m^3)	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/m^3	25 μg/m^3
	24-hour	5.0			100 ppb(2)		
	1-hour	7.52		100 ppb(4)			
$PM_{2.5}$	annual	0.2	0.05	12 μg/m^3(5)		1 μg/m^3	4 μg/m^3
	24-hour	1.2	0.27	35 μg/m^3(6)		2 μg/m^3	9 μg/m^3
PM_{10}	annual	1.0	0.2			4 μg/m^3	17 μg/m^3
	24-hour	5.0	0.3	150 μg/m^3(7)		8 μg/m^3	30 μg/m^3
SO_2	annual	1.0	0.1		20 ppb(2)	2 μg/m^3	20 μg/m^3
	24-hour	5.0	0.2		100 ppb(2)	5 μg/m^3	91 μg/m^3
	3-hour	25.0	1.0	500 ppb(1)		25 μg/m^3	512 μg/m^3
	1-hour	7.8		75 ppb(8)			

Standards converted from ppb to μg/m^3 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 of 24-hour daily maximum concentrations, 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 NO_2, CO, SO_2, PM_{10} and $PM_{2.5}$, from the proposed Star Paving's South Broadway 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

Structures and tanks will be located at the site. Structures and tanks located near point sources, such as drum mixer dust collector structure, asphalt storage silos, and asphalt cement storage tanks will be included in building downwash calculations.

2.3 METEOROLOGICAL DATA

The meteorological data input file to be used in this dispersion modeling analysis is Albuquerque met data covering years 2014 through 2018 (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 as required to ensure that the maximum estimated impacts are identified. Radius of impact (ROI) modeling will be performed with receptors within 14 kilometers of the model boundary. Because of the nature of the emissions from the site, it is expected the maximum modeled concentrations will be on or near the site's fenceline.

The refined receptor grid will include receptors located at 50-meter spacing from the facility boundary out to 500 meters; 100-meter spacing from 500 meters out to 1,000 meters; 250-meter spacing from 1,000 meters out to 3,000 meters; 500-meter spacing from 3,000 meters out to 5,000 meters; 1000-meter spacing from 5,000 meters out to 10,000 meters; and 2000-meter spacing from 10,000 meters out to 14,000 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 processed using U.S. Geological Survey (USGS) national elevation data (NED). 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 will be daylight hours only for the months of December and January; and operating 24 hours per day for the months of February through November. Star Paving will take site-specific conditions on daily HMA operating throughput. For the months of December through January, the daily throughput will be limited to 3,000 tons (10 hours maximum throughput at 300 tph). For the month of February, March, and November, the daily throughput will be limited to 3,300 tons (11 hours maximum throughput at 300 tph). For the months of April, May, September, and October, the daily throughput will be limited to 4,200 tons (14 hours maximum throughput at 300 tph). For the months of June through August, the daily throughput will be limited to 5,400 tons (18 hours maximum throughput at 300 tph). Total 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 on Table 4.

For the 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. Star Paving will limit the HMA plant to 300 tph and 700,000 tons per year (tpy). If the HMA plant were run 365 days per year at the daily limits discussed above, that would be equivalent to 1,488,900 tons per year. For HMA annual modeling, the annual emission factor reduces the hourly emission factor to 0.470 (700,000/1,488,900) for all throughput-based emission rate sources

.

TABLE 3: HMA Production Hours of Operation (MST)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
12:00 AM	0	1	1	1	1	1	1	1	1	1	1	0
1:00 AM	0	1	1	1	1	1	1	1	1	1	1	0
2:00 AM	0	1	1	1	1	1	1	1	1	1	1	0
3:00 AM	0	1	1	1	1	1	1	1	1	1	1	0
4:00 AM	0	1	1	1	1	1	1	1	1	1	1	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	1	1	1	1	1	1	1	1	1	1	0
11:00 PM	0	1	1	1	1	1	1	1	1	1	1	0
Total	10.5	24	24	24	24	24	24	24	24	24	24	10

TABLE 4: HMA Model Scenario Time Segments

Model Scenario	Time Segments 10-Hour Blocks January	Time Segments 10-Hour Blocks December	Time Segments 11-Hour Blocks February, March, and November	Time Segments 14-Hour Blocks April, May, September, and October	Time Segments 18-Hour Blocks June - August
1	7 AM to 5 PM	7 AM to 5 PM	12 AM to 11 AM	12 AM to 2 PM	12 AM to 6 PM
2	7 AM to 5 PM	7 AM to 5 PM	2 AM to 1 PM	2 AM to 4 PM	2 AM to 8 PM
3	7 AM to 5 PM	7 AM to 5 PM	4 AM to 3 PM	4 AM to 6 PM	4 AM to 10 PM
4	7 AM to 5 PM	7 AM to 5 PM	6 AM to 5 PM	6 AM to 8 PM	6 AM to 12 AM
5	7 AM to 5 PM	7 AM to 5 PM	8 AM to 7 PM	8 AM to 10 PM	8 AM to 2 AM
6	7 AM to 5 PM	7 AM to 5 PM	10 AM to 9 PM	10 AM to 12 AM	10 AM to 4 AM
7	7:30 AM to 5:30 PM	7 AM to 5 PM	12 PM to 11 PM	12 PM to 2 AM	12 PM to 6 AM
8	7:30 AM to 5:30 PM	7 AM to 5 PM	2 PM to 1 AM	2 PM to 4 AM	2 PM to 8 AM
9	7:30 AM to 5:30 PM	7 AM to 5 PM	4 PM to 3 AM	4 PM to 6 AM	4 PM to 10 AM
10	7:30 AM to 5:30 PM	7 AM to 5 PM	6 PM to 5 AM	6 PM to 8 AM	6 PM to 12 PM
11	7:30 AM to 5:30 PM	7 AM to 5 PM	8 PM to 7 AM	8 PM to 10 AM	8 PM to 2 PM
12	7:30 AM to 5:30 PM	7 AM to 5 PM	10 PM to 9 AM	10 PM to 12 PM	10 PM to 4 PM

2.5.1 Star Paving South Broadway HMA Road Vehicle Traffic Model Inputs

The access road fugitive dust for truck traffic will be modeled as a series 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 Star Paving South Broadway HMA Material Handling Volume Source Model Inputs

Particulate matter emissions from the material handling process 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 Star Paving South Broadway HMA Point Source Model Inputs

Emissions from exhaust stacks 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 degrees Kelvin (°K). For horizontal or raincap releases, the AERMOD option for horizontal and raincap releases will be used with actual release parameters. The Star Paving's South Broadway HMA asphalt heater (Unit 16) will be modeled as a raincap release source.

Tables 5, 6, 7, and 8 summarize the model inputs for the Star Paving's South Broadway 300 TPH HMA Plant.

TABLE 5: Summary of Model Inputs for Point Sources at the Star Paving South Broadway HMA Plant – NO_X, CO & SO_2

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)
Star Paving HMA Baghouse Stack Unit 13	HMASTK	6.4944	388.7056	22.4003	1.2789	16.50000	39.00000	17.40000
Star Paving HMA Asphalt Cement Heater Unit 16	HMAHEAT	4.2672	588.7100	6.3128	0.3048	0.22000	0.09836	0.07810

TABLE 6: Summary of Model Inputs for Point Sources at the Star Paving South Broadway 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)
Star Paving HMA Baghouse Stack Unit 13	HMASTK	6.4944	388.7056	22.4003	1.2789	6.90000	6.90000
Star Paving HMA Asphalt Cement Heater Unit 16	HMAHEAT	4.2672	588.7100	6.3128	0.3048	0.02200	0.02200

TABLE 7: Summary of Model Inputs for Volume Sources at the HMA Plant – Particulate for 35% RAP Input -105 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)
Star Paving HMA Asphalt Silo Loading Unit 14	DRUMUNL	2.0000	0.4700	0.9300	0.17577	0.17577	0.35399
Star Paving HMA Asphalt Silo Unloading Unit 15	HMASILO	4.0000	0.4700	0.9300	0.15658	0.15658	0.40477
Star Paving HMA Storage Pile Handling 1 Unit 1	HMAPILE1	2.4384	4.2500	2.2677	0.09879	0.01496	
Star Paving HMA Storage Pile Handling 2 Unit 1	HMAPILE2	2.4384	4.2500	2.2677	0.09879	0.01496	
Star Paving HMA Storage Pile Handling 3 Unit 1	HMAPILE3	2.4384	4.2500	2.2677	0.09879	0.01496	
Star Paving HMA Storage Pile Handling 4 Unit 1	HMAPILE4	2.4384	4.2500	2.2677	0.09879	0.01496	
Star Paving HMA Bin Loading Bin 1 Unit 2	HMABIN1	6.0000	1.1600	2.3300	0.09879	0.01496	
Star Paving HMA Bin Loading Bin 2 Unit 2	HMABIN2	6.0000	1.1600	2.3300	0.09879	0.01496	
Star Paving HMA Bin Loading Bin 3 Unit 2	HMABIN3	6.0000	1.1600	2.3300	0.09879	0.01496	
Star Paving HMA Bin Loading Bin 4 Unit 2	HMABIN4	6.0000	1.1600	2.3300	0.09879	0.01496	
Star Paving HMA Bin Unloading Unit 3	HMATP1	2.0000	0.4700	0.9300	0.00814	0.00230	
Star Paving HMA Scalping Screen Unit 4	HMASCR	4.0000	1.1600	2.3300	0.13098	0.00885	
Star Paving HMA Scalping Screen Unloading Unit 5	HMATP2	2.0000	0.4700	0.9300	0.00814	0.00230	
Star Paving HMA Conveyor to Sling Conveyor Unit 6	HMATP3	2.0000	0.4700	0.9300	0.00814	0.00230	
Star Paving HMA RAP Storage Pile Handling Unit 7	RAPPILE	2.4384	4.2500	2.2677	0.07033	0.01065	
Star Paving HMA RAP Bin Loading Unit 8	RAPBIN	6.0000	1.1600	2.3300	0.07033	0.01065	
Star Paving HMA RAP Bin Unloading Unit 9	RAPTP1	2.0000	0.4700	0.9300	0.00483	0.00137	
Star Paving HMA RAP Screen Unit 10	RAPSCR	4.0000	1.1600	2.3300	0.07770	0.00525	

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)
Star Paving HMA RAP Screen Unloading Unit 11	RAPTP2	2.0000	0.4700	0.9300	0.00483	0.00137	
Star Paving HMA RAP Transfer Conveyor Unit 12	RAPTP3	2.0000	0.4700	0.9300	0.00483	0.00137	
Star Paving HMA Haul Road Paved In Volume 1-21 (each source)	PVI_0001-21	3.4000	6.0500	3.1600	0.00780	0.00191	
Star Paving HMA Haul Road Paved Out Volume 1-10 (each source)	PVO_0001-10	3.4000	6.0500	3.1600	0.00751	0.00184	
Star Paving HMA Haul Road Paved Out Volume 1-10 (each source)	PVO_0001-10	3.4000	6.0500	3.1600			0.00587
Star Paving HMA Haul Road Unpaved Asphalt Volume 1-18 (each source)	UPA_001-18	3.4000	6.0500	3.1600	0.01679	0.00168	
Star Paving HMA Haul Road Unpaved Asphalt Volume 11-18 (each source)	UPA_011-18	3.4000	6.0500	3.1600			0.00587
Star Paving HMA Haul Road Unpaved Aggregate, Asphalt Cement, RAP Volume 1-28 (each source)	UPO_001-28	3.4000	6.0500	3.1600	0.01685	0.00168	

TABLE 8: Summary of Model Inputs for Volume Sources at the HMA Plant – Particulate for 0% RAP Input - 0 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)
Star Paving HMA Asphalt Silo Loading Unit 14	DRUMUNL	2.0000	0.4700	0.9300	0.17577	0.17577	0.35399
Star Paving HMA Asphalt Silo Unloading Unit 15	HMASILO	4.0000	0.4700	0.9300	0.15658	0.15658	0.40477
Star Paving HMA Storage Pile Handling 1 Unit 1	HMAPILE1	2.4384	4.2500	2.2677	0.15739	0.02383	
Star Paving HMA Storage Pile Handling 2 Unit 1	HMAPILE2	2.4384	4.2500	2.2677	0.15739	0.02383	
Star Paving HMA Storage Pile Handling 3 Unit 1	HMAPILE3	2.4384	4.2500	2.2677	0.15739	0.02383	
Star Paving HMA Storage Pile Handling 4 Unit 1	HMAPILE4	2.4384	4.2500	2.2677	0.15739	0.02383	
Star Paving HMA Bin Loading Bin 1 Unit 2	HMABIN1	6.0000	1.1600	2.3300	0.15739	0.02383	
Star Paving HMA Bin Loading Bin 2 Unit 2	HMABIN2	6.0000	1.1600	2.3300	0.15739	0.02383	
Star Paving HMA Bin Loading Bin 3 Unit 2	HMABIN3	6.0000	1.1600	2.3300	0.15739	0.02383	
Star Paving HMA Bin Loading Bin 4 Unit 2	HMABIN4	6.0000	1.1600	2.3300	0.15739	0.02383	
Star Paving HMA Bin Unloading Unit 3	HMATP1	2.0000	0.4700	0.9300	0.01297	0.00367	
Star Paving HMA Scalping Screen Unit 4	HMASCR	4.0000	1.1600	2.3300	0.20868	0.01410	
Star Paving HMA Scalping Screen Unloading Unit 5	HMATP2	2.0000	0.4700	0.9300	0.01297	0.00367	
Star Paving HMA Conveyor to Sling Conveyor Unit 6	HMATP3	2.0000	0.4700	0.9300	0.01297	0.00367	
Star Paving HMA RAP Storage Pile Handling Unit 7	RAPPILE	2.4384	4.2500	2.2677	0.00000	0.00000	
Star Paving HMA RAP Bin Loading Unit 8	RAPBIN	6.0000	1.1600	2.3300	0.00000	0.00000	
Star Paving HMA RAP Bin Unloading Unit 9	RAPTP1	2.0000	0.4700	0.9300	0.00000	0.00000	
Star Paving HMA RAP Screen Unit 10	RAPSCR	4.0000	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)
Star Paving HMA RAP Screen Unloading Unit 11	RAPTP2	2.0000	0.4700	0.9300	0.00000	0.00000	
Star Paving HMA RAP Transfer Conveyor Unit 12	RAPTP3	2.0000	0.4700	0.9300	0.00000	0.00000	
Star Paving HMA Haul Road Paved In Volume 1-21 (each source)	PVI_0001-21	3.4000	6.0500	3.1600	0.00780	0.00191	
Star Paving HMA Haul Road Paved Out Volume 1-10 (each source)	PVO_0001-10	3.4000	6.0500	3.1600	0.00751	0.00184	
Star Paving HMA Haul Road Paved Out Volume 1-10 (each source)	PVO_0001-10	3.4000	6.0500	3.1600			0.00587
Star Paving HMA Haul Road Unpaved Asphalt Volume 1-18 (each source)	UPA_001-18	3.4000	6.0500	3.1600	0.01679	0.00168	
Star Paving HMA Haul Road Unpaved Asphalt Volume 11-18 (each source)	UPA_011-18	3.4000	6.0500	3.1600			0.00587
Star Paving HMA Haul Road Unpaved Aggregate, Asphalt Cement, RAP Volume 1-28 (each source)	UPO_001-28	3.4000	6.0500	3.1600	0.01685	0.00168	

2.6 PARTICLE SIZE DISTRIBUTION

PM_{10} emissions may be modeled using plume deposition. Plume deposition simulates the effect of gravity as particles "fall-out" from the plume to the ground as the plume travels downwind. Therefore, the farther the plume travels from the emission point to the receptor, the greater the effect of plume deposition and the greater the decrease in modeled impacts or concentrations. Particle size distribution, particle mass fraction, and particle density are required inputs to the model to perform this function.

The particle size distribution data used in the modeling for material handling of aggregate will be based upon data obtained from the City of Albuquerque AQB's "Air Dispersion Modeling Guidelines for Air Quality Permitting", revised 02/03/2016, Table 1. Particle size distribution for fugitive road dust on paved and unpaved roads; neighboring lime silo baghouse exhaust; HMA asphalt particulate emissions; and combustion will use the particle size distribution found in the NMED Modeling Section approved values.

The mass-mean particle diameters were calculated using the formula:

$$d = ((d^3_1 + d^2_1 d_2 + d_1 d^2_2 + d^3_2) / 4)^{1/3}$$

Where: d = mass-mean particle diameter
d_1 = low end of particle size category range
d_2 = high end of particle size category range

Representative average particle densities were obtained from NMED accepted values.

Material	Density (g/cm^3)	Reference
Road Dust – Star Paving and Neighbor	2.5	NMED Value
Lime – Neighbor	3.3	NMED Value
HMA Asphalt – Star Paving and Neighbor	1.5	NMED Value
Combustion – Star Paving and Neighbor	1.5	NMED Value
Fugitive Dust – Star Paving and Neighbor	2.5	NMED Value

The densities and size distribution for PM_{10} emission sources are presented in Tables 9 - 13.

TABLE 9: Road Vehicle Fugitive Dust Deposition Parameters

Particle Size Category (µm)	Mass Mean Particle Diameter (µm)	Mass Weighted Size Distribution (%)	Density (g/cm^3)
PM10			
0 – 2.5	1.57	25.0	2.5
2.5 – 10	6.91	75.0	2.5

Based on NMED Particle Size Distribution Spreadsheet – April 25, 2007

TABLE 10: Neighbor Lime Baghouse Source Deposition Parameters

Particle Size Category (µm)	Mass Mean Particle Diameter (µm)	Mass Weighted Size Distribution (%)	Density (g/cm^3)
PM10			
0-2.5	1.57	25	3.3
2.5-10	6.91	75	3.3

Parameters based on baghouse exhaust capture percentages.

TABLE 11: Combustion Source Deposition Parameters

Particle Size Category (µm)	Mass Mean Particle Diameter (µm)	Mass Weighted Size Distribution (%)	Density (g/cm^3)
PM10			
0 - 2.5	1.57	100	1.5

Based on NMED Particle Size Distribution Spreadsheet – April 25, 2007

TABLE 12: Asphalt Baghouse and Stack Source Deposition Parameters

Particle Size Category (µm)	Mass Mean Particle Diameter (µm)	Mass Weighted Size Distribution (%)	Density (g/cm^3)
PM10			
0-1.0	0.63	50.0	1.5
1.0-2.5	1.85	19.0	1.5
2.5-10	6.92	31.0	1.5

Based on NMED Particle Size Distribution Spreadsheet – April 25, 2007

TABLE 13: Fugitive Dust Source Deposition Parameters

Particle Size Category (μm)	Mass Mean Particle Diameter (μm)	Mass Weighted Size Distribution (%)	Density (g/cm^3)
PM10			
2.5 – 5	3.88	22.6	2.5
5 – 10	7.77	77.4	2.5

Parameters based on values from the Albuquerque Air Quality Division Modeling Guidelines.

2.7 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 Ozone Limiting Method (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 the ambient impact of 1-hour and annual NOx predicted by the model will use Tier III – OLM or PVMRM.

When using ARM2, two inputs can be selected in the model. For this modeling analysis, EPA default minimum and maximum ambient NO_2/NO_X ratios for the ambient air of 0.50 and 0.90, respectively, will be used. 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 is determined from monitored ozone data collected from South Valley city monitoring station matching the modeled met years 2014 – 2018.

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 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. For neighboring sources within 1 kilometer of the site the ISR will be 0.30 in lieu of source specific data, such as diesel-fired engines at 0.15. For neighboring sources extended beyond 1 kilometer a default ISR of 0.20[1] will be used.

[1] Technical support document (TSD) for NO2-related AERMOD modifications, EPA- 454/B-15-004, July 2015

Model Ozone Data

For OLM or PVMRM, modeling of the project-generated 1-hour NO_2 concentrations requires use of ambient monitored ozone concentrations. This ozone data was provided by the AEHD AQP for the South Valley monitoring station for the years 2014 – 2018.

2.8 $PM_{2.5}$ SECONDARY EMISSIONS MODELING

Particulate matter includes both "primary" PM, which is directly emitted into the air, and "secondary" PM, which forms in the atmosphere from chemical reactions involving primary gaseous emissions of precursor air contaminants. 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 SO_2 emissions from power plants and industrial facilities;
- Nitrates formed from NO_X emissions from cars, trucks, industrial facilities, and power plants; and
- Carbon formed from reactive organic gas (ROG or VOC) 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 Star Paving's South Broadway 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 Star Paving assessment of their potential contribution to cumulative impacts as secondary $PM_{2.5}$ was performed based on guidance from the NMED Modeling Section and using prescribed equations. The permit application for Star Paving's South Broadway HMA emissions of precursors include:

- NO_X – 20.2 tons per year (below SER)
- SO_2 – 20.6 tons per year (below SER)
- Volatile Organic Compounds (VOC) – 17.6 tons per year (below SER)
- Particulate Matter with an aerodynamic diameter of 2.5 micron or less ($PM_{2.5}$) – 8.9 tons per year (below SER).

The $PM_{2.5}$ 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, Star Paving's South Broadway 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.

$PM_{2.5}$ annual = ((NO_X emission rate (tpy)/3184 + (SO_2 emission rate (tpy)/2289)) x 0.2 $\mu g/m^3$

$PM_{2.5}$ annual = ((20.2/3184) + (20.6/2289)) x 0.2 $\mu g/m^3$ = **0.0031 $\mu g/m^3$**

$PM_{2.5}$ 24 hour = ((NO_X emission rate (tpy)/1155 + (SO_2 emission rate (tpy)/225)) x 1.2 $\mu g/m^3$

$PM_{2.5}$ 24 hour = ((20.2/1155) + (20.6/225)) x 1.2 $\mu g/m^3$ = **0.13 $\mu g/m^3$**

2.9 AMBIENT MODELING BACKGROUND

Ambient background concentrations, based on the South Valley Monitoring Station for CO, NO_2, SO_2, PM_{10}, and $PM_{2.5}$ for 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.

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:	42 micrograms per cubic meter
$PM_{2.5}$ 24-hr:	22 micrograms per cubic meter
$PM_{2.5}$ annual:	8.4 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,*

[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.

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."

The NO_2 background data was provided by the AEHD AQP Modeling Section and is presented below in Table 14.

TABLE 14: Monitored Seasonal NO_2 Background – 3rd Highest Hourly µg/m³

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

Note: Aermod Version 19191 was used for NO_2 PVMRM modeling. To resolve the error in Version 21112 EPA recommends dividing by half the NO_2 background inputted in the model. Per the City Modeling Section request instead of modeling using Version 21112, Version 19191 was used.

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 South Broadway HMA 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	3000	10
February	3300	11
March	3300	11
April	4200	14
May	4200	14
June	5400	18
July	5400	18
August	5400	18
September	4200	14
October	4200	14
November	3300	11
December	3000	10

2. With the daily limits discussed above, the maximum annual production is 1,488,900 tons per year. The requested annual permit limit is 700,000 tons per year. The annual $PM_{2.5}$ modeled hourly factor is then 700,000/1,488,900 = 0.470.

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 through November are 24 hours per day and the limits of the daily production requested.

5. Virgin aggregate/RAP/Asphalt cement ratios used in estimating material handling particulate emission rates is equal to 59.0/35.0/6.0. If no RAP is allowed in a mix, the Virgin aggregate/RAP/Asphalt cement ratios used in estimating material handling particulate emission rates is equal to 94.0/0.0/6.0. The maximum plant input for combined aggregate/RAP is 282 tons per hour at any time. This allows a range for aggregate and RAP to be 177 to 282 tons for aggregate and 105 to 0 for RAP. Particulate emission rates were calculated using maximum aggregate (282 tons per hour) and RAP (105 tons per hour) inputs. Some RAP input to the typical mix rate will be normal operations. Modeling was performed for all 12 modeling scenarios based on material handling for RAP mix ratio of 35%. The 3 highest results from the 12 modeling scenarios were rerun using a maximum aggregate input of 282 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.

Total hours of operation of the HMA plant are presented in Table 15. 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 Table 16.

TABLE 15: HMA Production Hours of Operation (MST)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
12:00 AM	0	1	1	1	1	1	1	1	1	1	1	0
1:00 AM	0	1	1	1	1	1	1	1	1	1	1	0
2:00 AM	0	1	1	1	1	1	1	1	1	1	1	0
3:00 AM	0	1	1	1	1	1	1	1	1	1	1	0
4:00 AM	0	1	1	1	1	1	1	1	1	1	1	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	1	1	1	1	1	1	1	1	1	1	0
11:00 PM	0	1	1	1	1	1	1	1	1	1	1	0
Total	10.5	24	24	24	24	24	24	24	24	24	24	10

TABLE 16: HMA Model Scenario Time Segments

Model Scenario	Time Segments 10-Hour Blocks January	Time Segments 10-Hour Blocks December	Time Segments 11-Hour Blocks February, March, and November	Time Segments 14-Hour Blocks April, May, September, and October	Time Segments 18-Hour Blocks June - August
1	7 AM to 5 PM	7 AM to 5 PM	12 AM to 11 AM	12 AM to 2 PM	12 AM to 6 PM
2	7 AM to 5 PM	7 AM to 5 PM	2 AM to 1 PM	2 AM to 4 PM	2 AM to 8 PM
3	7 AM to 5 PM	7 AM to 5 PM	4 AM to 3 PM	4 AM to 6 PM	4 AM to 10 PM
4	7 AM to 5 PM	7 AM to 5 PM	6 AM to 5 PM	6 AM to 8 PM	6 AM to 12 AM
5	7 AM to 5 PM	7 AM to 5 PM	8 AM to 7 PM	8 AM to 10 PM	8 AM to 2 AM
6	7 AM to 5 PM	7 AM to 5 PM	10 AM to 9 PM	10 AM to 12 AM	10 AM to 4 AM
7	7:30 AM to 5:30 PM	7 AM to 5 PM	12 PM to 11 PM	12 PM to 2 AM	12 PM to 6 AM
8	7:30 AM to 5:30 PM	7 AM to 5 PM	2 PM to 1 AM	2 PM to 4 AM	2 PM to 8 AM
9	7:30 AM to 5:30 PM	7 AM to 5 PM	4 PM to 3 AM	4 PM to 6 AM	4 PM to 10 AM
10	7:30 AM to 5:30 PM	7 AM to 5 PM	6 PM to 5 AM	6 PM to 8 AM	6 PM to 12 PM
11	7:30 AM to 5:30 PM	7 AM to 5 PM	8 PM to 7 AM	8 PM to 10 AM	8 PM to 2 PM
12	7:30 AM to 5:30 PM	7 AM to 5 PM	10 PM to 9 AM	10 PM to 12 PM	10 PM to 4 PM

Neighboring sources included in the $PM_{2.5}$, PM_{10}, NO_2, and SO_2 CIA modeling are: New Mexico Terminal Services HMA (#3340), New Mexico Terminal Services Transload (#3311-M1), New Mexico Aggregate (#1435-M1), Western Organics (#0470), Brown-Minn Tank Inc (#1438-2AR), and Onate Feed (#1563-M1). The information on these sources was provided by the city air quality dispersion modeling section.

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 South Broadway HMA emission sources only. Table 17 lists the results of the modeling for pollutant and averaging period that falls below the applicable SILs.

TABLE 17: Summary of Air Dispersion Modeling Results below SILs

Parameter	Maximum Modeled Concentration (µg/m^3)	Significant Impact Level (µg/m^3)	% of SIL
CO 1 Hr.	316	2000	15.8
CO 8 Hr.	197	500	39.4

For CO, the results show impacts below the NAAQS SILs for the 1-hour averaging period of 2000 µg/m^3 and for the 8-hour averaging period of 500 µg/m^3, so no further CO 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 18 discussed which standards are the most stringent.

TABLE 18: 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
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

The model results using the maximum operation at Star Paving's South Broadway 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 19. Dispersion modeling analysis followed the modeling protocol outline in Section 2 of this report.

TABLE 19: Summary of CIA Modeling Results Including all Applicable Neighboring Sources, Approved Ambient Background, and for $PM_{2.5}$ Secondary Emissions

Parameter	Maximum Star Paving Modeled Concentration ($\mu g/m^3$)	Significant Impact Level ($\mu g/m^3$)	Maximum Modeled Concentration With Neighbor and Background ($\mu g/m^3$)	Lowest Applicable Standard ($\mu g/m^3$)	% of Standard
NO_2 1 Hr. 8th highest 1-hour daily maximum	74.1	7.54	142.8	188.1	75.9
NO_2 Annual	1.01	1.0	39.6	94.0	42.1
SO_2 1 Hr. 4th highest 1-hour daily maximum	91.2	7.8	104.5	196.4	53.2
$PM_{2.5}$ 24 Hr. High 8th High	10.6	1.2	32.6	35	93.1
$PM_{2.5}$ Annual	3.1	0.2	11.5	12	95.8
PM_{10} 24 Hr. High 2nd High	60.5	5	102.5	150	68.3

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 Star Paving's proposed South Broadway HMA and neighboring sources. NO_X emission rates represented the maximum hourly rate for Star Paving'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 modeling, the Tier 3 PVMRM approach found in Section 2.6 of this report was used for the analysis. For PVMRM, background ambient O_3 concentrations for the project area during the 2014-2018 meteorological data years was obtained from the Albuquerque South Valley monitoring station.

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.

CIA dispersion modeling showed exceedance of the NO_2 8th highest 1-hour daily maximum NAAQS where Star Paving Sources contributed to an exceedance of the NO_2 1-hour SILs. The exceedance was the result of modeled emissions from within the boundaries of neighboring New Mexico Terminal Services and New Mexico Aggregate sources. When the neighboring source contribution were eliminating from within their boundary, no exceedance existed.

Table 20 shows the NO_2 1-Hour 8th highest 1-hour daily maximum and annual model results and locations where Star Paving's proposed South Broadway HMA is above the SILs.

TABLE 20: NO_2 CIA MODEL RESULTS

	Star Paving Modeled Concentration ($\mu g/m^3$)	Modeled Concentration With Neighbor and Background ($\mu g/m^3$)	Location UTMs E/N	
NO_2 1 Hr. 8th highest 1-hour daily maximum	74.1	142.8	347800.7	3869609.7
NO_2 Annual	1.01	39.6	347900.0	3869400.0

Figure 3 shows an aerial map of the NO_2 8th highest 1-hour daily maximum and annual average concentrations and the location of the maximum modeled concentrations which includes background where Star Paving sources contribute above the NO_2 SIL.

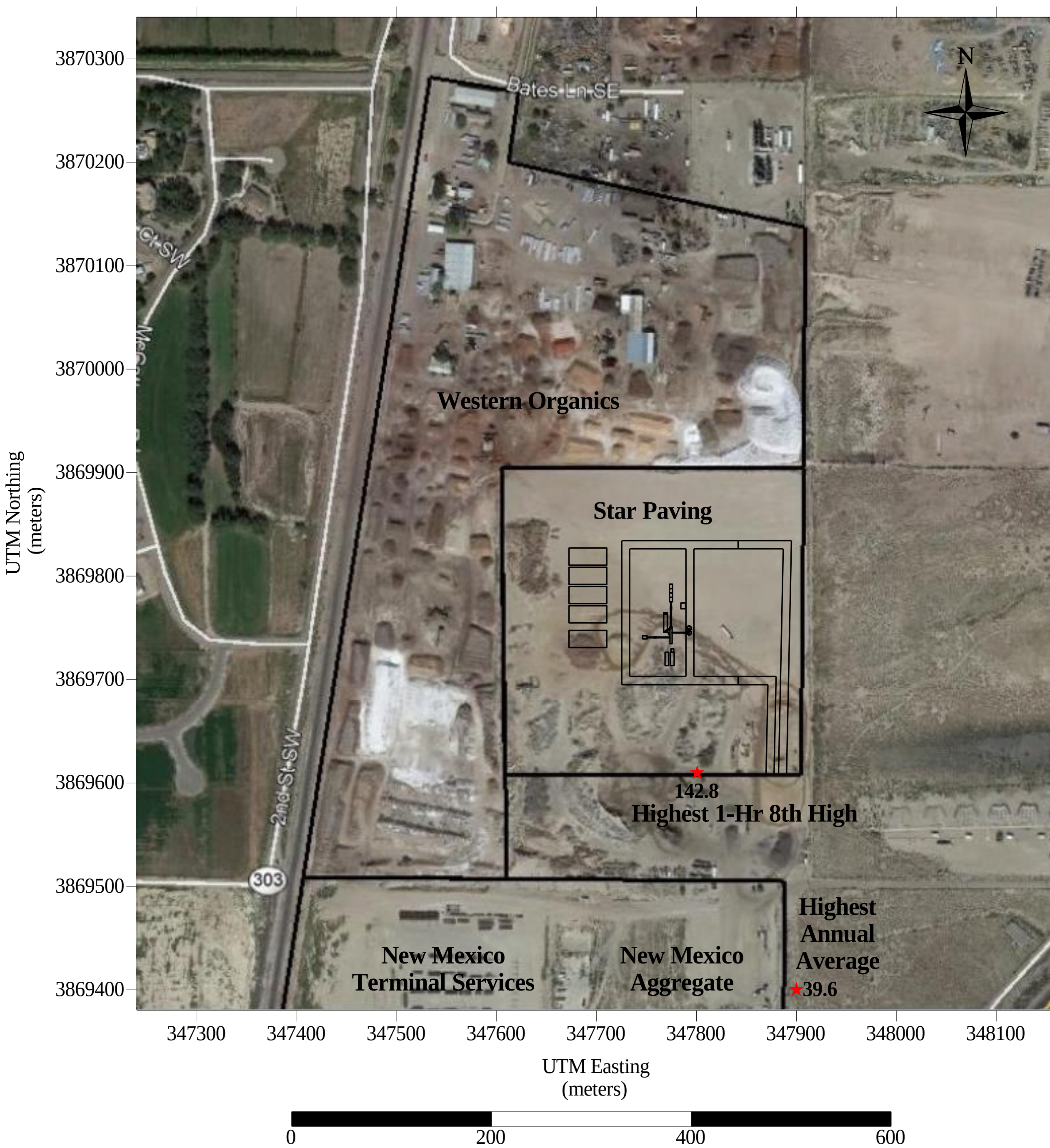

Figure 3: Aerial Map of NO_2 8th Highest 1-Hour Daily Maximum and Annual Average Model Results (μg/m^3)

3.2.2 SO_2 Cumulative Impact Analysis Modeling Results

SO_2 1-hour modeling was performed with terrain elevations and building downwash for Star Paving proposed South Broadway HMA and neighboring sources. SO_2 emission rates represented the maximum hourly rate for Star Paving permitted point sources and significant neighboring sources.

Table 21 shows the SO_2 4th highest 1-hour daily maximum model result and location.

TABLE 21: SO_2 CIA MODEL RESULTS

	Star Paving Modeled Concentration (μg/m^3)	Modeled Concentration With Neighbor and Background (μg/m^3)	Location UTMs E/N	
SO_2 1 Hr. 4th highest 1-hour daily maximum	91.2	104.5	347800.7	3869609.7

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.

CIA dispersion modeling showed the highest concentrations of the SO_2 4th highest 1-hour daily maximum NAAQS within the boundaries of neighboring New Mexico Terminal Services and New Mexico Aggregate sources. When the neighboring source contribution were eliminating from within their boundary, the 4th highest 1-hour daily maximum concentrations, where Star Paving sources were above the SILs was located on the Star Paving south boundary.

Figure 4 shows an aerial map of the 4th highest 1-hour SO_2 daily maximum concentration and the location of the maximum modeled concentration including background where Star Paving sources contribute above the 1-hour SO_2 SIL.

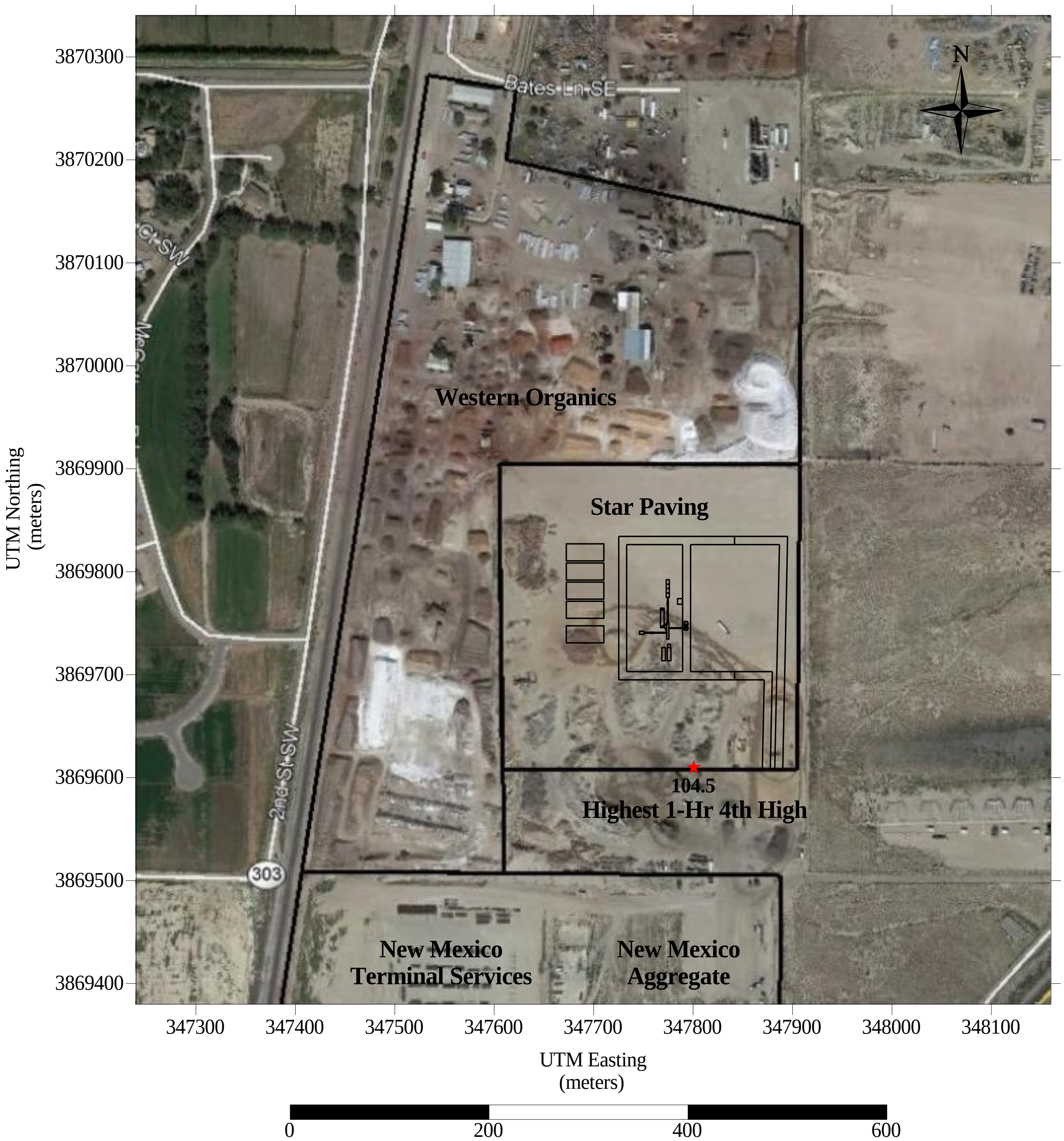

Figure 4: Aerial Map of SO_2 1 Hour Model Results ($\mu g/m^3$)

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 Star Paving's South Broadway 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 Star Paving's 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 Star Paving's South Broadway HMA emissions of precursors include:

- NO_X – 20.2 tons per year (below SER)
- SO_2 – 20.6 tons per year (below SER)
- Volatile Organic Compounds (VOC) – 17.6 tons per year (below SER)
- Particulate Matter with an aerodynamic diameter of 2.5 micron or less ($PM_{2.5}$) – 8.9 tons per year (below SER).

The $PM_{2.5}$ 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, Star Paving's South Broadway 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.

$$PM_{2.5}\text{ annual} = ((NO_X\text{ emission rate (tpy)}/3184 + (SO_2\text{ emission rate (tpy)}/2289)) \times 0.2\ \mu g/m^3$$

$$PM_{2.5}\text{ annual} = ((20.2/3184) + (20.6/2289)) \times 0.2\ \mu g/m^3 = \mathbf{0.0031\ \mu g/m^3}$$

$$PM_{2.5}\text{ 24 hour} = ((NO_X\text{ emission rate (tpy)}/1155 + (SO_2\text{ emission rate (tpy)}/225)) \times 1.2\ \mu g/m^3$$

$$PM_{2.5}\text{ 24 hour} = ((20.2/1155) + (20.6/225)) \times 1.2\ \mu g/m^3 = \mathbf{0.13\ \mu g/m^3}$$

CIA $PM_{2.5}$ 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.

All model scenarios results for $PM_{2.5}$ annual modeling are summarized in Tables 22 and 23.

TABLE 22: 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	11.3	0.0015	11.3
2	11.3	0.0015	11.3
3	11.3	0.0015	11.3
4	11.3	0.0015	11.3
5	11.3	0.0015	11.3
6	11.3	0.0015	11.3
7	11.4	0.0015	11.4
8	11.4	0.0015	11.4
9	11.4	0.0015	11.4
10	**11.4**	**0.0015**	**11.4**
11	11.4	0.0015	11.4
12	11.4	0.0015	11.4

TABLE 23: 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	11.4	0.0015	11.4
10	**11.5**	**0.0015**	**11.5**
11	11.5	0.0015	11.5

$PM_{2.5}$ 5-year annual average model result show the annual average occurred at Western Organic's western boundary and during modeling scenario 10 and a RAP input of 0%.

All model results scenarios for $PM_{2.5}$ 24-hour modeling are summarized in Tables 24 and 25.

TABLE 24: 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	31.6	0.034	31.6
2	30.6	0.034	30.6
3	29.4	0.034	29.4
4	29.4	0.034	29.4
5	29.3	0.034	29.3
6	29.6	0.034	29.6
7	30.4	0.034	30.4
8	30.6	0.034	30.6
9	31.2	0.034	31.2
10	32.0	0.034	32.0
11	**32.3**	**0.034**	**32.3**
12	32.3	0.034	32.3

TABLE 25: 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	32.1	0.034	32.1
10	32.3	0.034	32.3
11	**32.6**	**0.034**	**32.6**
12	32.6	0.034	32.6

$PM_{2.5}$ 5-Year 24 Hr. High 8th High model results show the highest 5-year 24-hour average occurred at Star Paving's southern boundary and during modeling scenario 10 and a RAP input of 0%.

The dispersion model output shows highest modeled concentration above the $PM_{2.5}$ NAAQs. These concentrations are located at receptors within the boundaries of neighboring sources. Per an EPA memo dated October 17, 1989, where a receptor is located within the neighboring source property boundary, the contribution from that neighboring source may be subtracted from the total concentration generated by the model. For each one of these exceedances, removing the source contribution within the boundary eliminated all observed exceedances of the $PM_{2.5}$.

The annual average results show that significant direct "primary" $PM_{2.5}$ from Star Paving's South Broadway HMA sources combined with neighboring sources, mostly Western Organics, are located at or near the western boundary of neighboring source Western Organics at receptor location 347,450E and 3,869,750N (11.5 µg/m^3). Annual $PM_{2.5}$ model results show the highest 5-year annual average occurred during modeling scenario 10 and a RAP input of 0%.

The 24-hour average highest 8th high concentrations showed that significant direct "primary" $PM_{2.5}$ (above SIL) from Star Paving's South Broadway HMA sources are located either on the shared boundary with Western Organics or on the Star Paving southern boundary. For results on the shared boundary all contribution from Western Organics was subtracted. The highest 24-hour average highest 8th high result occurred during model scenario 11 and was located on the southern facility boundary and a RAP input of 0%.

The result from direct "primary" $PM_{2.5}$ emissions dispersion modeling, secondary PM emissions, applicable neighboring sources, 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. $PM_{2.5}$ model results are summarized in Table 24.

TABLE 24: $PM_{2.5}$ CIA Model Results

	Modeled Concentration with Neighboring Sources and Secondary PM (µg/m^3)	Modeled Concentration With Background (µg/m^3)	Location UTMs E/N	
24 Hour Average Highest 8th High	10.6	32.6	347752.0	3869610.5
Annual Average	3.1	11.5	347450.0	3869750.0

Figures 5 and 6 summarize the results of the modeling analysis.

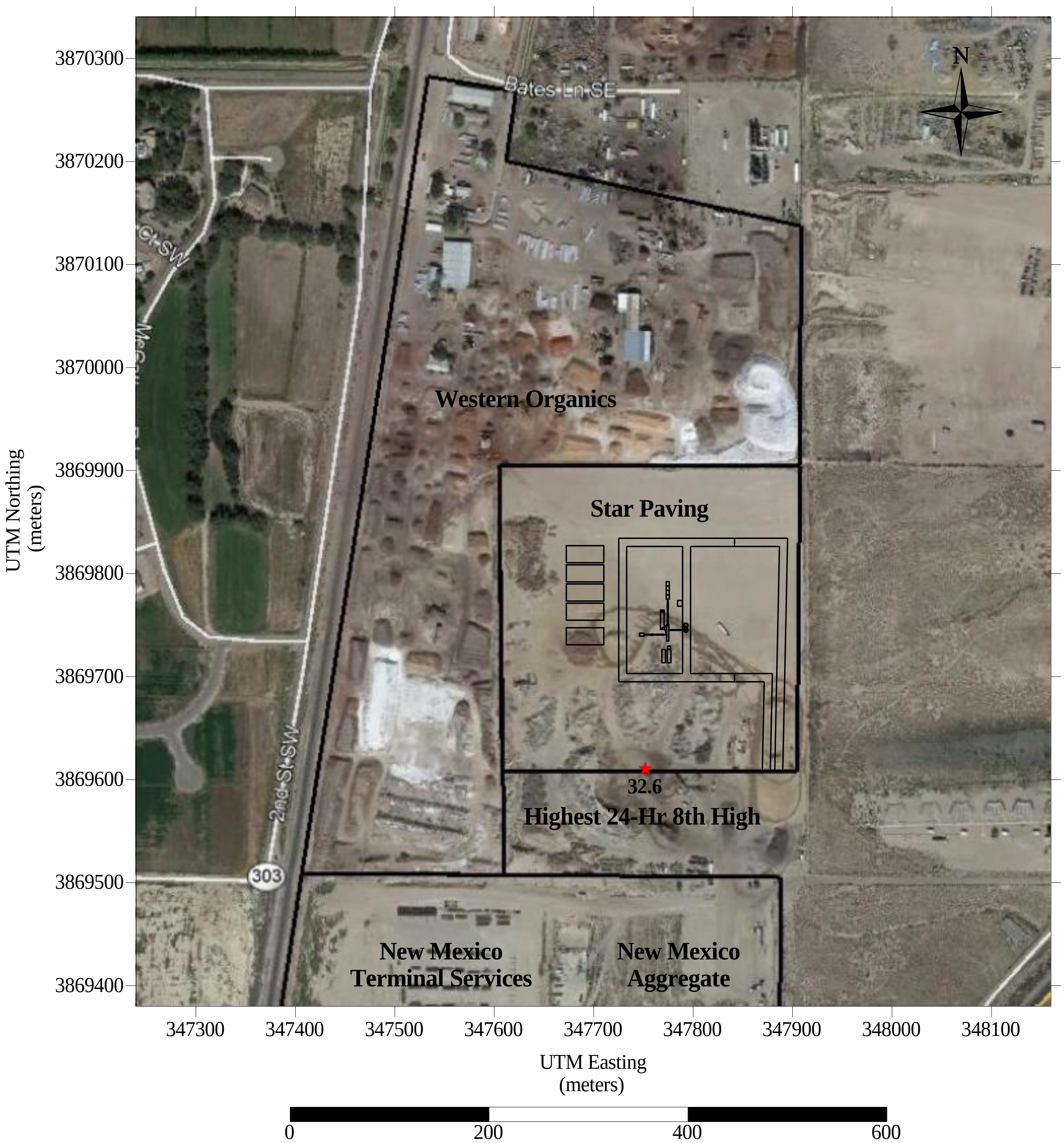

Figure 5: Aerial Map of $PM_{2.5}$ 8th Highest Daily Maximum High 24 Hour Model Result ($\mu g/m^3$)

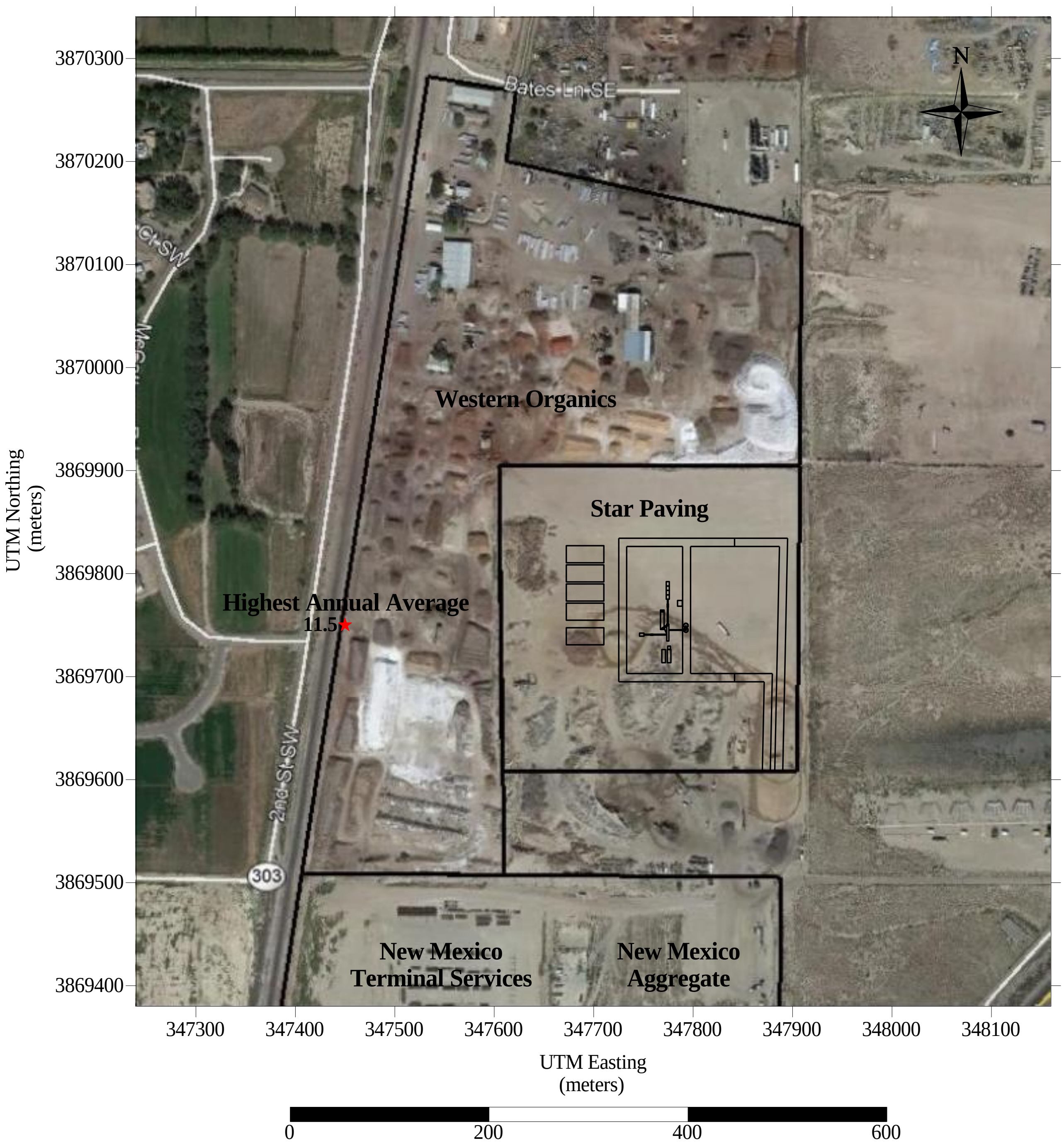

Figure 6: Aerial Map of $PM_{2.5}$ Annual Model Result ($\mu g/m^3$)

3.2.4 PM_{10} Cumulative Impact Analysis Modeling Results

CIA PM_{10} 24-hour average modeling was performed with terrain elevations and building downwash for Star Paving's proposed South Broadway HMA, neighboring sources and meteorology which included 5 years of data, 2014 – 2018 Albuquerque Meteorological data, obtained from the AEHD AQP. PM_{10} emissions rates represented the maximum hourly rate for all emission sources, including applicable neighboring sources. South Valley 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 model scenarios that produced the highest modeled concentrations. The model was then rerun for these 3 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.

Review of all model results showed exceedances within neighboring source boundaries. Per an EPA memo dated October 17, 1989, where a receptor is located within the neighboring source property boundary, the contribution from that neighboring source may be subtracted from the total concentration generated by the model. For each one of these exceedances, removing the source contribution within the boundary eliminated all observed exceedances and were not considered the highest model result where Star Paving sources caused a significant contribution.

The next set of highest concentrations were determined to be outside of the New Mexico Terminal Services west and south boundary and outside of Western Organics west boundary. To determine if these highest receptors included significant contributions from Star Paving sources, refined modeling was performed, which included "Post" files for group sources "All" (all sources with background) and "Star" (Star Paving sources only without background). For each day the model recorded the concentration for all the sources the model with background, a corresponding concentration from Star Paving South Broadway HMA sources only is recorded. Once the models are run, a comparison of the concentrations are reviewed to find the days that the SILs have been exceeded from Star Paving sources and the corresponding combined emission rate for each day, the Results of the refined modeling showed, where Star Paving sources contributed significant contribution, the highest contribution was less than the concentrations seen on the boundary of Star Paving.

The 24-hour average highest 6th high concentrations showed, where significant PM_{10} (above SIL) from Star Paving's South Broadway HMA sources, are located on the west of the boundary New Mexico Terminal Services.

PM_{10} 5-Year 24-hour High 6th High model results show the highest 5-year 24-hour average occurred during modeling scenario 10 and was located on the western facility boundary 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 6th High ($\mu g/m^3$)
1	80.6
2	77.5
3	76.2
4	75.6
5	75.5
6	75.5
7	80.5
8	85.0
9	90.0
10	**90.0**
11	87.4
12	83.8

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	98.3
10	**102.5**
11	99.3

Table 27 summarizes the 24-hour average highest 6th high and receptor location.

TABLE 27: PM_{10} CIA Model Results

	Modeled Concentration with Neighboring Sources ($\mu g/m^3$)	Modeled Concentration With Background ($\mu g/m^3$)	Location UTMs E/N	
24 Hour Average Highest 6th High	60.5	102.5	347607.5	3869846.1

Figure 7 summarize the results of the modeling analysis.

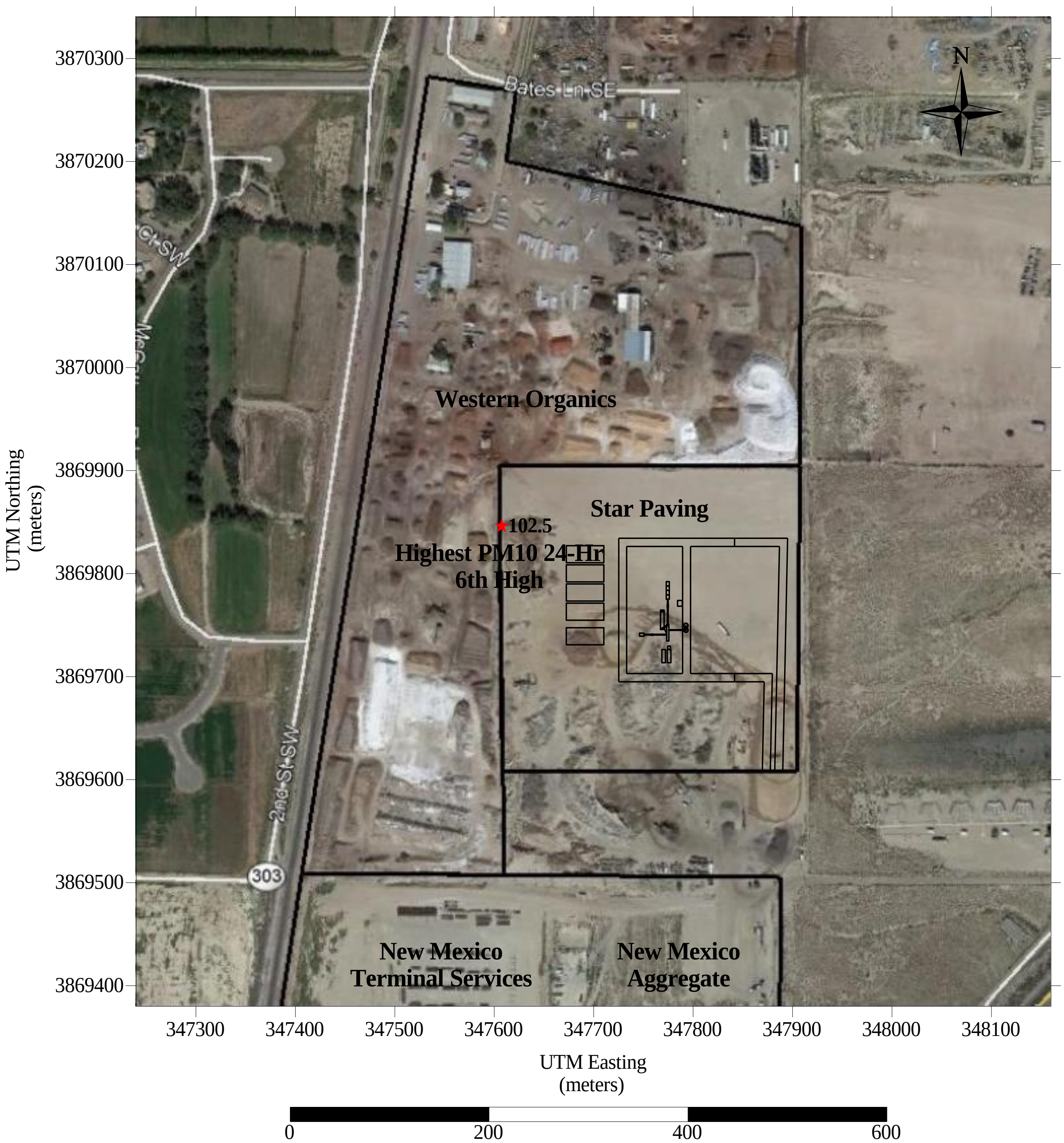

Figure 7: Aerial Map of PM_{10} Highest 6th High 24-Hour Model Result (µg/m^3)

3.3 HYDROGEN SULFIDE AND LEAD IMPACT MODEL ANALYSIS

Two additional dispersion modeling analysis were performed to determine compliance with State of New Mexico ambient limits for hydrogen sulfide (H_2S) and lead. 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. No background was added to any of the model results.

Hydrogen Sulfide

The highest 1-hour model result of H_2S is 0.34 µg/m^3 at receptor 347901.7E, 3869747.9N below the significant level. Highest concentration was located on the east facility boundary.

Lead

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 0.0017 µg/m^3 at receptor 347825.0E, 3869609.3N, below the significant level. Highest concentration was located on the south facility boundary.

Modeling File List

Model File Name	Description
StarPavingHMACombustROI	Star Paving HMA Site Only Combustion Sources ROI modeling
StarPavingHMAPMROIS1-12	Star Paving HMA Site Only Sources PM10 24 hour and PM2.5 24 hour and Annual ROI modeling – Scenarios 1 through 12

Model File Name	Description
StarPavingHMANO2_1HrCIA	Cumulative NO_2 Modeling – 1-Hour
StarPavingHMANO2_YrCIA	Cumulative NO_2 Modeling – Annual Average
StarPavingHMASO2_1HrCIA	Cumulative SO_2 Modeling – 1-Hour
StarPavingHMAPM10CIAS1-12	Cumulative PM_{10} Modeling 35% RAP – 24-Hour – Scenarios 1 through 12
StarPavingHMAPM10CIAAGGS9-11	Cumulative PM_{10} Modeling 0% RAP – 24-Hour – Scenarios 9 through 11
StarPavingHMAPM10CIAAGGPostS9-11	Post PM_{10} Modeling 0% RAP – 24-Hour – Scenarios 9 through 11
StarPavingHMAPM2524hrCIAS1-12	Cumulative $PM_{2.5}$ Modeling 35% RAP - 24-Hour – Scenarios 1 through 12
StarPavingHMAPM2524hrCIAAGGS9-12	Cumulative $PM_{2.5}$ Modeling 0% RAP – 24-Hour – Scenarios 9 through 12
StarPavingHMAPM25AnnCIAS1-12	Cumulative $PM_{2.5}$ Modeling 35% RAP - Annual – Scenarios 1 through 12
StarPavingHMAPM25AnnCIAAGGS9-11	Cumulative $PM_{2.5}$ Modeling 0% RAP – Annual – Scenarios 9 through 11
StarPavingHMATox	Lead and H_2S Dispersion Modeling

Attachment H
Public Notice Documents

Timothy M. Keller, Mayor

Public Participation

List of Neighborhood Associations and Neighborhood Coalitions MEMORANDUM

To: Paul Wade, Montrose Air Quality Services, LLC
From: Carina Munoz-Dyer, Air Quality Program, Environmental Health Department, City of Albuquerque
Subject: Determination of Neighborhood Associations and Coalitions within 0.5 mile of Tract B, C and D Plat of Unit I Lands of B G & W Partnership (UTME Coordinates 347,775m, UTMN 3,869,750m, Zone 13, NAD 83) in Bernalillo County, NM
Date: July 2, 2021

DETERMINATION:

On July 2, 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 Tract B, C and D Plat of Unit I Lands of B G & W Partnership (UTME Coordinates 347,775m, UTMN 3,869,750m, Zone 13, NAD 83) in Bernalillo County, NM.

I then used the City of Albuquerque Office (COA) of Neighborhood Coordination's Monthly Master NA List dated June 2021 and the Bernalillo County (BC) Monthly Neighborhood Association June 2021 Excel file to determine the contact information for each NA and NC located within 0.5 mile of Tract B, C and D Plat of Unit I Lands of B G & W Partnership (UTME Coordinates 347,775m, UTMN 3,869,750m, Zone 13, NAD 83) 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 6 Coalition of NA	Patricia Wilson Mandy Warr	info@willsonstudio.com; mandy@theremedydayspa.com;
Mountain View Commercial Property Owners	Richard Luna Ralph H. Hoffman	richard@championtruss.com; ralphh@kinneybrick.com;
Mountain View Community Action	Marla Painter Josie Lopez	marladesk@gmail.com; josiemlopez@gmail.com;
Mountain View NA	Nora Garcia Julian Vargas	norag3862@gmail.com; javargasconst@gmail.com;
South Valley Alliance	Sara Newton Juarez Zoe Economou	snjart@yahoo.com; zoecon@unm.edu;
South Valley Coalition of NA	Roberto Roibal Patricio Dominguez	rroibal@comcast.net; dpatriciod@gmail.com;

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: Star Paving Company, 3109 Love Road SW, Albuquerque, NM 87121

Owner / operator's name and address:
Nombre y domicilio del propietario u operador: Star Paving Company, 3109 Love Road SW, Albuquerque, NM 87121

Contact for comments and inquires:
Datos actuales para comentarios y preguntas:

Name *(Nombre)*: Joseph M Cruz
Address *(Domicilio)*: 3109 Love Road SW, Albuquerque, NM 87121
Phone Number *(Número Telefónico)*: (505) 877-0380
E-mail Address *(Correo Electrónico)*: joseph@starpaving.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: October 4, 2021

Description of the source:
Descripción de la fuente: A new drum mix hot mix asphalt plant to produce asphalt concrete at a rate of 300 tons per hour and 700,000 tons per year.

Exact location of the source or proposed source:
Ubicación exacta de la fuente o fuente propuesta: West of South Broadway, South of James Allen Pl SE; UTM Coord. 347775E; 3869750N; Zone 13; NAD 83

Nature of business:
Tipo de negocio: Produce asphalt concrete at a rate of 300 tons per hour and 700,000 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 Evotherm

Maximum operating schedule:
Horario máximo de operaciones: December-January, daylight hours: February-November, 24 hours/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	40.0	46.9	***	***
NOx	16.7	20.2	***	***
VOC	14.9	17.6	***	***
SO2	17.5	20.6	***	***
PM10	9.77	11.3	***	***
PM2.5	7.61	8.93	***	***
HAP	3.15	3.67	***	***

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

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	Star Paving Company
Site or Facility Name	South Broadway HMA
Site or Facility Address	West of South Broadway Blvd in Tract B, C, and D Plat of Unit I Lands of B G & W Partnership
New or Existing Source	New
Anticipated Date of Application Submittal	October 4, 2021
Summary of Proposed Source to Be Permitted	For this permit application, Star Paving Company is proposing to construct and operate a new typical hot mix asphalt plant. Asphalt concrete production will not exceed 300 tons per hour or 700,000 tons per year. In addition, daily production limits will be requested: for the months of January and December 3000 tons per day; for the months of February, March, and November 3300 tons per day; for the months of April, May, September, and October 4200 tons per day; and for the months of June - August 5400 tons per day. Maximum asphalt concrete production hours are limited for the months of December and January to daylight hours and for the months of February through November - 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:

- Joseph M Cruz
- joseph@starpaving.com
- (505) 877-0380

For inquiries regarding the air quality permitting process, contact:

- City of Albuquerque Environmental Health Department Air Quality Program
- aqd@cabq.gov
- (505) 768-1972

MONTROSE ENVIRONMENTAL

Paul Wade <pwade@montrose-env.com>

Public Notice for Star Paving Company Proposed South Broadway HMA

Paul Wade <pwade@montrose-env.com> Mon, Oct 4, 2021 at 12:11 PM
To: info@willsonstudio.com, mandy@theremedydayspa.com, Richard Luna <richard@championtruss.com>, ralphh@kinneybrick.com, Marla Painter <marladesk@gmail.com>, josiemlopez@gmail.com, norag3862@gmail.com, julian vargas <javargasconst@gmail.com>, Sara Newton Juarez <snjart@yahoo.com>, zoe Economou <zoecon@unm.edu>, rroibal@comcast.net, dpatriciod@gmail.com
Cc: "Munoz-Dyer, Carina G." <cmunoz-dyer@cabq.gov>, "Tavarez, Isreal L." <ITavarez@cabq.gov>, Joseph Cruz <Joseph@starpaving.com>

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 Star Paving Company's proposed South Broadway HMA Facility. The revision of the application includes a request from the environmental department to include two operating scenarios with worst-case emissions. Attached also is the NOI cover letter.

Thank You
[Quoted text hidden]

2 attachments

Star Paving Notice of Intent.pdf
145K

Star Paving Public Notice Cover Letter.pdf
65K

Proposed Air Quality Construction Permit
Permiso de Construcción de Calidad del Aire Propuesto

Albuquerque Environmental Health Department

Applicant's Name: *Nombre del solicitante:* Star Paving Company

Owner or Operator's Name: *Nombre del Propietario u Operador:* Star Paving Company

Actual or Estimated Date the Application will be Submitted to the Department: *Fecha Actual o Estimada en que se Entragará la Solicitud al Departamento:* October 4, 2021

Exact Location of the Source or Proposed Source: *Ubicación Excata de la Fuente o Fuente Propuesta:* West of South Broadway, South of James Allen PL SE; UTM Coord. 347,775 E, 3,869,750 N Zone 13 NAD 83

Description of the Source: *Descripción del Fuente:* A new drum mix hot mix asphalt plant to produce asphalt concrete at a rate of 300 tph and 700,000 tpy

Nature of Business: *Tipo de Negocio:* Produce asphalt concrete at a rate of 300 tph and 700,000 tpy

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 Evo therm

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	40.0	46.9	—	—
NOX	16.7	20.2	—	—
SO2	17.5	20.6	—	—
PM10	9.77	11.3	—	—
PM2.5	7.61	8.93	—	—
HAP	3.15	3.67	—	—
VOC	14.9	17.6	—	—

5. **Maximum Operating Schedule:** *Horario Máximo de Operaciones:* December – January – daylight hours; February – November – 24 hour / day

Normal Operation Schedule: *Horario Normal de Operaciones:* 5 days per week, 45 weeks per year, 6am – 5pm

6. **Current Contact Information for Comments and Inquiries**
Datos actuales para Comentarios y Preguntas

Name *(Nombre):* Joseph M Cruz

Address *(Domicilio):* 3109 Love Road SW Albuquerque, NM 87121

Phone Number *(Número Telefónico):* (505) 877-0380

Email Address *(Correo Electrónico):* joseph@starpaving.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

Proposed Air Quality Construction Permit
Permiso de Construcción de Calidad del Aire Propuesto
Applicant's Name:
Owner or Operator's Name:
PRIVATE PROPERTY
NO TRESPASSING