



Alan Frazier <afrazier@chattanooga.gov>

GreyRock Materials, LLC - APC Permit Application

1 message

mikayla@spearshopkins.com <mikayla@spearshopkins.com>

Wed, Apr 8, 2026 at 4:16 PM

To: Alan Frazier <afrazier@chattanooga.gov>

Cc: "thomas@spearshopkins.com" <thomas@spearshopkins.com>, Griffen Hopkins <griffen.greystone@icloud.com>, Drew Templeton <drew@spearshopkins.com>, Wick Spears <wickspears@yahoo.com>

Hi Alan,

I appreciate your help this week!

Please see the DropBox link below. This first link is our completed APC Permit Application. The second link is the additional copy of the Form E001 Initial Certificate of Completion. Let me know if you have any questions.

<https://www.dropbox.com/scl/fi/iu4akmg42lqjuu1fs2g8b/APC-Permit-Application-GR-Materials.pdf?rlkey=9fj6orb5n04xpwdcckpza6o0y&st=ojqeli3d&dl=0>

<https://www.dropbox.com/scl/fi/6wnjra2igkmkipb230ybb/Form-E001-Initial-Certificate-of-Operation-GR-Materials.pdf?rlkey=a3n9u2s653x4nxhp9u6tpbnl6&st=6q0dneru&dl=0>

Thank you!



Mikayla Hickman | HR Compliance Manager

Spears-Hopkins Paving Co.

GreyRock Milling Group

C: 615.210.4499

5730 Fisk Ave. Chattanooga, TN 37421

www.SpearsHopkins.com | www.GreyRockMillingGroup.com



AIR POLLUTION PERMIT APPLICATION

PURPOSE:

STATIONARY UNIFIED DRUM HOT MIX ASPHALT PLANT

LOCATION:

2027 E POLYMER DR.
CHATTANOOGA, TN 37421

APPLICANT:

GREYROCK MATERIALS, LLC.
537 MARKET STREET, SUITE 300
CHATTANOOGA, TN 37402

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Chattanooga-Hamilton County
Air Pollution Control Bureau

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-

**BASIC APPLICATION FOR EQUIPMENT / AIR POLLUTION PERMIT
OR CERTIFICATE OF OPERATION**

FORM E001
03/2011

1. Name of Company GreyRock Materials, LLC 2. NAICS Code: 324121
(If corporation or LLC, name on file with Tennessee Secretary of State Corporate Records Division)
3. Company Official to Contact: Thomas Hopkins 4. Phone No. (423)593-0703
5. Mailing Address: 537 Market Street Suite 300 Chattanooga, TN 37402
Street or P.O. Box City State Zip Code
6. Physical Location
(If different from line 5) 2027 E Polymer Drive Chattanooga, TN 37421
Street City State Zip Code

7. Application for:
 Installation Permit Initial Certificate of Operation Renewal Certificate of Operation
 Previous Installation Permit or Certificate of Operation No.: _____

8. Type of equipment for which application is made:
- | | | |
|---|---|--|
| <input checked="" type="checkbox"/> Process Equipment (Form E010 or Form E010A) | <input type="checkbox"/> Previously Submitted | <input checked="" type="checkbox"/> Attached |
| <input checked="" type="checkbox"/> Fuel Burning Equipment (Form E011) | <input type="checkbox"/> Previously Submitted | <input checked="" type="checkbox"/> Attached |
| <input type="checkbox"/> Incineration Equipment (Form E012) | <input type="checkbox"/> Previously Submitted | <input type="checkbox"/> Attached |
| <input type="checkbox"/> Minor Pollution Source (Form E014)
<i>(Less than 1000 lbs/yr and less than 10 lbs/day total uncontrolled contaminant emissions)</i> | <input type="checkbox"/> Previously Submitted | <input type="checkbox"/> Attached |

The following forms are filed with this application:
E102, E010, E011, E110


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9. Equipment Name:
~~See Attached~~ Drum Hot-Mix Asphalt Plant
10. If application is for a Certificate of Operation (Initial or Renewal), are there any changes since previous application in the equipment or operation which might:
 A. Increase, decrease, or alter process materials, fuel, refuse type, etc.? Yes No
 B. Increase, decrease, or alter emissions or emission points? Yes No
11. Process Weight, lb/hr, (Item 6 on Form E010), Incineration Rate, lb/hr, (Item 3C on Form E012), or Fuel Burning Rate, 1,000 Btu/hr, (Item 7C on Form E011): ~~See Attached~~ 600,000 lb/hr

Chattanooga-Hamilton County
Air Pollution Control Bureau

This is to certify that I am familiar with operations concerning this equipment and the information provided on this application is true and complete to the best of my knowledge:

Mail completed form to:
 CHATTANOOGA-HAMILTON COUNTY
 AIR POLLUTION CONTROL BUREAU
 2034 Hamilton Place Blvd., Suite 300
 Chattanooga, TN 37421



 Name
MEMBER

 Title
4/8/26

 Date

This form must be completely filled out before it will be processed

**BASIC APPLICATION FOR EQUIPMENT / AIR POLLUTION PERMIT
OR CERTIFICATE OF OPERATION**

**FORM E001
03/2011**

1. Name of Company GreyRock Materials, LLC
(If corporation or LLC, name on file with Tennessee Secretary of State Corporate Records Division)
2. NAICS Code: 324121
3. Company Official to Contact: Thomas Hopkins
4. Phone No. (423)593-0703
5. Mailing Address: 537 Market Street Suite 300 Chattanooga, TN 37402
Street or P.O. Box City State Zip Code
6. Physical Location
(If different from line 5) 2027 E Polymer Drive Chattanooga, TN 37421
Street City State Zip Code

7. Application for:
 Installation Permit Initial Certificate of Operation Renewal Certificate of Operation
- Previous Installation Permit or Certificate of Operation No.: _____

8. Type of equipment for which application is made:
- | | | |
|---|---|--|
| <input checked="" type="checkbox"/> Process Equipment (Form E010 or Form E010A) | <input type="checkbox"/> Previously Submitted | <input checked="" type="checkbox"/> Attached |
| <input checked="" type="checkbox"/> Fuel Burning Equipment (Form E011) | <input type="checkbox"/> Previously Submitted | <input checked="" type="checkbox"/> Attached |
| <input type="checkbox"/> Incineration Equipment (Form E012) | <input type="checkbox"/> Previously Submitted | <input type="checkbox"/> Attached |
| <input type="checkbox"/> Minor Pollution Source (Form E014)
<i>(Less than 1000 lbs/yr and less than 10 lbs/day total uncontrolled contaminant emissions)</i> | <input type="checkbox"/> Previously Submitted | <input type="checkbox"/> Attached |

The following forms are filed with this application:
E102, E010, E011, E110

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9. Equipment Name: ~~See Attached~~ Drum Hot-Mix Asphalt Plant

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**Chattanooga-Hamilton County
Air Pollution Control Bureau**

10. If application is for a Certificate of Operation (Initial or Renewal), are there any changes since previous application in this equipment or operation which might:
- A. Increase, decrease, or alter process materials, fuel, refuse type, etc.? Yes No
- B. Increase, decrease, or alter emissions or emission points? Yes No

11. Process Weight, lb/hr, (Item 6 on Form E010), Incineration Rate, lb/hr, (Item 3C on Form E012), or Fuel Burning Rate, 1,000 Btu/hr, (Item 7C on Form E011): ~~See Attached~~ 600,000 lb/hr

This is to certify that I am familiar with operations concerning this equipment and the information provided on this application is true and complete to the best of my knowledge:

Mail completed form to:
CHATTANOOGA-HAMILTON COUNTY
AIR POLLUTION CONTROL BUREAU
2034 Hamilton Place Blvd., Suite 300
Chattanooga, TN 37421

Thomas Hopkins Name
MEMBER Title
4/8/26 Date

This form must be completely filled out before it will be processed

PROCESS EQUIPMENT APPLICATION

**FORM E010
07/2000**

1. **Name of Company** (as shown on Line 1, Form E001): GreyRock Materials, LLC
2. **Equipment Name** (as shown on Line 10, Form E001): Stationary Unified Drum Hot Mix Asphalt Plant
3. **Installation Date:** July 2026 4. **Type of Process:** Continuous
5. **Major Raw Materials Used:** Virgin aggregate, liquid asphalt cement, recycled asphalt product
6. **Process Weight:** 600,000 Pounds per hour
This is the total weight of all materials introduced into the process.

7. Control Equipment

<input type="checkbox"/> Emissions Uncontrolled	<input checked="" type="checkbox"/> Baghouse (File Form E102)
<input type="checkbox"/> Wet Collecting Device (File Form E103)	<input type="checkbox"/> Inertial Separators (File Form E105)
<input type="checkbox"/> Electrostatic Precipitator (File Form E104)	<input type="checkbox"/> Other – Specify: _____

8. Control Efficiency

Enter the control efficiency for each pollutant emitted by this equipment (for appropriate Forms E102, E103, E104, E105, E107, or enter zeros if the emissions are uncontrolled as noted in Item 7.

Pollutant	% Efficiency
Particulates	99.96
SO _x	
NO _x	
CO	
Hydrocarbons	
Other: PM10	99.94

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9. Emissions Summary

Enter the amount of each pollutant listed in pounds per hour.

Pollutant	Uncontrolled Emissions (File Form E106)	Actual Emissions (Stack Test Report)	Estimated Emissions (See Formula A)
Total Suspended Particulate	30,000		10.82
PM10	1,920		1.17
Sulfur Oxides			
Nitrogen Oxides (as NO ₂)			
Other (specify)			

OR

Formula A: Estimated Emissions = $\frac{(100\% - \text{Control Efficiency (\%)})}{100\%} \times \text{Uncontrolled Emissions}$

10. **Environmental Impact**

Those emissions indicated in Item 9 may at times under normal operating conditions cause (check all that apply):

- Odors Eye Irritations Property Damage Health Effects
- Other nuisances outside of plant property No environmental damage

11. **Emission Point Data**

Stack Height (emission point) above ground:	<u>30</u>	Ft.	Volume of gas discharged into atmosphere:	<u>63,000</u>	cfm
Ground Elevation above sea level at stack base:	<u>660</u>	Ft.	Gas exit temperature:	<u>240</u>	°F
Stack Diameter:	<u>4.20</u>	Ft.			

12. **Ave. Operating Time**

Daily: 24 hours Weekly: 6 Days Yearly: 52 Weeks

This is to certify that I am familiar with the operations concerning this equipment and that the information provided on this application is true and complete to the best of my knowledge.

Thomas R. [Signature]
Company Official

MEMBER
Title

4/7/26
Date

AIR POLLUTION CONTROL EQUIPMENT DATA - BAGHOUSE

**FORM E102
01/2001**

1. **Name of Company:** GreyRock Materials, LLC
As shown on Line 1 of Form E001

2. **Name of Equipment:** Stationary Unified Drum Hot Mix Asphalt Plant
As shown on Line 9 of Form E001

3. **Equipment Data:**

Manufacturer of Baghouse: Astec Industries

Model Number: BH-62-14 Cost of Baghouse: \$700,000

Date of Manufacture: 2026 Date of Installation: July, 2026

Pre-cleaning Equipment No Yes Inertial Separator
If yes, what type (File appropriate form for control equipment)

Volume of gas discharged from baghouse at dry standard conditions: 31,567 dscfm

Total cloth area of baghouse: 10,849 ft²

Air to cloth ratio: 5.7 $\frac{\text{ft}}{\text{Min}}$ *(Divide volume of gas discharged by total cloth area)*

4. **Pressure Drop Across Baghouse:**

Stated by manufacturer: 2-6 Inches of H₂O

Measured (actual): _____ Inches of H₂O

Calculated: _____ X _____ = _____ Inches of H₂O
(K Factor) Air to cloth ratio in ft/min

The recommended pressure drop range in inches of H₂O is 1.5 (minimum) to 8.0 (maximum).

If the measured or calculated pressure drop falls outside the recommended range, contact the Chattanooga-Hamilton County Air Pollution Control Bureau.

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5. **Filter Data:**

Type of fabric filters used in baghouse: 14oz Aramid

Operating temperature: 200-375 °F 200-375 °F 375 °F
Manufacturer's Recommended Normal Maximum

If the maximum operating temperature exceeds the recommended operating temperature, contact the Chattanooga-Hamilton County Air Pollution Control Bureau.

6. **Baghouse Components:**
Check all that apply.

Flow rate instrumentation Inlet gas temperature instrumentation Evaporative Cooler

Dew point indicator Differential pressure instrumentation Other (Describe) Stack temperature

Heat Exchanger Transmissometer

7. **Baghouse Operation:**

Continuous Intermittent

8. **Baghouse Description:**

Baghouse Inlet (dirty gas): Bottom Feed Top Feed

Exterior Filtration Tangential

Other (Describe): _____

Does the baghouse have a wear-resistant plate? yes no

Baghouse shape: Rectangular Cubical Cylindrical

Other (Describe): _____

Baghouse volume: 6,786 Ft³ (bag compartment + hopper: 6,196 ft³; clean-air plenum: 590 ft³; inertial separator and fan inlet not included)

Baghouse dimensions: 45.81 Ft 11.83 Ft 18.33 Ft
Length Width height

Baghouse shell material: A36 Carbon Steel

8. **Bag Cleaning:** (check one)

Fabric Flexing Reverse Air Cleaning

Mechanical Shaking & Rapping Reverse Jet

Sonic Cleaning Reverse Flow

Collapse Cleaning Manual Cleaning

Pulse (pressure) – Jet Cleaning

9. **Filter Configuration:**

Panels Multiple Tube Bag

Circular Cross-Section Tube Other (Describe): _____

Filter Fabric: Felted Woven Number of Compartments: 1

Filter Area: 10,849 Ft² Number of Filters per Compartment: 896

10. **Particle Size Distribution in Microns (μ):**

Particle Type(s): aggregate dust Moisture in gas stream: 30-35 %

Size	0-5μ	5-10μ	10-20μ	20-44μ	Greater than 44μ
% by weight		Unknown, site-specific			

11. **Dust Disposal:**

Automatic (screw conveyor, etc.) Manual (Describe): automatic return to mixing drum

How often are hoppers emptied? Every _____ hours

Name of commercial disposal company (if applicable): N/A

Is disposed material wetted for transport? Yes No

Disposal Site: _____

12. **Control Efficiency:**

Manufacturer's Stated Efficiency: 99.96 %

Required Efficiency: _____ %

Operational Efficiency (performance testing): _____ %

Size	0-5 μ	5-10 μ	10-20 μ	20-44 μ	Greater than 44 μ
% by weight		Unknown, site-specific			

13. **Fan Data:**

Fan Location: Clean air side (pull through) Dirty air side (push through)

Fan Design (check one - A, B, or C):

Fan Type:	Blade Type:
A. <input checked="" type="checkbox"/> Centrifugal (radial flow)	<input type="checkbox"/> Forward Curve <input checked="" type="checkbox"/> Backward Curve <input type="checkbox"/> Straight
B. <input type="checkbox"/> Axial-flow (propeller)	<input type="checkbox"/> Propeller <input type="checkbox"/> Tube Axial <input type="checkbox"/> Vane Axial

Fan Properties:

Diameter: 49 Inches Braking Horsepower: <= 289.9 BHP
Speed: VFD <= 1764 RPM Inlet Area: 14.38 Ft²
Volume: var. Cfm @ STP Outlet Area: 13.79 Ft²
Static Pressure: var. Inches WC Motor Horsepower: 250 HP

Standard Heavy Duty Submitted copy of Manufacturer's Multirating Tables Yes No

Special Construction Materials: none

Bronze Alloys Aluminum Stainless Steel Bisonite
 Zinc Chromate Primer Rubber, Phenolics, Vinyls, or Epoxy Covering

C. Compressor for pulse cleaning Positive Displacement Dynamic Reciprocating

*This is to certify that I am familiar with the operations concerning this equipment and that the information provided on this application is true and complete to the best of my knowledge. **This form must be completely filled out before it will be processed.***

Mail to:
CHATTANOOGA-HAMILTON
COUNTY AIR POLLUTION
CONTROL BUREAU
2034 Hamilton Place Blvd., Suite 300
Chattanooga, TN 37421

Company Official: 
Signature

Title: MEMBER

Date: 4/8/26

Do not write below this line.

Engineer Approval Permit Number: _____

Special Notations: _____

FUEL BURNING EQUIPMENT APPLICATION
A separate form must be filed for each stack or emission point.

FORM E011
01/2001

1. Name of Company: **GreyRock Materials, LLC**
As shown on Line 1 of Form E001

2. Equipment Name:
As shown on Line 9 of Form E001
Stationary Unified Drum Hot Mix Asphalt Plant (Drum Dryer Burner)

3. Stack Designation:
EPI *If there is more than one stack at this location, provide a written or numeric designation to identify each stack.*

4. Control Equipment Data:

<input type="checkbox"/> Emissions Uncontrolled	<input type="checkbox"/> Electrostatic Precipitator (File Form E104)
<input checked="" type="checkbox"/> Baghouse (File Form E102)	<input type="checkbox"/> Inertial Separators (File Form E105)
<input type="checkbox"/> Wet Collecting Device (File Form E103)	<input type="checkbox"/> Other (Specify): _____

5. Control Equipment Efficiency:
Enter the control equipment efficiency for each pollutant emitted by this equipment as determined on the appropriate Form E102, E103, E104, E105, E107, or enter zeros if "A" is checked in Item 4.

Pollutant	% Efficiency
Particulates	99.96*
PM ₁₀	99.94*
SO _x	0**
NO _x	0
CO	0
VOC	0

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Other: *PM emissions from fuel combustion are indistinguishable from dryer drum PM emissions.
 PM control efficiencies refer to control of the entire process PM emissions.

**SO_x is uncontrolled, however 50% of fuel-bound sulfur up to a maximum (as SO₂) of 0.1 lb/ton of product is expected to be retained in the product, with the remainder emitted as SO₂ (calculated with emission factors from AP-42 Chapter 1.) Refer to AP-42 Table 11.1-5 footnote c.

6. Emissions Estimation: *File Form E110 for each fuel used*

		<i>Fuel No.1</i>	<i>Fuel No.2</i>	<i>Fuel No.3</i>
SEE ATTACHMENT A				
Particulate Matter (Form E110, Item 6)	Uncontrolled	Lbs/hr	Lbs/hr	Lbs/hr
	Actual ¹	Lbs/hr	Lbs/hr	Lbs/hr
	Estimated ²	Lbs/hr	Lbs/hr	Lbs/hr
SO _x (Form E110, Item 7)	Uncontrolled	Lbs/hr	Lbs/hr	Lbs/hr
	Actual ¹	Lbs/hr	Lbs/hr	Lbs/hr
	Estimated ²	Lbs/hr	Lbs/hr	Lbs/hr
PM ₁₀	Uncontrolled	Lbs/hr	Lbs/hr	Lbs/hr
	Actual ¹	Lbs/hr	Lbs/hr	Lbs/hr
	Estimated ²	Lbs/hr	Lbs/hr	Lbs/hr
NO _x (Form E110, Item 9E)	Uncontrolled	ppm	ppm	ppm
	Actual ¹	ppm	ppm	ppm
	Estimated ²	ppm	ppm	ppm
Other Air Contaminants (Specify)	Uncontrolled	Lbs/hr	Lbs/hr	Lbs/hr
	Actual ¹	Lbs/hr	Lbs/hr	Lbs/hr
	Estimated ²	Lbs/hr	Lbs/hr	Lbs/hr

1. Submit stack test report with full details.
2. Estimate the emissions using the formula below

$$\text{Estimated Emissions (lbs/hr, ppm)} = \frac{100\% - \text{Control Efficiency (\%)}}{100\%} \times \text{Uncontrolled Emissions}$$

Company Name: GreyRock Materials, LLC

Equipment Name: Stationary Unified Drum HMA Plant (Drum Dryer Burner)

7.

Equipment Data:

Manufacturer of Equipment: Astec Industries

Date of Manufacture: 2026 Date of Installation: July, 2026

Boiler No.	Fuel Type	Rated Capacity 10 ⁶ BTU/hr. Input	Type of Firing	Fuel Consumption			Percent Content		Heating Content of Fuel	(%) Excess Air	
				Ave.	Max.	Annual	Sulfur	Ash			
Emission Source 1 Drum Dryer Burner	Primary: Normal Operating Fuel(s)	Nat. Gas	82.5	Total air Nozzle- mix	Varies	79,600 scf/hr	up to 159.1 MMscf/yr	0.0017	negl.	1037 btu/scf	20
	Standby: Fuel(s) used in emergency only	No.2 Oil	82.5	Total air Nozzle- mix	Varies	585 gal/hr	up to 1.2 MMgal/yr	0.5	negl.	141,000 btu/gal	20
	Primary: Normal Operating Fuel(s)										
	Standby: Fuel(s) used in emergency only										

a. If more than one boiler per stack, list a separate code number to represent each individual boiler.
 b. List all fuels used.
 c. Give rated or maximum input capacity, whichever is greater.
 d. Specify the type of firing for each fuel used.
 e. Indicate consumption of each fuel used in tons/hr, gal/hr, or ft³/hr.
 f. Indicate annual consumption of each fuel used in tons/yr, gal/yr, or ft³/yr.
 g. The average sulfur and ash content of each fuel must be included - This information may be obtained from the fuel supplier.
 h. Indicate the heating content of each fuel in BTU/ton, BTU/gal, or BTU/ft³ - This information may be obtained from the fuel supplier.

Space Heating	Process Heating	Other (Describe)
	100%	

Percent (%) of Load Used

8. Emissions Impact:

Those emissions indicated in Item 6 that at times under normal operating conditions cause (check one or more):

- Odors
- Eye Irritations
- Property Damage
- Health Effects
- Other nuisances outside of plant property
- No environmental damage

9. Emission Point Data:

Stack Height (emission point) above ground: 30 Ft
 Ground Elevation above sea level at stack base: 600 Ft
 Stack Diameter: 4.20 Ft
 Volume of gas discharged into atmosphere: 63,000 Cfm
 Gas exit temperature: Design: 240F Actual range: 200-375 °F

10. Average Equipment Operating Time:

Daily: 24 Hours
 Weekly: 6 Days
 Yearly: 52 Weeks

This is to certify that I am familiar with the operations concerning this equipment and that the information provided on this application is true and complete to the best of my knowledge. This form must be completely filled out before it will be processed.

Mail to:
 CHATTANOOGA-HAMILTON
 COUNTY AIR POLLUTION
 CONTROL BUREAU
 2034 Hamilton Place Blvd. Suite 300
 Chattanooga, TN 37421

Company Official 

Title MEMBER

Date 4/8/26

Do not write below this line

Engineer Approval
 Lbs/hr Allowable particulate emissions
 Lbs/10⁶ BTU allowable SO_x emissions
 ppm allowable NO_x emissions

UTM Coordinate of Company: EW NS

This form corresponds to permit number:

Special Notations:

POLLUTION ESTIMATION FORM
(Fuel Burning Equipment)

FORM E110
01/2002

1. Name of Company: GreyRock Materials, LLC
(As shown on Line 1 of Form E001)
2. Equipment Name: Stationary Unified Drum Hot Mix Asphalt Plant (Drum Dryer Burner)
(As shown on Line 10 of Form E001)
3. Percent excess air used in fuel burning (make allowances for leaks around doors and other openings): 20%
4. Type of Fuel (file Form E110 for each fuel used): Natural Gas

5. Source of Emission Factors: AP-42 Ch. 11.1 and Manufacturer Data

SEE ATTACHMENT A FOR ALL POLLUTANT EMISSION RATE CALCULATIONS

6. Uncontrolled Particulate Emission Rate:
PM emissions from fuel combustion are indistinguishable from dryer drum PM emissions.
Particulate Emission Factor: _____ Refer to Attachment A for total process PM emissions.
(lbs/ton; lbs/10³ gal; lbs/10⁶ ft³)

_____ X _____ = _____ Lbs/hr
Maximum Fuel Consumption Rate Particulate Emission Uncontrolled Particulate Emission
(tons/hr; gal/hr; ft³/hr) Factor Rate

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7. Uncontrolled Sulfur Oxide (SO_x) Emission Rate:

SO_x Emission Factor: 0.0034 lb/ton
Lbs/ton; lbs/10³ gal; lbs/10⁶ ft³

300 ton/hr X 0.0034 lb/ton = 1.0 Lbs/hr
Maximum Fuel Consumption Rate SO_x Emission Factor Uncontrolled SO_x Emission Rate
(tons/hr; gal/hr; ft³/hr)

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8. Uncontrolled Hydrocarbon (HC) Emission Rate:
HC emissions from fuel combustion are indistinguishable from HC contributed by asphalt cement.
HC Emission Factor: _____ Refer to Attachment A for total process HC emissions.
Lbs/ton; lbs/10³ gal; lbs/10⁶ ft³

_____ X _____ = _____ Lbs/hr
Maximum Fuel Consumption Rate HC Emission Factor Uncontrolled HC Emission Rate
(tons/hr; gal/hr; ft³/hr)

9. Uncontrolled Nitrogen Oxides (NO_x) Emission Rate:

A. NO_x Emission Factor: 0.013 lb/ton
Lbs/ton; lbs/10³ gal; lbs/10⁶ ft³

B. 300 ton/hr X 0.013 lb/ton = 3.9 Lbs/hr
Maximum Fuel Consumption Rate NO_x Emission Factor Uncontrolled NO_x Emission Rate
(tons/hr; gal/hr; ft³/hr)

10. NO_x Emission Rate in PPM by Volume at STP:

Cubic feet per hour (CFH) of Exhaust Gases at 15% Excess Air:

A.
$$\frac{V}{\text{See Table A}} \times \frac{82.5}{\text{Maximum Fuel Consumption Rate}} = \frac{924,000}{\text{Exhaust Rate}} \text{ CFH}$$

11,200 10³ BTU/hr

B.
$$\frac{3.9 \text{ Lbs/hr}}{\text{Uncontrolled NO}_x \text{ (Item 9B)}} \div \frac{924,000}{\text{CFH of Exhaust Gas (Item 10A)}} = 4.2 * 10^{-6} \text{ Lb/ft}^3 \text{ NO}_x$$

C.
$$\text{PPM} = (8.37 \times 10^6) \times \frac{4.2 * 10^{-6}}{\text{Lb/ft}^3 \text{ NO}_x \text{ (Item 10B)}} = \frac{35}{\text{PPM at STP and 15\% Excess Air (NO}_x \text{ calculated as NO}_2\text{)}}$$

Table A	
Fuel	V
Bituminous Coal	11700
Fuel Oil	11400
Natural Gas	11200
Wood	12800

*This is to certify that I am familiar with the operations concerning this equipment and that the information provided on this application is true and complete to the best of my knowledge. **This form must be completely filled out before it will be acceptable.***

Mail to:
CHATTANOOGA-HAMILTON COUNTY
AIR POLLUTION CONTROL BUREAU
 2034 Hamilton Place Blvd. Suite 300
 Chattanooga, TN 37421



 Company Official

MEMBER

 Title

4/8/26

 Date

Do Not Write Below This Line

_____ Engineer Approval

This form corresponds to permit number: _____

Special Notations: _____

POLLUTION ESTIMATION FORM
(Fuel Burning Equipment)

FORM E110
01/2002

1. Name of Company: GreyRock Materials, LLC
(As shown on Line 1 of Form E001)
2. Equipment Name: Stationary Unified Drum Hot Mix Asphalt Plant (Drum Dryer Burner)
(As shown on Line 10 of Form E001)
3. Percent excess air used in fuel burning (make allowances for leaks around doors and other openings): 20%
4. Type of Fuel (file Form E110 for each fuel used): No.2 Fuel Oil (Backup)

5. Source of Emission Factors: AP-42 Ch. 1.3, AP-42 Ch. 11.1, and Manufacturer Data

SEE ATTACHMENT A FOR ALL POLLUTANT EMISSION RATE CALCULATIONS

6. Uncontrolled Particulate Emission Rate:
PM emissions from fuel combustion are indistinguishable from dryer drum PM emissions.
Particulate Emission Factor: _____ Refer to Attachment A for total process PM emissions.
(lbs/ton; lbs/10³ gal; lbs/10⁶ ft³)

_____ X _____ = _____ Lbs/hr
Maximum Fuel Consumption Rate Particulate Emission Uncontrolled Particulate Emission
(tons/hr; gal/hr; ft³/hr) Factor Rate

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7. Uncontrolled Sulfur Oxide (SO_x) Emission Rate:

SO_x Emission Factor: 50% * 142 * S lb/10³ gal, where S indicates weight % of fuel Sulfur, S = 0.5
Lbs/ton; lbs/10³ gal; lbs/10⁶ ft³ 50% reduction from documented SO₂ retention in product
 See AP-42 Table 11.1-5 footnote c.

0.585 10³ gal/hr X 35.5 lb/10³ gal = 20.8 Lbs/hr
Maximum Fuel Consumption Rate SO_x Emission Factor Uncontrolled SO_x Emission Rate
(tons/hr; gal/hr; ft³/hr)

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8. Uncontrolled Hydrocarbon (HC) Emission Rate:
HC emissions from fuel combustion are indistinguishable from HC contributed by asphalt cement.
HC Emission Factor: _____ Refer to Attachment A for total process HC emissions.
Lbs/ton; lbs/10³ gal; lbs/10⁶ ft³

_____ X _____ = _____ Lbs/hr
Maximum Fuel Consumption Rate HC Emission Factor Uncontrolled HC Emission Rate
(tons/hr; gal/hr; ft³/hr)

9. Uncontrolled Nitrogen Oxides (NO_x) Emission Rate:

A. NO_x Emission Factor: 0.036 lb/ton
Lbs/ton; lbs/10³ gal; lbs/10⁶ ft³

B. 300 ton/hr X 0.036 lb/ton = 10.8 Lbs/hr
Maximum Fuel Consumption Rate NO_x Emission Factor Uncontrolled NO_x Emission Rate
(tons/hr; gal/hr; ft³/hr)

10. NO_x Emission Rate in PPM by Volume at STP:

Cubic feet per hour (CFH) of Exhaust Gases at 15% Excess Air:

A.
$$\frac{V}{\text{See Table A}} \times \frac{82.5}{\text{Maximum Fuel Consumption Rate}} = \frac{940,500}{\text{Exhaust Rate}} \text{ CFH}$$

11,400 10^6 BTU/hr

B.
$$\frac{10.8 \text{ Lbs/hr}}{\text{Uncontrolled NO}_x \text{ (Item 9B)}} \div \frac{940,500}{\text{CFH of Exhaust Gas (Item 10A)}} = 1.1 * 10^{-5} \text{ Lb/ft}^3 \text{ NO}_x$$

C.
$$\text{PPM} = (8.37 \times 10^6) \times \frac{1.1 * 10^{-5}}{\text{Lb/ft}^3 \text{ NO}_x \text{ (Item 10B)}} = \frac{92}{\text{PPM at STP and 15\% Excess Air (NO}_x \text{ calculated as NO}_2\text{)}}$$

Table A	
Fuel	V
Bituminous Coal	11700
Fuel Oil	11400
Natural Gas	11200
Wood	12800

*This is to certify that I am familiar with the operations concerning this equipment and that the information provided on this application is true and complete to the best of my knowledge. **This form must be completely filled out before it will be acceptable.***

Mail to:
**CHATTANOOGA-HAMILTON COUNTY
 AIR POLLUTION CONTROL BUREAU**
 2034 Hamilton Place Blvd. Suite 300
 Chattanooga, TN 37421



 Company Official

MEMBER

 Title

4/8/21

 Date

Do Not Write Below This Line

_____ Engineer Approval

This form corresponds to permit number: _____

Special Notations: _____

FUEL BURNING EQUIPMENT APPLICATION
A separate form must be filed for each stack or emission point.

FORM E011
01/2001

1. Name of Company: **GreyRock Materials, LLC**
As shown on Line 1 of Form E001

2. Equipment Name:
As shown on Line 9 of Form E001

Stationary Unified Drum Hot Mix Asphalt Plant (1-lot Oil Heater)

3. Stack Designation:
 EP2 *If there is more than one stack at this location, provide a written or numeric designation to identify each stack.*

4. Control Equipment Data:

- | | |
|---|--|
| <input checked="" type="checkbox"/> Emissions Uncontrolled | <input type="checkbox"/> Electrostatic Precipitator (File Form E104) |
| <input type="checkbox"/> Baghouse (File Form E102) | <input type="checkbox"/> Inertial Separators (File Form E105) |
| <input type="checkbox"/> Wet Collecting Device (File Form E103) | <input type="checkbox"/> Other (Specify): |

5. Control Equipment Efficiency:
Enter the control equipment efficiency for each pollutant emitted by this equipment as determined on the appropriate Form E102, E103, E104, E105, E107, or enter zeros if "A" is checked in Item 4.

Pollutant	% Efficiency
Particulates	0
PM ₁₀	0
SO _x	0
NO _x	0
CO	0
VOC	0
Other:	

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6. Emissions Estimation: *File Form E110 for each fuel used*

		<i>Fuel No.1</i>	<i>Fuel No.2</i>	<i>Fuel No.3</i>
	SEE ATTACHMENT A			
Particulate Matter (Form E110, Item 6)	Uncontrolled	Lbs/hr	Lbs/hr	Lbs/hr
	Actual ¹	Lbs/hr	Lbs/hr	Lbs/hr
	Estimated ²	Lbs/hr	Lbs/hr	Lbs/hr
SO _x (Form E110, Item 7)	Uncontrolled	Lbs/hr	Lbs/hr	Lbs/hr
	Actual ¹	Lbs/hr	Lbs/hr	Lbs/hr
	Estimated ²	Lbs/hr	Lbs/hr	Lbs/hr
PM ₁₀	Uncontrolled	Lbs/hr	Lbs/hr	Lbs/hr
	Actual ¹	Lbs/hr	Lbs/hr	Lbs/hr
	Estimated ²	Lbs/hr	Lbs/hr	Lbs/hr
NO _x (Form E110, Item 9F)	Uncontrolled	ppm	ppm	ppm
	Actual ¹	ppm	ppm	ppm
	Estimated ²	ppm	ppm	ppm
Other Air Contaminants (Specify)	Uncontrolled	Lbs/hr	Lbs/hr	Lbs/hr
	Actual ¹	Lbs/hr	Lbs/hr	Lbs/hr
	Estimated ²	Lbs/hr	Lbs/hr	Lbs/hr

- Submit stack test report with full details.
- Estimate the emissions using the formula below:

$$\text{Estimated Emissions (lbs/hr, ppm)} = \frac{100\% - \text{Control Efficiency (\%)}}{100\%} \times \text{Uncontrolled Emissions}$$

Company Name: GreyRock Materials, LLC

Equipment Name: Stationary Unified Drum HMA Plant (Hot Oil Heater)

7. Equipment Data:

Manufacturer of Equipment: Astec Industries

Date of Manufacture: 2026

Date of Installation: July, 2026

Boiler No.	Fuel Type	Rated Capacity 10 ⁶ BTU/hr. Input	Type of Firing	Fuel Consumption			Percent Content		Heating Content of Fuel	(% Excess Air	
				Ave.	Max.	Annual	Sulfur	Ash			
Emission Source 2 Hot Oil Heater	Primary: Normal Operating Fuel(s)	Nat. Gas	1.6	Total air Nozzle-mix	Varies	1,540 scf/hr	up to 13.5 MMscf/yr	0.0017	negl.	1037 btu/scf	20
	Standby: Fuel(s) used in emergency only	No.2 Oil	1.6	Total air Nozzle-mix	Varies	11.3 gal/hr	up to 99,400 gal/yr	0.5	negl.	141,000 btu/gal	20
	Primary: Normal Operating Fuel(s)										
	Standby: Fuel(s) used in emergency only										

- a. If more than one boiler per stack, list a separate code number to represent each individual boiler.
- b. List all fuels used.
- c. Give rated or maximum input capacity, whichever is greater.
- d. Specify the type of firing for each fuel used.
- e. Indicate consumption of each fuel used in tons/hr, gal/hr, or ft³/hr.
- f. Indicate annual consumption of each fuel used in tons/yr, gal/yr, or ft³/yr.
- g. The average sulfur and ash content of each fuel must be included - This information may be obtained from the fuel supplier.
- h. Indicate the heating content of each fuel in BTU/ton, BTU/gal, or BTU/ft³ - This information may be obtained from the fuel supplier.

Percent (%) of Load Used	Space Heating	Process Heating	Other (Describe)
		100%	

8. Emissions Impact:

Those emissions indicated in Item 6 that at times under normal operating conditions cause (check one or more):

- Odors
- Eye Irritations
- Property Damage
- Health Effects
- Other nuisances outside of plant property
- No environmental damage

9. Emission Point Data:

Stack Height (emission point) above ground:	8.85 Ft
Ground Elevation above sea level at stack base:	660 Ft
Stack Diameter:	1 Ft
Volume of gas discharged into atmosphere:	976 Cfm
Gas exit temperature:	600 °F

10. Average Equipment Operating Time:

Daily:	24 Hours
Weekly:	7 Days
Yearly:	52 Weeks

This is to certify that I am familiar with the operations concerning this equipment and that the information provided on this application is true and complete to the best of my knowledge. This form must be completely filled out before it will be processed.

Mail to:
 CHATTANOOGA-HAMILTON
 COUNTY AIR POLLUTION
 CONTROL BUREAU
 2034 Hamilton Place Blvd. Suite 300
 Chattanooga, TN 37421

Company Official



Title

MEMBER

Date

4/8/26

Do not write below this line

Engineer Approval

Lbs/hr Allowable particulate emissions

Lbs/10⁶ BTU allowable SO_x emissions

ppm allowable NO_x emissions

UTM Coordinate of Company: EW NS

This form corresponds to permit number:

Special Notations:

POLLUTION ESTIMATION FORM
(Fuel Burning Equipment)

FORM E110
01/2002

1. Name of Company: GreyRock Materials, LLC
(As shown on Line 1 of Form E001)
2. Equipment Name: Stationary Unified Drum Hot Mix Asphalt Plant (Hot Oil Heater)
(As shown on Line 10 of Form E001)
3. Percent excess air used in fuel burning (make allowances for leaks around doors and other openings): 20%
4. Type of Fuel (file Form E110 for each fuel used): Natural Gas

5. Source of Emission Factors: AP-42 Ch. 1.4, AP-42 Ch. 11.1, and Manufacturer Data

SEE ATTACHMENT A FOR ALL POLLUTANT EMISSION RATE CALCULATIONS

6. Uncontrolled Particulate Emission Rate:

	Particulate Emission Factor: $\frac{0.0075 \text{ lb/MMBtu}}{\text{(lbs/ton; lbs/10}^3 \text{ gal; lbs/10}^6 \text{ ft}^3)}$				
$\frac{1.6 \text{ MMBtu/hr}}{\text{Maximum Fuel Consumption Rate (tons/hr; gal/hr; ft}^3\text{/hr)}}$	X	$\frac{0.0075 \text{ lb/MMBtu}}{\text{Particulate Emission Factor}}$	=	$\frac{0.012}{\text{Uncontrolled Particulate Emission Rate}}$	Lbs/hr

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7. Uncontrolled Sulfur Oxide (SO_x) Emission Rate:

	SO _x Emission Factor: $\frac{0.0006 \text{ lb/MMBtu}}{\text{Lbs/ton; lbs/10}^3 \text{ gal; lbs/10}^6 \text{ ft}^3}$				
$\frac{1.6 \text{ MMBtu/hr}}{\text{Maximum Fuel Consumption Rate (tons/hr; gal/hr; ft}^3\text{/hr)}}$	X	$\frac{0.0006 \text{ lb/MMBtu}}{\text{SO}_x \text{ Emission Factor}}$	=	$\frac{0.001}{\text{Uncontrolled SO}_x \text{ Emission Rate}}$	Lbs/hr

8. Uncontrolled Hydrocarbon (HC) Emission Rate:

	HC Emission Factor: $\frac{0.025 \text{ lb/MMBtu}}{\text{Lbs/ton; lbs/10}^3 \text{ gal; lbs/10}^6 \text{ ft}^3}$				
$\frac{1.6 \text{ MMBtu/hr}}{\text{Maximum Fuel Consumption Rate (tons/hr; gal/hr; ft}^3\text{/hr)}}$	X	$\frac{0.025 \text{ lb/MMBtu}}{\text{HC Emission Factor}}$	=	$\frac{0.040}{\text{Uncontrolled HC Emission Rate}}$	Lbs/hr

9. Uncontrolled Nitrogen Oxides (NO_x) Emission Rate:

A. NO_x Emission Factor: $\frac{0.091 \text{ lb/MMBtu}}{\text{Lbs/ton; lbs/10}^3 \text{ gal; lbs/10}^6 \text{ ft}^3}$

	B. $\frac{1.6 \text{ MMBtu/hr}}{\text{Maximum Fuel Consumption Rate (tons/hr; gal/hr; ft}^3\text{/hr)}}$				
	X	$\frac{0.091 \text{ lb/MMBtu}}{\text{NO}_x \text{ Emission Factor}}$	=	$\frac{0.146}{\text{Uncontrolled NO}_x \text{ Emission Rate}}$	Lbs/hr

10. NO_x Emission Rate in PPM by Volume at STP;

Cubic feet per hour (CFH) of Exhaust Gases at 15% Excess Air:

A.
$$\frac{V}{\text{See Table A}} \times \frac{1.6}{\text{Maximum Fuel Consumption Rate}} = \frac{17,920}{\text{Exhaust Rate}} \text{ CFH}$$

11,200 10⁶ BTU/hr

B.
$$\frac{0.146 \text{ Lbs/hr}}{\text{Uncontrolled NO}_x \text{ (Item 9B)}} \div \frac{17,920}{\text{CFH of Exhaust Gas (Item 10A)}} = 8.1 \times 10^{-6} \text{ Lb/ft}^3 \text{ NO}_x$$

C.
$$\text{PPM} = (8.37 \times 10^6) \times \frac{8.1 \times 10^{-6}}{\text{Lb/ft}^3 \text{ NO}_x \text{ (Item 10B)}} = \frac{68}{\text{PPM at STP and 15\% Excess Air (NO}_x \text{ calculated as NO}_2\text{)}}$$

Table A	
Fuel	V
Bituminous Coal	11700
Fuel Oil	11400
Natural Gas	11200
Wood	12800

This is to certify that I am familiar with the operations concerning this equipment and that the information provided on this application is true and complete to the best of my knowledge. This form must be completely filled out before it will be acceptable.

Mail to:
CHATTANOOGA-HAMILTON COUNTY
AIR POLLUTION CONTROL BUREAU
 2034 Hamilton Place Blvd. Suite 300
 Chattanooga, TN 37421



 Company Official

MEMBER

 Title

4/8/26

 Date

Do Not Write Below This Line

_____ Engineer Approval

This form corresponds to permit number: _____

Special Notations: _____

POLLUTION ESTIMATION FORM
(Fuel Burning Equipment)

FORM E110
01/2002

1. Name of Company: GreyRock Materials, LLC
(As shown on Line 1 of Form E001)
2. Equipment Name: Stationary Unified Drum Hot Mix Asphalt Plant (Hot Oil Heater)
(As shown on Line 10 of Form E001)
3. Percent excess air used in fuel burning (make allowances for leaks around doors and other openings): 20%
4. Type of Fuel (file Form E110 for each fuel used): No.2 Fuel Oil (Backup)

5. Source of Emission Factors: AP-42 Ch. 1.3, AP-42 Ch. 11.1, and Manufacturer Data

SEE ATTACHMENT A FOR ALL POLLUTANT EMISSION RATE CALCULATIONS

6. Uncontrolled Particulate Emission Rate:

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Particulate Emission Factor:	<u>0.0236 lb/MMBtu</u>		
	<small>(lbs/ton; lbs/10³ gal; lbs/10⁶ ft³)</small>		
<u>1.6 MMBtu/hr</u>	X	<u>0.0236 lb/MMBtu</u>	=
<small>Maximum Fuel Consumption Rate (tons/hr; gal/hr; ft³/hr)</small>		<small>Particulate Emission Factor</small>	<small>Uncontrolled Particulate Emission Rate</small>
			<u>0.0378</u>

7. Uncontrolled Sulfur Oxide (SO_x) Emission Rate:

SO_x Emission Factor: 1.055*S lb/MMBtu, where S indicates weight % of fuel Sulfur, S = 0.5
Lbs/ton; lbs/10³ gal; lbs/10⁶ ft³

<u>1.6 MMBtu/hr</u>	X	<u>0.5275 lb/MMBtu</u>	=	<u>0.844</u>	
<small>Maximum Fuel Consumption Rate (tons/hr; gal/hr; ft³/hr)</small>		<small>SO_x Emission Factor</small>		<small>Uncontrolled SO_x Emission Rate</small>	<small>Lbs/hr</small>

8. Uncontrolled Hydrocarbon (HC) Emission Rate:

HC Emission Factor: 0.038 lb/MMBtu
Lbs/ton; lbs/10³ gal; lbs/10⁶ ft³

<u>1.6 MMBtu/hr</u>	X	<u>0.038 lb/MMBtu</u>	=	<u>0.608</u>	
<small>Maximum Fuel Consumption Rate (tons/hr; gal/hr; ft³/hr)</small>		<small>HC Emission Factor</small>		<small>Uncontrolled HC Emission Rate</small>	<small>Lbs/hr</small>

9. Uncontrolled Nitrogen Oxides (NO_x) Emission Rate:

A. NO_x Emission Factor: 0.115 lb/MMBtu
Lbs/ton; lbs/10³ gal; lbs/10⁶ ft³

B.

<u>1.6 MMBtu/hr</u>	X	<u>0.115 lb/ton</u>	=	<u>0.184</u>	
<small>Maximum Fuel Consumption Rate (tons/hr; gal/hr; ft³/hr)</small>		<small>NO_x Emission Factor</small>		<small>Uncontrolled NO_x Emission Rate</small>	<small>Lbs/hr</small>

10. NO_x Emission Rate in PPM by Volume at STP:

Cubic feet per hour (CFH) of Exhaust Gases at 15% Excess Air:

$$A. \quad \frac{V}{\text{See Table A}} \times \frac{1.6}{\text{Maximum Fuel Consumption Rate}} = \frac{18,240}{\text{Exhaust Rate}} \text{ CFH}$$

11,400 10⁶ BTU/hr

$$B. \quad \frac{0.184}{\text{Uncontrolled NO}_x} \text{ Lbs/hr} \div \frac{18,240}{\text{CFH of Exhaust Gas (Item 10A)}} = \frac{1.01 \times 10^{-5}}{\text{Lb/ft}^3 \text{ NO}_x}$$

(Item 9B)

$$C. \quad \text{PPM} = (8.37 \times 10^6) \times \frac{1.01 \times 10^{-5}}{\text{Lb/R}^3 \text{ NO}_x \text{ (Item 10B)}} = \frac{84}{\text{PPM at STP and 15\% Excess Air (NO}_x \text{ calculated as NO}_2)}$$

Table A	
Fuel	V
Bituminous Coal	11700
Fuel Oil	11400
Natural Gas	11200
Wood	12800

This is to certify that I am familiar with the operations concerning this equipment and that the information provided on this application is true and complete to the best of my knowledge. This form must be completely filled out before it will be acceptable.

Mail to:
CHATTANOOGA-HAMILTON COUNTY
AIR POLLUTION CONTROL BUREAU
 2034 Hamilton Place Blvd. Suite 300
 Chattanooga, TN 37421



 Company Official

MEMBER

 Title

4/8/26

 Date

Do Not Write Below This Line

_____ Engineer Approval

This form corresponds to permit number: _____

Special Notations: _____

**ATTACHMENT A: HMA DRUM
FACILITY EMISSIONS**



4101 Jerome Avenue
 Chattanooga, TN 37407
 423.867.4210

Facility Name 26-067 GreyRock Materials, LLC.
Facility Location 2027 Polymer Drive Chattanooga, TN 37421

Dryer / Drum Mixer	D-UCF-9050 Stationary 7'-6" x 50' Unified Counterflow Drum Mixer
Drum Burner	WJ-75U-G-O-X19P-SFF-S-TP-BH 82.5 MMBTU Gas/Oil Burner
Particulate Control	BH-62-14 Stationary 62,000 ACFM Pulse Jet Baghouse
Hot Oil Heater	HC-120 1.2 MMBTU Hot Oil Heater
Heater Burner	C2-GO-15 1.6 MMBTU Gas/Oil Burner

OPERATIONAL PARAMETERS

Max Production Capacity	300	ton/hr	Stack Exit Height	30	ft
Annual Production	600000	ton/yr	Stack Diameter (ID)	50.375	in
Max RAP per mix	40	%	Stack Area	13.84	ft ²
RAP Usage per yr	50	%	Stack Velocity	74.7	ft/sec
Avg AC per mix	5	%		4479.5	ft/min
Exhaust Flow Rate	62000	ACFM	Stack Oxygen %:	11	actual
Standard Flow Rate	31567	DSCFM		3	reference
Maximum Heat Input	82.5	MMBTU			
Exhaust Temperature	240	F	<i>Typical exhaust temperature range: 200 - 375 °F</i>		
Exhaust Moisture	32.5	%	<i>Typical stack moisture range: 30 - 35 %</i>		

PRODUCTION NOTES	BAGHOUSE SPECIFICATIONS
Plant's nominal capacity based on production of 300F conventional-type virgin surface mix with 5% composite aggregate moisture removal at cool-down	* BCS490 exhaust fan with 250hp VFD direct drive variable frequency Pulse Jet cleaning with self adjusting cycle to maintain 2 - 6 inWC differential pressure (ΔP) across filter media
ACFM = airflow in ft ³ /min at temperature DSCFM = dry standard airflow in ft ³ /min (corrected to 68F, 1 atm, dry)	Inertial separator located at inlet for coarse particle collection
Heat input based on firing rate required for given production rate @ design conditions	* (896) 4-5/8" dia X 10' long 14-oz Aramid felt bags contained in one compartment
	* 10,849 sq.ft. of cloth @ 5.7 fpm filtering velocity (air/cloth)
	* Vertical exhaust stack with unobstructed opening

Raw Material Usage Rates

	lb/hr	ton/hr	gal/hr	ton/yr	gal/yr	
Virgin Aggregate	570000	285		570000		(NO RAP)
Liquid AC (8.5 lb/gal)	30000	15	3529	30000	7.1E+6	
Recycled material	240000	120		120000		(RAP)
Virgin aggregate	342000	171		456000		
Liquid AC (8.5 lb/gal)	18000	9	2118	24000	5.6E+6	

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Filterable Particulate Emissions (AP-42 Table 11.1-3)

	%	gr/dscf	lb/hr	ton/yr
Uncontrolled Filterable PM ¹		110.9	3000 07	3000 07
Controlled Filterable PM ²		0.04	10.82 3	10.82 3
Control Efficiency	99.96 4			
Uncontrolled Filterable PM-10		7.1	1920	1920
Controlled Filterable PM-10		0.004	1.17	1.17
PM-10 Control Efficiency	99.94			
Uncontrolled PM-2.5		1.7	450	450
Controlled PM-2.5		0.003	0.87	0.87
PM-2.5 Control Efficiency	99.81			

¹ Filterable PM inlet loading based on Manufacturer Data

² Outlet concentration based on NSPS 40 CFR Part 60 Subpart I

Condensable Particulate Emissions (AP-42 Table 11.1-3)

	%	gr/dscf	lb/hr	ton/yr
Uncontrolled Inorganic PM		0.008	2.22	2.22
Uncontrolled Organic PM		0.064	17	17
Controlled Organic PM		0.013	3.60	3.6
Organic PM Control Efficiency	79.31			

Greenhouse Gases (AP-42 Tables 11.1-7 & 11.1-8)

POLLUTANT	CASRN	MW	FACTOR	PTE	EMISSION RATES	
			lb/ton	ton/yr	lb/hr	ton/yr
Carbon Dioxide	124-38-9	44.01	33	43362	9900	9900
Methane	74-82-8	16.04	0.012	15.77	3.6	3.6
Total CO ₂ e			33.3	43756	9990	9990



Facility Name 26-067 GreyRock Materials, LLC.
Facility Location 2027 Polymer Drive Chattanooga, TN 37421

Burner Fuels - Net Heating Values & Usage Rates

	BTU/unit	Sulfur %	scf/hr	scf/yr	therm/yr
Natural Gas	1037	0.0017	79.6E+3	159.1E+6	1.6E+3

Criteria Pollutants (AP-42 Tables 11.1-7 & 11.1-8; Manufacturer Data)

POLLUTANT	CASRN	MW	FACTOR	PTE	EMISSION RATES	
			lb/ton	ton/yr	lb/hr	ton/yr
Sulfur Dioxide	7446-09-5	64.06	0.0034	4.47	1.0	1.02
Carbon Monoxide	630-08-0	28.01	0.13	170.82	39.0	39.0
Oxides of Nitrogen	10102-44-0	46.0	0.013	17.08	3.9	3.9
Volatile Organics	74-98-6	44.1	0.032	42.05	9.6	9.6

50% reduction

NON-HAP Organics (AP-42 Table 11.1-10)

POLLUTANT	CASRN	MW	FACTOR	PTE	EMISSION RATES	
			lb/ton	ton/yr	lb/hr	ton/yr
Butane	106-97-8	58.1	0.00067	0.88	0.201	2.01E-01
Ethylene	74-85-1	28.05	0.007	9.20	2.10	2.10
Heptane	142-82-5	100.2	0.0094	12.35	2.82	2.82
2-Methyl-1-pentane	763-29-1	84.2	0.004	5.26	1.20	1.20E+00
2-Methyl-2-butene	513-35-9	70.1	0.00058	0.76	0.174	1.74E-01
3-Methylpentane	96-14-0	86.2	0.00019	0.25	0.057	5.70E-02
1-pentene	109-67-1	70.13	0.0022	2.89	0.660	6.60E-01
n-Pentane	109-66-0	72.15	0.00021	0.28	0.063	6.30E-02
TOTAL NON-HAP ORGANICS			0.024	31.54	7.20	7.20E+00

NON-PAH HAPS (AP-42 Table 11.1-10)

POLLUTANT	CASRN	MW	FACTOR	PTE	EMISSION RATES	
			lb/ton	ton/yr	lb/hr	ton/yr
Benzene	71-43-2	78.11	0.00039	0.512	0.117	1.17E-01
Ethylbenzene	100-41-4	106.17	0.00024	0.315	0.072	7.20E-02
Formaldehyde	50-00-0	30.03	0.0031	4.07	0.93	9.30E-01
Hexane	110-54-3	86.18	0.00092	1.21	0.276	2.76E-01
Methyl Chloroform	71-55-6	133.4	4.80E-05	0.063	0.014	1.44E-02
Xylene	1330-20-7	106.17	0.0002	0.263	0.060	6.00E-02
Isooctane	540-84-1	114.23	4.00E-05	0.053	0.012	1.20E-02
Toluene	108-88-3	92.14	0.00015	0.197	0.045	4.50E-02
TOTAL NON-PAH HAPS			0.0051	6.70	1.53	1.53E+00



Facility Name 26-067 GreyRock Materials, LLC.
Facility Location 2027 Polymer Drive Chattanooga, TN 37421

PAH HAPS (AP-42 Table 11.1-10)

POLLUTANT	CASRN	MW	FACTOR	PTE	EMISSION RATES	
			lb/ton	ton/yr	lb/hr	ton/yr
Acenaphthene	83-32-9	154.21	1.40E-06	1.84E-03	4.20E-04	4.20E-04
Acenaphthylene	208-96-8	152.2	8.60E-06	1.13E-02	2.58E-03	2.58E-03
Anthracene	120-12-7	178.23	2.20E-07	2.89E-04	6.60E-05	6.60E-05
Benzo(a)anthracene	56-55-3	228.3	2.10E-07	2.76E-04	6.30E-05	6.30E-05
Benzo(a)pyrene	50-32-8	176.5	9.80E-09	1.29E-05	2.94E-06	2.94E-06
Benzo(b)fluoranthene	205-99-2	252.3	1.00E-07	1.31E-04	3.00E-05	3.00E-05
Benzo(e)pyrene	192-97-2	252.3	1.10E-07	1.45E-04	3.30E-05	3.30E-05
Benzo(g,h,i)perylene	191-24-2	276.3	4.00E-08	5.26E-05	1.20E-05	1.20E-05
Benzo(k)fluoranthene	207-08-9	252.3	4.10E-08	5.39E-05	1.23E-05	1.23E-05
Chrysene	218-01-9	228.3	1.80E-07	2.37E-04	5.40E-05	5.40E-05
Fluoranthene	206-44-0	202.3	6.10E-07	8.02E-04	1.83E-04	1.83E-04
Fluorene	86-73-7	166.2	3.80E-06	4.99E-03	1.14E-03	1.14E-03
Indeno(1,2,3-cd)pyrene	193-39-5	276.3	7.00E-09	9.20E-06	2.10E-06	2.10E-06
2-Methylnaphthalene	91-57-6	142.2	7.40E-05	9.72E-02	2.22E-02	2.22E-02
Naphthalene	91-20-3	127.17	9.00E-05	1.18E-01	2.70E-02	2.70E-02
Perylene	198-55-0	252.1	8.80E-09	1.16E-05	2.64E-06	2.64E-06
Phenanthrene	85-01-8	178.2	7.60E-06	9.99E-03	2.28E-03	2.28E-03
Pyrene	129-00-0	202.3	5.40E-07	7.10E-04	1.62E-04	1.62E-04
TOTAL PAH HAPS			0.00019	0.250	5.70E-02	5.70E-02
TOTAL HAPS			0.0053	6.96	1.59	1.59

Trace Metals (AP-42 Table 11.1-12)

POLLUTANT	CASRN	MW	FACTOR	PTE	EMISSION RATES	
			lb/ton	ton/yr	lb/hr	ton/yr
Antimony	7440-36-0	121.8	1.80E-07	2.37E-04	5.40E-05	5.40E-05
Arsenic	7440-38-2	74.9	5.60E-07	7.36E-04	1.68E-04	1.68E-04
Barium	7440-39-3	137.3	5.80E-06	7.62E-03	1.74E-03	1.74E-03
Cadmium	7440-43-9	112.4	4.10E-07	5.39E-04	1.23E-04	1.23E-04
Chromium	7440-47-3	52.0	5.50E-06	7.23E-03	1.65E-03	1.65E-03
Cobalt	7440-48-4	58.9	2.60E-08	3.42E-05	7.80E-06	7.80E-06
Copper	7440-50-8	63.5	3.10E-06	4.07E-03	9.30E-04	9.30E-04
Hexavalent Chromium	18540-29-9	52.0	4.50E-07	5.91E-04	1.35E-04	1.35E-04
Lead	7439-92-1	207.2	6.20E-07	8.15E-04	1.86E-04	1.86E-04
Manganese	7439-96-5	54.9	7.70E-06	1.01E-02	2.31E-03	2.31E-03
Mercury	7439-97-6	200.6	2.40E-07	3.15E-04	7.20E-05	7.20E-05
Nickel	7440-02-0	58.7	6.30E-05	8.28E-02	1.89E-02	1.89E-02
Phosphorus	7723-14-0	31.0	2.80E-05	3.68E-02	8.40E-03	8.40E-03
Selenium	7782-49-2	79.0	3.50E-07	4.60E-04	1.05E-04	1.05E-04
Silver	7440-22-4	107.9	4.80E-07	6.31E-04	1.44E-04	1.44E-04
Thallium	7440-28-0	204.4	4.10E-09	5.39E-06	1.23E-06	1.23E-06
Zinc	7440-66-6	65.4	6.10E-05	8.02E-02	1.83E-02	1.83E-02

Facility Name 26-067 GreyRock Materials, LLC.
Facility Location 2027 Polymer Drive Chattanooga, TN 37421

Burner Fuels - Net Heating Values & Usage Rates

	BTU/unit	Sulfur %	gal/hr	gal/yr
No. 2 Fuel Oil (Diesel)	141000	0.5	585	1.2E+6

Criteria Pollutants (AP-42 Tables 11.1-7, 11.1-8 & 1.3-1; Manufacturer Data)

POLLUTANT	CASRN	MW	FACTOR	PTE	EMISSION RATES	
			lb/1k gal	ton/yr	lb/hr	ton/yr
Sulfur Dioxide *	7446-09-5	64.06	142*S/1000	91.0	20.8	20.8
				50% retained in product		
POLLUTANT	CASRN	MW	FACTOR	PTE	EMISSION RATES	
			lb/ton	ton/yr	lb/hr	ton/yr
Carbon Monoxide	630-08-0	28.01	0.13	170.82	39.0	39.0
Oxides of Nitrogen	10102-44-0	46.0	0.036575	47.30	10.8	10.8
Volatile Organics	74-98-6	44.1	0.032	42.05	9.6	9.6

* SO2 based on fuel usage and sulfur content with documented scrubbing effect by fabric filter applied.

NON-HAP Organics (AP-42 Table 11.1-10)

POLLUTANT	CASRN	MW	FACTOR	PTE	EMISSION RATES	
			lb/ton	ton/yr	lb/hr	ton/yr
Butane	106-97-8	58.1	0.00067	0.88	0.201	2.01E-01
Ethylene	74-85-1	28.05	0.007	9.20	2.10	2.10E+00
Heptane	142-82-5	100.2	0.0094	12.35	2.82	2.82E+00
2-Methyl-1-pentane	763-29-1	84.2	0.004	5.26	1.20	1.20E+00
2-Methyl-2-butene	513-35-9	70.1	0.00058	0.76	0.174	1.74E-01
3-Methylpentane	96-14-0	86.2	0.00019	0.25	0.057	5.70E-02
l-pentene	109-67-1	70.13	0.0022	2.89	0.660	6.60E-01
n-Pentane	109-66-0	72.15	0.00021	0.28	0.063	6.30E-02
TOTAL NON-HAP ORGANICS			0.024	31.54	7.20	7.20

35% reduction

NON-PAH HAPS (AP-42 Table 11.1-10)

POLLUTANT	CASRN	MW	FACTOR	PTE	EMISSION RATES	
			lb/ton	ton/yr	lb/hr	ton/yr
Benzene	71-43-2	78.11	0.00039	5.12E-01	1.17E-01	1.17E-01
Ethylbenzene	100-41-4	106.17	0.00024	3.15E-01	7.20E-02	7.20E-02
Formaldehyde	50-00-0	30.03	0.0031	4.07E+00	9.30E-01	9.30E-01
Hexane	110-54-3	86.18	0.00092	1.21E+00	2.76E-01	2.76E-01
Isooctane	540-84-1	114.23	0.00004	5.26E-02	1.20E-02	1.20E-02
Methyl Chloroform	71-55-6	133.4	4.80E-05	6.31E-02	1.44E-02	1.44E-02
Toluene	108-88-3	92.14	0.0029	3.81E+00	8.70E-01	8.70E-01
Xylene	1330-20-7	106.17	0.0002	2.63E-01	6.00E-02	6.00E-02
TOTAL NON-PAH HAPS			0.0078	10.25	2.34	2.34

Facility Name 26-067 GreyRock Materials, LLC.
Facility Location 2027 Polymer Drive Chattanooga, TN 37421

PAH HAPS (AP-42 Table 11.1-10)

POLLUTANT	CASRN	MW	FACTOR	PTE	EMISSION RATES	
			lb/ton	ton/yr	lb/hr	ton/yr
Acenaphthene	83-32-9	154.21	1.40E-06	1.84E-03	4.20E-04	4.20E-04
Acenaphthylene	208-96-8	152.2	2.20E-05	2.89E-02	6.60E-03	6.60E-03
Anthracene	120-12-7	178.23	3.10E-06	4.07E-03	9.30E-04	9.30E-04
Benzo(a)anthracene	56-55-3	228.3	2.10E-07	2.76E-04	6.30E-05	6.30E-05
Benzo(a)pyrene	50-32-8	176.5	9.80E-09	1.29E-05	2.94E-06	2.94E-06
Benzo(b)fluoranthene	205-99-2	252.3	1.00E-07	1.31E-04	3.00E-05	3.00E-05
Benzo(e)pyrene	192-97-2	252.3	1.10E-07	1.45E-04	3.30E-05	3.30E-05
Benzo(g,h,i)perylene	191-24-2	276.3	4.00E-08	5.26E-05	1.20E-05	1.20E-05
Benzo(k)fluoranthene	207-08-9	252.3	4.10E-08	5.39E-05	1.23E-05	1.23E-05
Chrysene	218-01-9	228.3	1.80E-07	2.37E-04	5.40E-05	5.40E-05
Fluoranthene	206-44-0	202.3	6.10E-07	8.02E-04	1.83E-04	1.83E-04
Fluorene	86-73-7	166.2	1.10E-05	1.45E-02	3.30E-03	3.30E-03
Indeno(1,2,3-cd)pyrene	193-39-5	276.3	7.00E-09	9.20E-06	2.10E-06	2.10E-06
2-Methylnaphthalene	91-57-6	142.2	1.70E-04	2.23E-01	5.10E-02	5.10E-02
Naphthalene	91-20-3	127.17	6.50E-04	8.54E-01	1.95E-01	1.95E-01
Perylene	198-55-0	252.1	8.80E-09	1.16E-05	2.64E-06	2.64E-06
Phenanthrene	85-01-8	178.2	2.30E-05	3.02E-02	6.90E-03	6.90E-03
Pyrene	129-00-0	202.3	3.00E-06	3.94E-03	9.00E-04	9.00E-04
TOTAL PAH HAPS			0.00088	1.16	0.264	0.264
TOTAL HAPS			0.0087	11.43	2.61	2.61

Trace Metals (AP-42 Table 11.1-12)

POLLUTANT	CASRN	MW	FACTOR	PTE	EMISSION RATES	
			lb/ton	ton/yr	lb/hr	ton/yr
Antimony	7440-36-0	121.8	1.80E-07	2.37E-04	5.40E-05	5.40E-05
Arsenic	7440-38-2	74.9	5.60E-07	7.36E-04	1.68E-04	1.68E-04
Barium	7440-39-3	137.3	5.80E-06	7.62E-03	1.74E-03	1.74E-03
Cadmium	7440-43-9	112.4	4.10E-07	5.39E-04	1.23E-04	1.23E-04
Chromium	7440-47-3	52.0	5.50E-06	7.23E-03	1.65E-03	1.65E-03
Cobalt	7440-48-4	58.9	2.60E-08	3.42E-05	7.80E-06	7.80E-06
Copper	7440-50-8	63.5	3.10E-06	4.07E-03	9.30E-04	9.30E-04
Hexavalent Chromium	18540-29-9	52.0	4.50E-07	5.91E-04	1.35E-04	1.35E-04
Lead	7439-92-1	207.2	1.50E-05	1.97E-02	4.50E-03	4.50E-03
Manganese	7439-96-5	54.9	7.70E-06	1.01E-02	2.31E-03	2.31E-03
Mercury	7439-97-6	200.6	2.60E-06	3.42E-03	7.80E-04	7.80E-04
Nickel	7440-02-0	58.7	6.30E-05	8.28E-02	1.89E-02	1.89E-02
Phosphorus	7723-14-0	31.0	2.80E-05	3.68E-02	8.40E-03	8.40E-03
Selenium	7782-49-2	79.0	3.50E-07	4.60E-04	1.05E-04	1.05E-04
Silver	7440-22-4	107.9	4.80E-07	6.31E-04	1.44E-04	1.44E-04
Thallium	7440-28-0	204.4	4.10E-09	5.39E-06	1.23E-06	1.23E-06
Zinc	7440-66-6	65.4	6.10E-05	8.02E-02	1.83E-02	1.83E-02

Facility Name 26-067 GreyRock Materials, LLC.
Facility Location 2027 Polymer Drive Chattanooga, TN 37421

Unit HC-120 1.2 MMBTU Hot Oil Heater
Burner C2-GO-15 Nominal 1.6 MMBTU Gas/Oil Burner

Total Airflow	976	ACFM	Stack Height	8.85	ft
Standard Airflow	438	DSCFM	Stack Diameter	12	in
Heat Input	1.6	MMBtu/hr	Stack Area	0.79	sq.ft.
Stack Temperature	600	F	Stack Velocity	20.7	ft/sec
Stack Moisture	10	%		1242.7	ft/min

Burner Fuels - Net Heating Values & Usage Rates *

	BTU/unit	Sulfur %	ft ³ /hr	ft ³ /yr
Natural Gas	1037	0.0017	1.54E+03	13.5E+6
	BTU/unit	Sulfur %	gal/hr	gal/yr
No. 2 Fuel Oil	141000	0.5	11.3	99.4E+3

* Usage rates based on exclusive use of each fuel annually (8760 hrs)

Criteria Pollutants - NATURAL GAS (Mfr. Data)

POLLUTANT	CASRN	MW	FACTOR	ACTUAL	
			lb/MMBtu	lb/hr	ton/yr
Total Particulates			0.0075	0.012	0.053
Sulfur Dioxide	7446-09-5	64.06	0.0006	0.001	0.004
Carbon Monoxide	630-08-0	28.01	0.037	(0.059)	0.259
Oxides of Nitrogen	10102-44-0	46.05	0.091	(0.146)	0.638
Volatile Organics	74-98-6	44.1	0.025	(0.040)	0.175

AP-42
lb/hr tons/yr
0.011922 0.052216
0.002238 0.009804
0.131765 0.577129 ✓
0.163137 0.714541
0.008627 0.037788 ✓

Non-HAP Organics - NATURAL GAS (AP-42 Table 1.4-3)

POLLUTANT	CASRN	MW	FACTOR	ACTUAL	
			lb/MMscf	lb/hr	ton/yr
Butane	106-97-8	58.12	2.1E+00	0.0032	0.014
Ethane	74-84-0	30.07	3.1E+00	0.0048	0.021
Pentane	109-66-0	72.15	2.6E+00	0.0040	0.018
Propane	74-98-6	44.1	1.6E+00	0.0025	0.011

Non-PAH HAPS - NATURAL GAS (AP-42 Table 1.4-3)

POLLUTANT	CASRN	MW	FACTOR	ACTUAL	
			lb/MMscf	lb/hr	ton/yr
Benzene	71-43-2	78.11	2.1E-03	3.2E-06	1.4E-05
Dichlorobenzene	25321-226	147	1.2E-03	1.9E-06	8.1E-06
Formaldehyde	50-00-0	30.03	7.5E-02	1.2E-04	5.1E-04
Hexane	110-54-3	86.18	1.8E+00	2.8E-03	1.2E-02
Toluene	108-88-3	92.14	3.4E-03	5.2E-06	2.3E-05

PAH HAPS - NATURAL GAS (AP-42 Table 1.4-3)

POLLUTANT	CASRN	MW	FACTOR	ACTUAL	
			lb/MMscf	lb/hr	ton/yr
2-Methylnaphthalene	91-57-6	142.2	2.4E-05	3.7E-08	1.6E-07
3-Methylcholanthrene	56-49-5	268.35	<1.8E-06	<2.8E-09	<1.2E-08
7,12-Dimethylbenz(a)anthracene	57-97-6	256.34	<1.6E-05	<2.5E-08	<1.1E-07
Acenaphthene	83-32-9	154.21	<1.8E-06	<2.8E-09	<1.2E-08
Acenaphthylene	208-96-8	152.19	<1.8E-06	<2.8E-09	<1.2E-08
Anthracene	120-12-7	178.23	<2.4E-06	<3.7E-09	<1.6E-08
Benz(a)anthracene	56-55-3	228.29	<1.8E-06	<2.8E-09	<1.2E-08
Benzo(a)pyrene	50-32-8	252.31	<1.2E-06	<1.9E-09	<8.1E-09
Benzo(b)fluoranthene	205-99-2	252.31	<1.8E-06	<2.8E-09	<1.2E-08
Benzo(g,h,i)perylene	191-24-2	276.34	<1.2E-06	<1.9E-09	<8.1E-09
Benzo(k)fluoranthene	207-08-9	252.31	<1.8E-06	<2.8E-09	<1.2E-08
Chrysene	218-01-9	228.29	<1.8E-06	<2.8E-09	<1.2E-08
Dibenzo(a,h)anthracene	53-70-3	278.35	<1.2E-06	<1.9E-09	<8.1E-09
Fluoranthene	206-44-0	202.25	3.0E-06	4.6E-09	2.0E-08
Fluorene	86-73-7	166.22	2.8E-06	4.3E-09	1.9E-08
Indeno(1,2,3-cd)pyrene	193-39-5	276.34	<1.8E-06	<2.8E-09	<1.2E-08
Naphthalene	91-20-3	128.17	6.1E-04	9.4E-07	4.1E-06
Phenanthrene	85-01-8	178.23	1.7E-05	2.6E-08	1.1E-07
Pyrene	129-00-0	202.25	5.0E-06	7.7E-09	3.4E-08

Trace Metals - NATURAL GAS (AP-42 Tables 1.4-2 & 1.4-3)

POLLUTANT	CASRN	MW	FACTOR	ACTUAL	
			lb/MMscf	lb/hr	ton/yr
Arsenic	7440-38-2	74.92	2.0E-04	3.1E-07	1.4E-06
Barium	7440-39-3	137.33	4.4E-03	6.8E-06	3.0E-05
Beryllium	7440-41-7	9.01	<1.2E-05	<1.9E-08	<8.1E-08
Cadmium	7440-43-9	112.41	1.1E-03	1.7E-06	7.4E-06
Chromium	7440-47-3	52	1.4E-03	2.2E-06	9.5E-06
Cobalt	7440-48-4	58.93	8.4E-05	1.3E-07	5.7E-07
Copper	7440-50-8	63.55	8.5E-04	1.3E-06	5.7E-06
Lead	7439-92-1	207.2	5.0E-04	7.7E-07	3.4E-06
Manganese	7439-96-5	54.94	3.8E-04	5.9E-07	2.6E-06
Mercury	7439-97-6	200.59	2.6E-04	4.0E-07	1.8E-06
Molybdenum	7439-98-7	95.95	1.1E-03	1.7E-06	7.4E-06
Nickel	7440-02-0	58.69	2.1E-03	3.2E-06	1.4E-05
Selenium	7782-49-2	78.97	<2.4E-05	<3.7E-08	<1.6E-07
Vanadium	7440-62-2	50.94	2.3E-03	3.5E-06	1.6E-05
Zinc	7440-66-6	65.38	2.9E-02	4.5E-05	2.0E-04

Criteria Pollutants - No2 Oil (Mfr. Data)

POLLUTANT	CASRN	MW	FACTOR	ACTUAL	
			lb/MMBtu	lb/hr	ton/yr
Total Particulates			0.0236	3.78E-02	1.65E-01
Sulfur Dioxide	7446-09-5	64.06	1.055 * S	8.44E-01	3.70E+00
Carbon Monoxide	630-08-0	28.01	0.037	(5.92E-02)	2.59E-01
Oxides of Nitrogen	10102-44-0	46.05	0.115	(1.84E-01)	8.06E-01
Volatile Organics	74-98-6	44.1	0.038	(6.08E-02)	2.66E-01

AP-42
lb/hr tons/yr
0.037714 0.165189 ✓
0.082296 0.360411 ✓
0.057143 0.250286
0.228571 1.001143 ✓
0.003686 0.017019

HAPS - No2 Oil (AP-42 Table 11.1-13)

POLLUTANT	CASRN	MW	FACTOR	ACTUAL	
			lb/gal	lb/hr	ton/yr
Formaldehyde	50-00-0	30.03	3.50E-06	4.0E-05	1.7E-04
Acenaphthene	83-32-9	154.21	5.30E-07	6.0E-06	2.6E-05
Acenaphthylene	208-96-8	152.2	2.00E-07	2.3E-06	9.9E-06
Anthracene	120-12-7	178.23	1.80E-07	2.0E-06	8.9E-06
Benzo(b)fluoranthene	205-99-2	252.3	1.00E-07	1.1E-06	5.0E-06
Fluoranthrene	206-44-0	202.3	4.40E-08	5.0E-07	2.2E-06
Fluorene	86-73-7	166.2	3.20E-08	3.6E-07	1.6E-06
Naphthalene	91-20-3	127.17	1.70E-05	1.9E-04	8.4E-04
Phenanthrene	85-01-8	178.2	4.90E-06	5.6E-05	2.4E-04
Pyrene	129-00-0	202.3	3.20E-08	3.6E-07	1.6E-06

Trace Metals - No2 Oil (AP-42 Table 1.3-10)

POLLUTANT	CASRN	MW	FACTOR	ACTUAL	
			lb/10 ¹² Btu	lb/hr	ton/yr
Arsenic	7440-38-2	74.92	4	6.4E-06	2.8E-05
Beryllium	7440-41-7	9.01	3	4.8E-06	2.1E-05
Cadmium	7440-43-9	112.41	3	4.8E-06	2.1E-05
Chromium	7440-47-3	52	3	4.8E-06	2.1E-05
Copper	7440-50-8	63.55	6	9.6E-06	4.2E-05
Lead	7439-92-1	207.2	9	1.4E-05	6.3E-05
Mercury	7439-97-6	200.59	3	4.8E-06	2.1E-05
Manganese	7439-96-5	54.94	6	9.6E-06	4.2E-05
Nickel	7440-02-0	58.69	3	4.8E-06	2.1E-05
Selenium	7782-49-2	78.97	15	2.4E-05	1.1E-04
Zinc	7440-66-6	65.38	4	6.4E-06	2.8E-05



Facility Name 26-067 GreyRock Materials, LLC.
Facility Location 2027 Polymer Drive Chattanooga, TN 37421

Asphalt Volatility (V)	-0.50	deg F
Mix Temp	325	

Silo Filling Emission Factors (AP-42 Table 11.1-14)

Total PM	$EF = 0.000332 + 0.00105(-V)e^{((0.0251)(T+460)-20.43)}$
Organic PM	$EF = 0.00105(-V)e^{((0.0251)(T+460)-20.43)}$
TOC	$EF = 0.0504(-V)e^{((0.0251)(T+460)-20.43)}$
CO	$EF = 0.00488(-V)e^{((0.0251)(T+460)-20.43)}$

Silo Filling Emission Rates

POLLUTANT	FACTOR	PTE		EMISSION RATES		
		lb/ton	lb/yr	ton/yr	lb/hr	lb/yr
Total PM	0.000586	1540	0.77	0.176	351.5	0.18
Organic PM	0.000254	667	0.33	0.076	152.3	0.08
TOC	0.012187	32027	16.01	3.656	7312.0	3.66
CO	0.001180	3101	1.55	0.354	708.0	0.35

uncontrolled rates
see below
see below
uncontrolled

Plant Load-out Emission Factors (AP-42 Table 11.1-14)

Total PM	$EF = 0.000181 + 0.00141(-V)e^{((0.0251)(T+460)-20.43)}$
Organic PM	$EF = 0.00141(-V)e^{((0.0251)(T+460)-20.43)}$
TOC	$EF = 0.0172(-V)e^{((0.0251)(T+460)-20.43)}$
CO	$EF = 0.00558(-V)e^{((0.0251)(T+460)-20.43)}$

Plant Load-out Emission Rates

POLLUTANT	FACTOR	PTE		EMISSION RATES		
		lb/ton	lb/yr	ton/yr	lb/hr	lb/yr
Total PM	0.000522	1372	0.69	0.157	313.2	0.16
Organic PM	0.000341	896	0.45	0.102	204.6	0.10
TOC	0.004159	10930	5.46	1.248	2495.4	1.25
CO	0.001349	3546	1.77	0.405	809.5	0.40

uncontrolled rates
see below
see below
uncontrolled

Facility Name 26-067 GreyRock Materials, LLC.
Facility Location 2027 Polymer Drive Chattanooga, TN 37421

Organic PM

Uncontrolled Emissions (AP-42 Table 11.1-15)

Pollutant	CAS #	Silo Filling				Load-out			
		EF (%)	lb/ton	lb/hr	ton/yr	EF (%)	lb/ton	lb/hr	ton/yr
Acenaphthene	83-32-9	0.47	1.19E-06	3.58E-04	3.58E-04	0.26	8.86E-07	2.66E-04	2.66E-04
Acenaphthylene	208-96-8	0.014	3.55E-08	1.07E-05	1.07E-05	0.028	9.55E-08	2.86E-05	2.86E-05
Anthracene	120-12-7	0.13	3.30E-07	9.90E-05	9.90E-05	0.07	2.39E-07	7.16E-05	7.16E-05
Benzo(a)anthracene	56-55-3	0.056	1.42E-07	4.27E-05	4.27E-05	0.019	6.48E-08	1.94E-05	1.94E-05
Benzo(b)fluoranthene	205-99-2	Not Detected				0.0076	2.59E-08	7.77E-06	7.77E-06
Benzo(k)fluoranthene	207-08-9	Not Detected				0.0022	7.50E-09	2.25E-06	2.25E-06
Benzo(g,h,i)perylene	191-24-2	Not Detected				0.0019	6.48E-09	1.94E-06	1.94E-06
Benzo(a)pyrene	50-32-8	Not Detected				0.0023	7.84E-09	2.35E-06	2.35E-06
Benzo(e)pyrene	192-97-2	0.0095	2.41E-08	7.24E-06	7.24E-06	0.0078	2.66E-08	7.98E-06	7.98E-06
Chrysene	218-01-9	0.21	5.33E-07	1.60E-04	1.60E-04	0.103	3.51E-07	1.05E-04	1.05E-04
Dibenz(a,h)anthracene	53-40-3	Not Detected				0.00037	1.26E-09	3.78E-07	3.78E-07
Fluoranthene	206-44-0	0.15	3.81E-07	1.14E-04	1.14E-04	0.05	1.70E-07	5.11E-05	5.11E-05
Fluorene	86-73-7	1.01	2.56E-06	7.69E-04	7.69E-04	0.77	2.63E-06	7.88E-04	7.88E-04
Indeno(1,2,3-cd)pyrene	193-39-5	Not Detected				0.00047	1.60E-09	4.81E-07	4.81E-07
2-Methylnaphthalene	91-57-6	5.27	1.34E-05	4.01E-03	4.01E-03	2.38	8.11E-06	2.43E-03	2.43E-03
Naphthalene	91-20-3	1.82	4.62E-06	1.39E-03	1.39E-03	1.25	4.26E-06	1.28E-03	1.28E-03
Perylene	198-55-0	0.03	7.62E-08	2.29E-05	2.29E-05	0.022	7.50E-08	2.25E-05	2.25E-05
Phenanthrene	85-01-8	1.8	4.57E-06	1.37E-03	1.37E-03	0.81	2.76E-06	8.28E-04	8.28E-04
Pyrene	129-00-0	0.44	1.12E-06	3.35E-04	3.35E-04	0.15	5.11E-07	1.53E-04	1.53E-04
TOTAL PAH HAPs		11.4	2.89E-05	8.68E-03	8.68E-03	5.93	2.02E-05	6.07E-03	6.07E-03
Phenol	108-95-2	Not Detected				1.18	4.02E-06	1.21E-03	1.21E-03



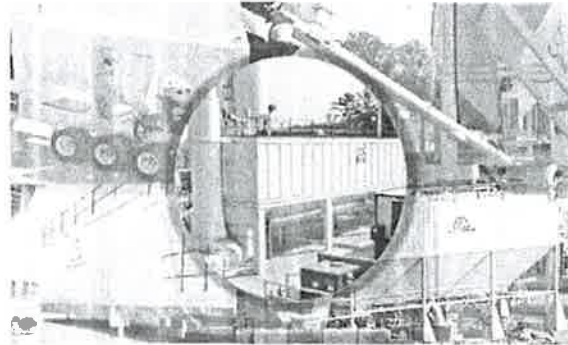
Facility Name 26-067 GreyRock Materials, LLC.
Facility Location 2027 Polymer Drive Chattanooga, TN 37421

TOC		Uncontrolled Emissions (AP-42 Table 11.1-16)							
Pollutant	CAS #	Silo Filling				Load-out			
		EF (%)	lb/ton	lb/hr	ton/yr	EF (%)	lb/ton	lb/hr	ton/yr
Volatile Organic Compounds		100	1.22E-02	3.66	3.66	94	3.91E-03	1.17	1.17
Methane	74-82-8	0.26	3.17E-05	9.51E-03	9.51E-03	6.5	2.70E-04	8.11E-02	8.11E-02
Acetone	67-64-1	0.055	6.70E-06	2.01E-03	2.01E-03	0.046	1.91E-06	5.74E-04	5.74E-04
Ethylene	74-85-1	1.1	1.34E-04	4.02E-02	4.02E-02	0.71	2.95E-05	8.86E-03	8.86E-03
Total non-VOC/non-HAPs		1.4	1.71E-04	5.12E-02	5.12E-02	7.3	3.04E-04	9.11E-02	9.11E-02
Benzene	71-43-2	0.032	3.90E-06	1.17E-03	1.17E-03	0.052	2.16E-06	6.49E-04	6.49E-04
Bromomethane	74-83-9	0.0049	5.97E-07	1.79E-04	1.79E-04	0.0096	3.99E-07	1.20E-04	1.20E-04
2-Butanone	78-93-3	0.039	4.75E-06	1.43E-03	1.43E-03	0.049	2.04E-06	6.11E-04	6.11E-04
Carbon Disulfide	75-15-0	0.016	1.95E-06	5.85E-04	5.85E-04	0.013	5.41E-07	1.62E-04	1.62E-04
Chloroethane	75-00-3	0.004	4.87E-07	1.46E-04	1.46E-04	0.00021	8.73E-09	2.62E-06	2.62E-06
Chloromethane	74-87-3	0.023	2.80E-06	8.41E-04	8.41E-04	0.015	6.24E-07	1.87E-04	1.87E-04
Cumene	92-82-8	Not Detected				0.11	4.57E-06	1.37E-03	1.37E-03
Ethylbenzene	100-41-4	0.038	4.63E-06	1.39E-03	1.39E-03	0.28	1.16E-05	3.49E-03	3.49E-03
Formaldehyde	50-00-1	0.69	8.41E-05	2.52E-02	2.52E-02	0.088	3.66E-06	1.10E-03	1.10E-03
n-Hexane	100-54-3	0.1	1.22E-05	3.66E-03	3.66E-03	0.15	6.24E-06	1.87E-03	1.87E-03
Isooctane	540-84-1	0.00031	3.78E-08	1.13E-05	1.13E-05	0.0018	7.49E-08	2.25E-05	2.25E-05
Methylene Chloride	75-09-2	0.00027	3.29E-08	9.87E-06	9.87E-06	Not Detected			
Styrene	100-42-5	0.0054	6.58E-07	1.97E-04	1.97E-04	0.0073	3.04E-07	9.11E-05	9.11E-05
Tetrachloroethane	127-184-4	Not Detected				0.0077	3.20E-07	9.61E-05	9.61E-05
Toluene	100-88-3	0.062	7.56E-06	2.27E-03	2.27E-03	0.21	8.73E-06	2.62E-03	2.62E-03
Trichlorofluoromethane	75-69-4	Not Detected				0.0013	5.41E-08	1.62E-05	1.62E-05
m-/p-Xylene	1330-20-7	0.2	2.44E-05	7.31E-03	7.31E-03	0.41	1.71E-05	5.12E-03	5.12E-03
o-Xylene	95-47-6	0.057	6.95E-06	2.08E-03	2.08E-03	0.08	3.33E-06	9.98E-04	9.98E-04
Total Volatile Organic HAPs		1.3	1.58E-04	4.75E-02	4.75E-02	1.5	6.24E-05	1.87E-02	1.87E-02

**ATTACHMENT B: BAGHOUSE
PERFORMANCE**

BAGHOUSE PERFORMANCE SPECIFICATIONS

CUSTOMER	GreyRock Materials, LLC.	
SERIAL NUMBER	26-067	
PROPOSAL NUMBER		
MODEL NO.	BH-62-14	
PRIMARY COLLECTOR	Inertial Separator	
RATED AIRFLOW	62,000	ACFM
	1756	ACMM
EXHAUST FAN	BCS490	Model
	250	HP
SYSTEM CONTROLLED	7'-6" x 50' Unified Counterflow Drum Mixer	



FILTRATION MEDIA SPECIFICATIONS

FILTRATION MEDIA	14 oz/yd ² [475 g/m ²] Aramid		# of COMPARTMENTS	1	
BAG TYPE	ROUND: 4-5/8" [117.5 mm] DIAMETER		ROW CONFIGURATION	Straight, not staggered	
BAG QUANTITY	896	Total	896	10ft long	N/A
					N/A
CLOTH AREA	10849	SF	AIR/CLOTH RATIO ¹		5.71 fpm
	1007.9	SM			1.74 m/min

EXHAUST STACK SPECIFICATIONS

STACK SHAPE	ROUND		OPENING SIZE	4'-2 3/8"	
DISCHARGE AREA ²	13.84	ft ²	EXHAUST VELOCITY ³	74.66	fps
	1.29	m ²		22.76	m/sec
EXHAUST HEIGHT	30'	IMP	9.14 m	MET	

OPERATING PARAMETERS

DESIGN TEMPERATURE	240 °F	115.6 °C	DESIGN STACK H ₂ O	32.5 %
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* The actual operating exhaust temperature will range from 185 °F [85 °C] to 375 °F [190 °C].

* The actual stack moisture content is dependent on the materials being dried; Stack moisture can range from 25% to 38%.

* The operating differential pressure (DP) will typically range from 2 - 6 inWC [5 - 15 mbar]. Operation outside of this range does *not* indicate the unit is malfunctioning or that it is out of compliance with the applicable particulate emission standard. Contact Astec Industries, Inc. (423.867.4210) for more information.

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CLEANING SYSTEM

CLEANING METHOD	Pulse-Jet	CYCLE FREQUENCY	self-adjusting based on DP
DISPOSAL METHOD	Collected particulate matter returned to the process via transfer screw auger		

PARTICULATE EMISSION CONTROL

The baghouse will comply with the following emission standard when operated and maintained according to all manufacturer recommendations:

MAX OUTLET CONCENTRATION	0.04	gr/dscf	90	mg/dscm
DESIGN CONTROL EFFICIENCY	99.96%	%	Inlet loading based on Mfr Data	
APPLICABLE PM STANDARD	USEPA NSPS 40 CFR 60 Subpart I			

Particle size distribution is site-specific based on the feed materials. This data cannot be provided for the baghouse. Note that proper material selection, the external operating environment of the baghouse, and other variables outside the control of the manufacturer may impact compliance with emission standards.

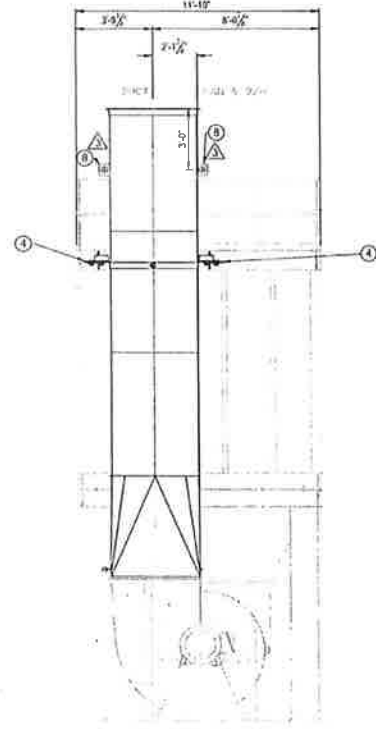
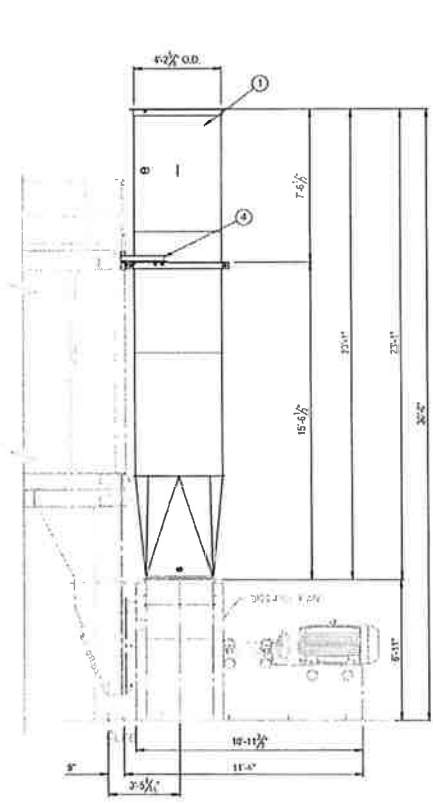
¹ACR = maximum filtering velocity

²unobstructed vertical discharge

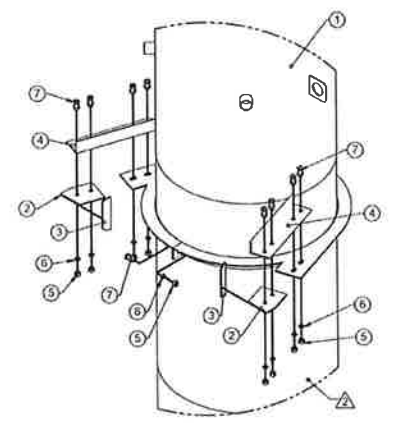
³maximum velocity at rated airflow

NOTE: Information provided is based on baghouse configuration as originally manufactured.

K
J
H
G
C
B
A



#	PART NUMBER	REV	QTY	DESCRIPTION	UNIT	WEIGHT
1	FA000017A24	24	1	STACK SECTION HIGH VOLUME UNIT	ZL0504	
2	FA000024P01	06	2	BRACKET STACK BRACES		7.39
3	FA000025P01	06	2	GUSSET SUPPORT BRACES		2.94
4	FA000027P01	06	2	SUPPORT ANGLE BRACKETS 2x4x8 FH		29.57
5	08040	06	16	WALNUT 1/2\"/>		
6	080319	16	16	WALNUT LOCK TIGHT PLT 1/2		0.64
7	081912	16	16	BOLT A325 1/2 x 3 1/2		0
8	090000H2P04	00	2	LIFTING LUG SA 8 x 10 3/4		3.53



ASSEMBLY DETAIL

#	REVISION LEVEL	DATE	BY
1	ISSUED FOR CONSTRUCTION	07/20/07	BDT
2	ISSUED FOR CONSTRUCTION	07/20/07	BDT
3	ISSUED FOR CONSTRUCTION	07/20/07	BDT
4	ISSUED FOR CONSTRUCTION	07/20/07	BDT
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50	ISSUED FOR CONSTRUCTION	07/20/07	BDT

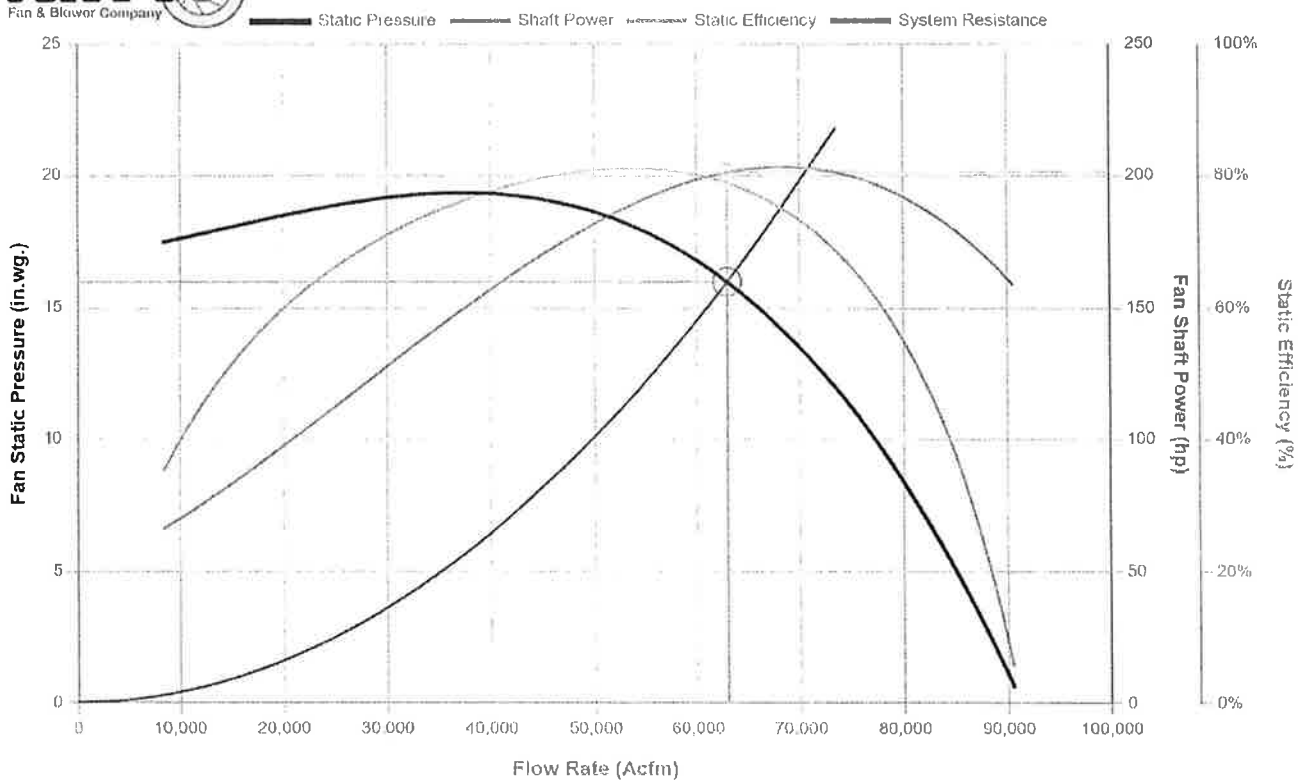
Fan Data

Fan Type: BCES	Volume: 63,000 Acfm	Outlet Velocity: 4,848 fpm
Size: 490	Fan Static Pressure: 16.0 in. wg.	Fan Shaft Power: 201.3 hp
Width: 85 %	Inlet Pressure: -16 in. wg.	Cold Start Power: 289.9 hp (68°F)
Speed: 1,764 rpm	Inlet Air Temp: 300°F	Static Efficiency: 79 %
Class: Class 4	Elevation: 1,000 ft	FEI: 1.29
Arrangement: 8	Density: 0.0482 lb/ft ³	

(Performance and Power indicated do not include drive losses)



Fan Performance Curve



Sound Data

Noise levels based on Hemispherical Free Field conditions
(Directivity = 2, Measurement Distance = 5 ft)

Octave Band	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
Lw dB	111	119	115	111	110	109	103	96
Lp dB	99	107	103	99	98	97	91	84

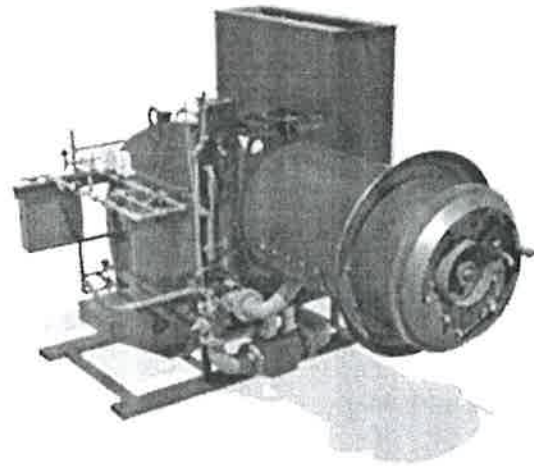
Overall Predicted Noise Level = 104 dBA (Open Inlet)

**ATTACHMENT C: WJ75 BURNER
PERFORMANCE**



BURNER PERFORMANCE SPECIFICATIONS

CUSTOMER	GreyRock Materials, LLC.	
SERIAL NUMBER	26-067	
PROPOSAL NUMBER		
MODEL NO.	Whisper Jet [®]	WJ-75
RATED CAPACITY	82.5	MMBTU/HR
(with 20% XSA ¹)	87.0	GJ/HR
BLOWER MOTOR	75	HP
BLOWER AIR CAPACITY	1,020,618	SCFH ²



The Whisper Jet[®] is a highly efficient total-air burner that operates at up to 20% excess air. This burner utilizes patented technology to rapidly swirl high energy combustion air to minimize emissions. It employs compressed air for oil atomization. True to its name, the Whisper Jet burner is designed and equipped to reduce combustion noise.

OPERATING PARAMETERS

DRUM MODEL	D-UCF-9050 7'-6" x 50' Unified Counterflow Drum Mixer						
PRIMARY FUEL	NATURAL GAS	HHV	1000	BTU/SCF	MAX FUEL	82500	SCF/HR
SECONDARY FUEL	NO. 2 FUEL OIL	HHV	141000	BTU/GAL	MAX FUEL	585	GAL/HR
TERTIARY FUEL	NOT APPLICABLE	HHV			MAX FUEL		

PROJECTED EMISSION RATES

POLLUTANT	TECHNOLOGY	FUEL	EMISSION LEVELS	REGULATION
Oxides of Nitrogen (Nox)	Low-NOx burner	natural gas	0.013 lb NOx / ton of HMA 50% Reduction of emission factor from AP-42 Table 11.1-7)	TDEC Rule 1200-03-07-.07(2) Rule 1200-03-06-.03(2)
		fuel oil	0.036 lb NOx / ton of HMA (35% Reduction of emission factor from AP-42 Table 11.1-7)	TDEC Rule 1200-03-07-.07(2) Rule 1200-03-06-.03(2)

REGULATORY AGENCY: Chattanooga-Hamilton County Air Pollution Control Bureau

COMBUSTION PERFORMANCE CAVEATS

1. NOx emission rates are for combustion only and do not include NOx formation due to impurities that could be present in the feed materials due to blasting nitrates or agricultural fertilizers. The burner is incapable of controlling NOx formation originating through processes other than combustion.
2. Burner performance is dependent on properly sized fuel system delivering fuel in sufficient quantity, and pressure applicable, to support desired firing rate. The distance from the control regulator to the gas blocking valves should comply with recommendations provided.

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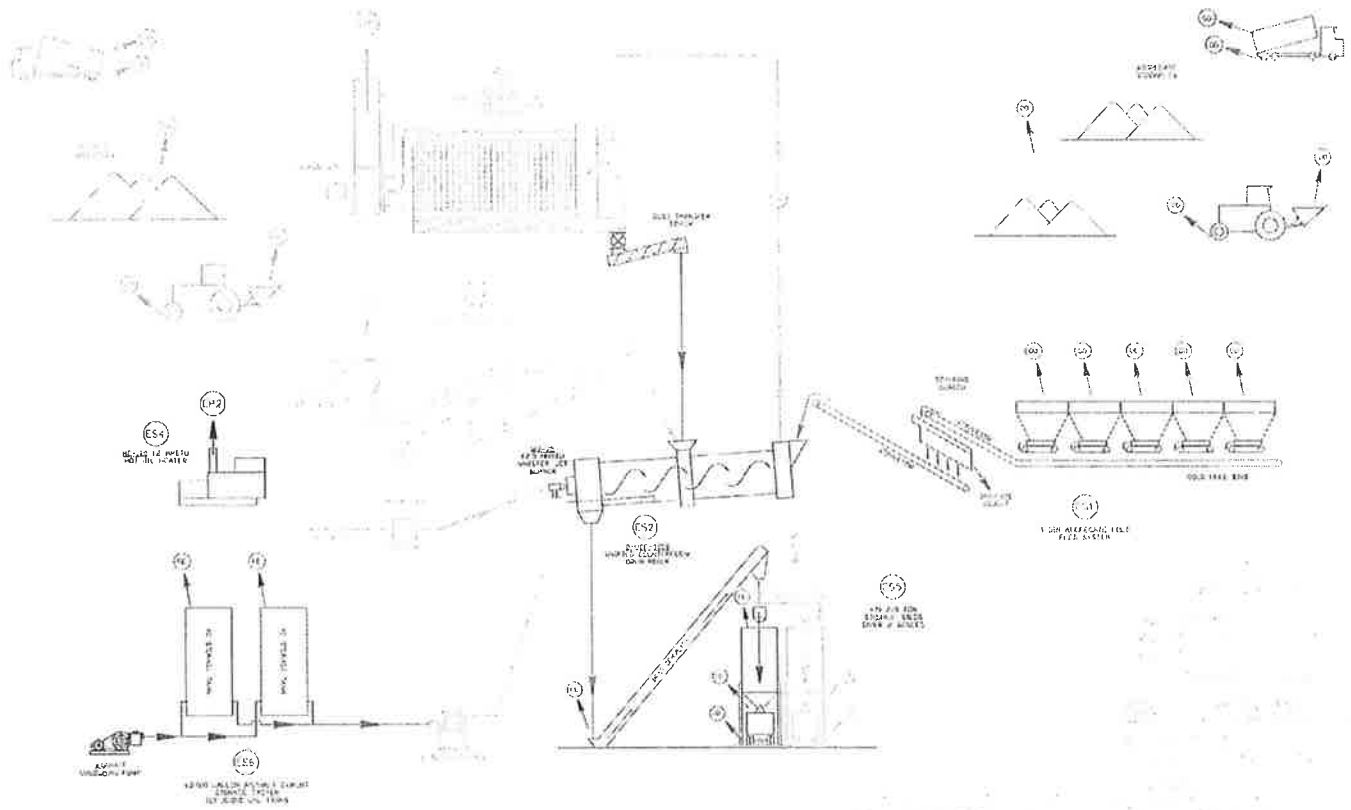
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¹ XSA - Excess Air

² SCFH - Standard Cubic Feet per Hour

**ATTACHMENT D: UNIDRUM
FACILITY FLOW DIAGRAM**

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Chattanooga-Hamilton County
Air Pollution Control Bureau

**ATTACHMENT E: LOW- NOX
BURNER LIMITATIONS**



Memo

To: Thomas Hopkins

From: Catherine Sutton Choate

CC:

Date: April 7, 2026

Re: Low-NOx Burner Limitations

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Chattanooga-Hamilton County
 Air Pollution Control Bureau

The Technical Secretary from Tennessee Department of Environment and Conservation (TDEC) determined in April 2005 that low-NOx burner technology is "reasonable and proper" [TAPCR 1200-03-07-0.07(2)] and "best equipment and technology" [TAPCR 1200-03-06-.03(2)]. However, this requirement has not been consistently applied across the state for hot mix asphalt plants.

A permitting workshop conducted in August 2025 for TDEC permit writers provided an update on this issue. The guidance specifically addressed diesel engines used at asphalt plants. This document (apc_general-permitting-information.pdf) however, still did not address aggregate dryer burners. I reached out to TDEC for clarification on the percent NOx reduction required for certification as a low-NOx unit. The guidance provided to me indicated minimum 50% NOx reduction is required for natural gas combustion. I was referred to AP-42 Table 1.3-14 for NOx control options for oil-fired boilers and their respective NOx reduction potential for oil combustion.

The combustion process varies significantly between boilers and aggregate dryer burners. A boiler heats a medium, typically water, indirectly within a carefully controlled pressure vessel. An aggregate dryer uses hot gases from a direct-fired burner to heat and dry materials within the rotating drum. These differences affect the anticipated emission rates from each burner type, as well as the emission reduction methods that can be employed. The following table compares each combustion process:

Combustion Characteristic	Boiler	Dryer Burner
Heat Transfer	Indirect. Heat transferred from hot gases to the desired medium through a heat exchanger. The entire	Direct, Convective, & Radiant. Hot gases are pulled through a rotating dryer drum to directly transfer heat to the materials

Combustion Characteristic	Boiler	Dryer Burner
	process is contained within a pressure vessel.	showered within the drum via convection. Materials are further heated via radiant heat from the burner flame within the combustion zone.
Operating Environment	Tightly controlled. Combustion occurs within a sealed pressure vessel using a precise air to fuel ratio. The burner firing rate is typically constant.	Variable operating conditions. Aggregate dryers process various materials. The interior of the drum is very dusty, and the moisture levels fluctuate significantly, which affects the volume of gases generated during the drying process. Burner firing rate is not constant - it varies based on production.
Process Goals	Maximum combustion efficiency. Conversion of chemical (fuel) energy to heat with minimal excess air, which in turn lowers fuel consumption.	Maximize material heating. Aggregate dryers at hot mix production facilities deal with drastically different operating conditions, even on an hourly basis, depending on the asphaltic concrete mixture being produced. The primary goal is to completely dry and heat the aggregate to ensure proper adhesion of the asphalt cement. This requires a delicate balance of operating temperatures, airflow within the drum, and dwell time of the materials to produce a suitable paving mixture.
Fuel / Air Mixing	Precise and controlled. The fuel/air ratio is strictly controlled to optimize combustion efficiency and lower emissions.	Rapid and turbulent. The burner must thoroughly mix the fuel and air in a very short time period and complete the combustion process within a turbulent combustion zone within a rotating dryer drum under negative pressure from a fan on a particulate control

Combustion Characteristic	Boiler	Dryer Burner
		device. Flighting must be properly designed and maintained to prevent impingement from aggregate falling through the flame.
Excess Air Limits	Low. Burners firing into boilers operate with minimal excess air to maximize combustion efficiency.	High. Aggregate dryer burners are designed to operate typically with 25% to 50% excess air depending on the fuel type and emission requirements.
Flame Characteristics	Stable. Flame diameter and length stability achievable due to flame shaping and consistent firing rate.	Variable. Firing rate varies with production rate, which is dependent on mix temperature, mix type, and material moistures. Flame is shaped for maximum firing rate only.
Fuel Versatility	Designed for consistent fuel. Most boilers are configured to only combust one fuel and are optimized accordingly.	Engineered for multiple fuels. Burners are often configured to combust multiple fuels based on availability and pricing. Some burners even burn multiple fuels simultaneously.

Emission Controls

Emissions from boilers are highly regulated throughout the United States. These combustion sources must meet stringent emission regulations. Many are fired on natural gas to lower emissions. Employing techniques such as low excess air (LEA) firing and technologies such as staged combustion (SC) and flue gas recirculation (FGR) are employed to lower emissions from oil-fired boilers. These NOx-control options are not feasible for dryer burners.

- **Low Excess Air (LEA) Firing** This technique involves reducing the amount of combustion air available to the burner, which is a rich fuel/air ratio. Aggregate dryer burners must operate at higher excess air, or lean fuel/air ratios, to ensure complete combustion is achieved. Employing low excess air firing causes flame instability for aggregate dryer burners.
- **Staged Combustion (SC)** This burner design combines injecting a rich fuel/air mixture into the combustion chamber and then using secondary injection ports to bring additional air into the chamber, which serves to lower flame temperature and limit thermal NOx formation. It is not possible to employ staged combustion for aggregate dryer burners because they are not firing into a sealed combustion chamber.
- **Burners out of Service (BOOS)** Many boilers employ multiple burners firing into the combustion chamber. For boilers utilizing four or more burners, one of the burners will push air

only, while the remaining burners are firing on a rich fuel/air ratio. An aggregate dryer is outfitted with a single burner, so this is not an option.

- **Flue Gas Recirculation (FGR)** This technique involves recirculating 25% - 30% of the flue gases back into the combustion chamber to deplete oxygen and cool the flame, both of which serve to restrict NO_x formation. This method results in a reduction in capacity and is best suited to new units.

Astec has experience employing this technique to control NO_x emissions at hot mix asphalt plants in California. The FGR system did result in a significant reduction in NO_x emissions. However, implementation also caused several unintended consequences:

1. **CO emissions increased significantly**, creating a balancing act to achieve compliance for both pollutants.
2. **System complexity:** Implementing FGR requires extensive ductwork, a fan, and a control system to modulate airflow based on firing rate. Recirculated air must be taken from the baghouse exhaust stack to minimize particulate matter in the gas stream. Otherwise, injecting PM into the burner flame causes incomplete combustion due to impingement.
3. **Condensation and corrosion:** Exhaust gases contain significant water vapor. The gas stream cooled and condensed during transport, even with insulated ducting, resulting in water dripping and corrosion. To combat this, the entire system—including burner, duct, and fan—had to be fabricated from 304 stainless steel.
4. **Production impact:** Recirculating 25%–30% of exhaust gases reduces production by a comparable percentage. This is unfeasible for existing plants replacing the burner. Even in new applications, it increases the capacity of all exhaust system components, leading to higher horsepower usage and increased production costs.

Astec discontinued use of FGR systems nearly 20 years ago due to these challenges. Instead, we focused on designing aggregate dryer burners that achieve a near-perfect homogeneous fuel/air mixture and burn rapidly to reduce NO_x emissions.

- **Talon Burners:** Employ a pre-mix design where natural gas and combustion air are blended within the burner body, not at the face.
- **Whisper Jet Burners:** Use patented technology to rapidly swirl high-energy combustion air to minimize emissions.

Both burner types can achieve a 50% reduction in NO_x emissions for natural gas combustion when properly tuned, operated, and maintained.

Oil Combustion:

Comparable NO_x reductions are not achievable for oil combustion. Oil must evaporate before ignition because liquids do not burn. Both Talon and Whisper Jet burners use compressed air atomization for fuel oils, creating an aerosol of fuel droplets with particle diameters around 100 microns.

- **Light oils (e.g., No. 2):** Readily atomize. A 35% NO_x reduction is achievable.
- **Heavy oils (No. 4 and higher) and recycled oils:** Require pre-heating to reduce viscosity sufficiently for adequate atomization. These fuels have high nitrogen content and often contain water and metal fragments, affecting combustibility and emissions. A 25% NO_x reduction is achievable under optimal conditions.



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Contaminated Aggregates:

NOx can also form from nitrates present in aggregates due to blasting residues from quarry operations. Aggregate dryer burners cannot control NOx emissions from contaminated aggregates.

Astec is committed to innovatively pushing the emissions capabilities of our combustion products to the highest levels of performance. At this time, technology is not available to allow our burners to consistently achieve the percent NOx reduction suggested by TDEC for oil combustion under all operating conditions during asphaltic concrete production. We appreciate your consideration regarding the specific constraints and operating environments associated with aggregate drying and hot mix asphalt (HMA) production. Please contact us with any comments or questions regarding this matter.

Best Regards,



Catherine Sutton Choate

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**ATTACHMENT F: GENERAL
PROCESS DESCRIPTION**

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**GENERAL PROCESS DESCRIPTION
ASPHALTIC CONCRETE PRODUCTION PLANT**

INTRODUCTION

This process description is for a typical Asphaltic Concrete production plant equipped with a UniDrum™ counterflow drum mixer and with other equipment manufactured by Dillman Equipment, a division of Astec, Inc., in Prairie du Chien, Wisconsin. A particular plant may have slightly different equipment, but its operation will be generally as described.

VIRGIN AGGREGATE STOCKPILE

Virgin aggregate, with average moisture of 5%, is stored in stockpiles. The stockpiles are separated by material size. Water can be sprayed on the stockpiles and the haul roads to control dust. Material is moved from the stockpiles to the cold feed bins by a wheeled front-end (bucket) loader.

RECYCLE AGGREGATE STOCKPILE

Recycled Asphalt Product (RAP), with average moisture of 5%, is stored in stockpiles. Water can be sprayed on the stockpiles and the haul roads to control dust. Material is moved from the stockpile to the recycle feed bins by a wheeled front-end (bucket) loader.

COLD FEED BINS AND VIRGIN AGGREGATE FEED SYSTEM

Damp virgin aggregate, of the correct size range, is placed in each cold feed bin by the front-end loader. Belt conveyors under each bin feed aggregate at the proper rate to the gathering conveyor. It is discharged from the gathering conveyor onto the scalping screen, mounted over the inclined conveyor to the UniDrum™ counterflow drum mixer. The screen removes any over sized or extraneous material from the aggregate. Once it has passed through the screen, the aggregate travels up the incline conveyor, across a weigh scale, discharging into the feed chute on the inlet end of the Double Barrel® drum. The weigh scale transmits instantaneous mass flow

rates to the computer in the control system. The computer regulates the speed of the coldfeed belt feeders to match the desired production rate.

UNIDRUM™ COUNTERFLOW DRUM MIXER

The UniDrum™ counterflow drum mixer is inclined from its material inlet end down to the discharge end. Flights in the drum, control the movement of the aggregate, also they shower the material to promote its drying, and heating. Special flights in the combustion zone prevent the showering of aggregate through the flame, while protecting the shell from excessive heat. These flights form a combustion space, so that the fuels can be efficiently burned without the aggregate showering through the flame.

The mixing zone is located downhill of the combustion zone. Here, the dried and heated aggregate is mixed with liquid asphalt cement (AC), dust returned from the baghouse, and ingredients such as RAP and various dry additives. The AC and RAP are introduced to the drum after the burner to segregate them from the hot gases generated in the drying zone. This greatly reduces the vaporizing of light ends from the asphalt, and the "blue smoke" which these hydrocarbon vapors cause. Vapors released in the mixing zone of the UniDrum™ are drawn into the combustion zone where they are burned.

BURNER AND FUEL SYSTEM

A direct-fired burner is mounted on the low end of the UniDrum™ counterflow drum mixer. The burner nose extends through the mixing zone into the combustion zone, roughly midpoint of the drum. Liquid fuel is pumped to the burner from the fuel tank. The burner furnishes the energy to dry and heat the aggregate. It can be ordered to burn various types and grades of fuels. It also can be equipped with sound attenuating equipment for quieter operation.

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GENERAL PROCESS DESCRIPTION

ASPHALTIC CONCRETE PRODUCTION PLANT

RECYCLE BIN AND FEED SYSTEM

RAP is fed at the desired rate from the recycle-bin belt feeder onto an inclined RAP conveyor. It then passes through a scalping screen, which removes over-sized or extraneous material, then onto the RAP conveyor. At certain facilities, rejected material from the scalping screen may be sent to through a "lump breaker", which break apart oversized pieces. Output from the "lump breaker" is returned to the scalping screen. The feed conveyor carries the RAP over a weighbridge section and feeds it into the RAP collar of the UniDrum™ counterflow drum mixer.

DRAG CHAIN

The finished HMA is discharged from the UniDrum™ counterflow drum mixer into the boot of the drag chain conveyor. This conveyor elevates the HMA to a "batcher" mounted above each storage bin. By dropping material into the surge bin in "batches", rather than a steady stream, segregation of the HMA is reduced. Any material, which is out of specification (as at start up and shut down), is dumped out the drag by pass chute for subsequent recycling.

STORAGE SILOS AND TRUCK LOADOUT

The storage silos serve two functions. First, they permit the plant to operate at an efficient steady rate with out regard for: the availability of trucks, or the need to frequently switch formulas (if the other mixes are stored in various silos). Secondly, they have the ability to store asphalt for several days without deterioration, by sealing out oxygen and preventing significant heat loss.

HOT LIQUID ASPHALT TANK AND FEED SYSTEM

A heated tank is used to store the AC. A pump and metering system transfer the AC to the

mixing zone of the UniDrum™ counterflow drum mixer. The tank can be directly fired or heated by hot oil flowing through coils. If the tank is direct fired, coils within the tank are used to heat oil.

HOT OIL HEATER

Hot oil is used to heat the AC lines, silo cones, and other components, which must be kept hot. The hot oil can be furnished by a separate hot oil heater, or can be scavenged from a direct-fired AC storage tank.

BAGHOUSE AND DUST RETURN SYSTEM

Exhaust gases from the UniDrum™ counterflow drum mixer travel to the baghouse, which is equipped with an inertial separator inlet section. Oversized particles are collected there. The air then is distributed to the bag chamber; where dust is collected on the outside of the bags. It passes through the built up dust cake, the bag fabric, and supporting wire bag cage up to the clean air plenum at the top of the baghouse.

Periodically, a short burst of high-pressure air is injected through the top, discharge end, of each bag. The back flow of gas through the bag causes most of the dust cake to drop off the outside. The dust falls into a hopper at the bottom of the baghouse. Screws in the hopper move the dust to a discharge point. It then passes through an air lock to transfer screws that carry the dust to the UniDrum™ for use in the mix.

EXHAUST AIR DISCHARGE; FAN AND STACK

The flow of gas through the baghouse and UniDrum™ counterflow drum mixer is

GENERAL PROCESS DESCRIPTION

ASPHALTIC CONCRETE PRODUCTION PLANT

induced by the exhaust fan. The flow of air is controlled by a modulating damper (positioned at the fan outlet) or VFD drive. Filtered air is discharged to the environment through the exhaust stack. The exhaust stack is equipped with test ports, which can be easily accessed from the top of the baghouse.

ADDITIVES

Additives, dry or liquid, as required by a particular mix formula, are stored in special silos or tanks for precise metering into the process.

CONTROLS

The plant operator in the control house controls the process system. Computers automatically regulate the flow of virgin aggregate, based on the mix formula and production rate, set by the plant operator. The flow of material is synchronized so that the computer can adjust the flow of AC to correspond to the actual flow of virgin aggregate past the injection point.

The control system also provides both normal burner safety interlocks, controls to regulate the temperature of the finished product, and modulates the airflow through the UniDrum™ counterflow drum mixer.

GreyRock Materials, LLC - Drum Hot-Mix Asphalt Plant
300 tons/hr @ 2,000 hr/yr = 600,000 tons/yr

SO₂ emissions from dryer burner:

$$\text{natural gas: } 300 \frac{\text{tons}}{\text{hr}} \cdot 0.0034 \frac{\text{lb}}{\text{ton}} = 1.02 \frac{\text{lb}}{\text{hr}}$$

$$\text{or } 82.5 \frac{\text{MMBtu}}{\text{hr}} \cdot \frac{10^6 \text{ ft}^3}{1,020 \text{ MMBtu}} \cdot 1.427 \frac{\text{lb}}{10^6 \text{ ft}^3}$$
$$= 0.115419 \frac{\text{lb}}{\text{hr}}$$

$$\frac{0.115419 \text{ lb/hr}}{300 \text{ tons/hr}} = 0.000385 \text{ lb/ton} < 0.1 \text{ lb/ton}$$

∴ 50% remains in product

$$0.5 \cdot 0.115419 \frac{\text{lb}}{\text{hr}} = 0.057710 \text{ lb/hr} < 1.02 \frac{\text{lb}}{\text{hr}}$$

$$\text{No. 2 fuel oil: } 300 \frac{\text{tons}}{\text{hr}} \cdot 0.011 \frac{\text{lb}}{\text{ton}} = 3.30 \frac{\text{lb}}{\text{hr}}$$

$$\text{or } 82.5 \frac{\text{MMBtu}}{\text{hr}} \cdot \frac{1 \text{ gal}}{0.14 \text{ MMBtu}} \cdot 0.144 \cdot 0.05 = 4.242857 \frac{\text{lb}}{\text{hr}}$$

$$\frac{4.242857 \text{ lb/hr}}{300 \text{ tons/hr}} = 0.0141 \text{ lb/ton} < 0.1 \text{ lb/ton}$$

∴ 50% remains in product

$$0.5 \cdot 4.242857 \frac{\text{lb}}{\text{hr}} = 2.121429 \text{ lb/hr} < 3.30 \frac{\text{lb}}{\text{hr}}$$

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Grey Rock Materials, LLC - Drum Mix Asphalt Plant - Potential Emissions

PM from dryer:

← 40 CFR 60, Subpart I

$$\text{filterable: } 0.04 \frac{\text{gr}}{\text{scf}} \cdot 31,567 \frac{\text{scf}}{\text{min}} \cdot 60 \frac{\text{min}}{\text{hr}} \cdot 2,000 \frac{\text{hr}}{\text{yr}} \cdot \frac{1 \text{ lb}}{7,000 \text{ gr}}$$

$$\cdot \frac{1 \text{ ton}}{2,000 \text{ lb}} = \underline{10.822971 \text{ tons/yr}}$$

$$\text{condensable: } (0.0074 + 0.012) \frac{\text{lb}}{\text{ton}} \cdot 300 \frac{\text{tons}}{\text{hr}} \cdot 2,000 \frac{\text{hr}}{\text{yr}}$$

$$\cdot \frac{1 \text{ ton}}{2,000 \text{ lb}} = \underline{5.820 \text{ tons/yr}}$$

SO_x from dryer:

$$82.5 \frac{\text{MMBtu}}{\text{hr}} \cdot \frac{1 \text{ gal}}{0.14 \text{ MMBtu}} \cdot 0.144 \cdot 0.05 \frac{\text{lb}}{\text{gal}} \cdot (1-0.5) \cdot 2,000 \frac{\text{hr}}{\text{yr}}$$

$$\cdot \frac{1 \text{ ton}}{2,000 \text{ lb}} = \underline{2.121429 \text{ tons/yr}}$$

$$\text{SO}_x \text{ from heater: } 1.6 \frac{\text{MMBtu}}{\text{hr}} \cdot \frac{1 \text{ gal}}{0.14 \text{ MMBtu}} \cdot 0.144 \cdot 0.05 \frac{\text{lb}}{\text{gal}} \cdot 8,760 \frac{\text{hr}}{\text{yr}}$$

$$\cdot \frac{1 \text{ ton}}{2,000 \text{ lb}} = \underline{0.360411 \text{ ton/yr}}$$

$$\text{NO}_x \text{ from dryer: } 0.055 \frac{\text{lb}}{\text{ton}} \cdot (1-0.35) \cdot 300 \frac{\text{tons}}{\text{hr}} \cdot 2,000 \frac{\text{hr}}{\text{yr}}$$

$$\cdot \frac{1 \text{ ton}}{2,000 \text{ lb}} = \underline{10.725 \text{ tons/yr}}$$

$$\text{NO}_x \text{ from heater: } 1.6 \frac{\text{MMBtu}}{\text{hr}} \cdot 0.115 \frac{\text{lb}}{\text{MMBtu}} \cdot 8,760 \frac{\text{hr}}{\text{yr}} \cdot \frac{1 \text{ ton}}{2,000 \text{ lb}}$$

$$= \underline{0.80592 \text{ ton/yr}}$$

$$\text{CO from dryer: } 0.13 \frac{\text{lb}}{\text{ton}} \cdot 300 \frac{\text{tons}}{\text{hr}} \cdot 2,000 \frac{\text{hr}}{\text{yr}} \cdot \frac{1 \text{ ton}}{2,000 \text{ lb}}$$

$$= \underline{39.0 \text{ tons/yr}}$$

$$\text{CO from heater: } 1.6 \frac{\text{MMBtu}}{\text{hr}} \cdot 0.037 \frac{\text{lb}}{\text{MMBtu}} \cdot 8,760 \frac{\text{hr}}{\text{yr}} \cdot \frac{1 \text{ ton}}{2,000 \text{ lb}}$$

$$= \underline{0.259296 \text{ ton/yr}}$$

$$\text{VOC from dryer: } 0.032 \frac{\text{lb}}{\text{ton}} \cdot 300 \frac{\text{tons}}{\text{hr}} \cdot 2,000 \frac{\text{hr}}{\text{yr}} \cdot \frac{1 \text{ ton}}{2,000 \text{ lb}}$$

$$= \underline{9.60 \text{ tons/yr}}$$

$$\text{VOC from heater: } 1.6 \frac{\text{MMBtu}}{\text{hr}} \cdot 0.038 \frac{\text{lb}}{\text{MMBtu}} \cdot 8,760 \frac{\text{hr}}{\text{yr}} \cdot \frac{1 \text{ ton}}{2,000 \text{ lb}}$$

$$= \underline{0.266304 \text{ ton/yr}}$$

$$\text{PM from heater: } 1.6 \frac{\text{MMBtu}}{\text{hr}} \cdot \frac{1 \text{ gal}}{0.14 \text{ MMBtu}} \cdot \frac{3.3 \text{ lb}}{1,000 \text{ gal}} \cdot 8,760 \frac{\text{hr}}{\text{yr}}$$

$$\cdot \frac{1 \text{ ton}}{2,000 \text{ lb}} = \underline{0.165189 \text{ ton/yr}}$$

PM from silos:

$$\left[0.000332 + 0.00105 \cdot 0.5 \cdot e^{(0.0251 \cdot [325+460] - 20.43)} \right] \cdot 300 \frac{\text{tons}}{\text{hr}} \cdot 2,000 \frac{\text{hr}}{\text{yr}} \cdot \frac{1 \text{ ton}}{2,000 \text{ lb}} = \underline{0.175767 \text{ ton/yr}}$$

PM from loadout:

$$\left[0.000181 + 0.00141 \cdot 0.5 \cdot e^{(0.0251 \cdot [325+460] - 20.43)} \right] \cdot 300 \frac{\text{tons}}{\text{hr}} \cdot 2,000 \frac{\text{hr}}{\text{yr}} \cdot \frac{1 \text{ ton}}{2,000 \text{ lb}} = \underline{0.156581 \text{ ton/yr}}$$

VOC from silos:

$$\left[0.0504 \cdot 0.5 \cdot e^{(0.0251 \cdot [325+460] - 20.43)} \right] \cdot 300 \frac{\text{tons}}{\text{hr}} \cdot 2,000 \frac{\text{hr}}{\text{yr}} \cdot \frac{1 \text{ ton}}{2,000 \text{ lb}} = \underline{3.656006 \text{ tons/yr}}$$

VOC from loadout:

$$\left[0.0172 \cdot 0.5 \cdot e^{(0.0251 \cdot [325+460] - 20.43)} \right] \cdot 300 \frac{\text{tons}}{\text{hr}} \cdot 2,000 \frac{\text{hr}}{\text{yr}} \cdot \frac{1 \text{ ton}}{2,000 \text{ lb}} = \underline{1.247684 \text{ tons/yr}}$$

CO from silos:

$$\left[0.00488 \cdot 0.5 \cdot e^{(0.0251 \cdot [325+460] - 20.43)} \right] \cdot 300 \frac{\text{tons}}{\text{hr}} \cdot 2,000 \frac{\text{hr}}{\text{yr}} \cdot \frac{1 \text{ ton}}{2,000 \text{ lb}} = \underline{0.353994 \text{ ton/yr}}$$

CO from loadout:

$$\left[0.00558 \cdot 0.5 \cdot e^{(0.0251 \cdot [325+460] - 20.43)} \right] \cdot 300 \frac{\text{tons}}{\text{hr}} \cdot 2,000 \frac{\text{hr}}{\text{yr}} \cdot \frac{1 \text{ ton}}{2,000 \text{ lb}} = \underline{0.404772 \text{ ton/yr}}$$

VOC from asphalt cement tanks:

$$P_v = 10^{\left[\frac{-0.05223 \cdot 75,350.06}{(325+459.67)^{1.8}} + 9.00346 \right]} = 0.94517289 \text{ mm Hg}$$

$$0.94517289 \text{ mm Hg} \cdot \frac{14.69594878 \text{ psi}}{760.001 \text{ mm Hg}} = 0.01827657 \text{ psi @ } 325^\circ\text{F}$$

$$\text{(assume } K_N = 1) L_w = 30,000 \frac{\text{lb}}{\text{hr}} \cdot \frac{1 \text{ gal (60}^\circ\text{F)}}{8.67 \text{ lb}} \cdot \frac{1 \text{ gal (325}^\circ\text{F)}}{0.9105 \text{ gal (60}^\circ\text{F)}}$$

$$\cdot 0.01245674838 \frac{\text{lb-mol} \cdot ^\circ\text{R}}{\text{psi} \cdot \text{gal}} \cdot 0.01827657 \text{ psi} \cdot 105 \frac{\text{lb}}{\text{lb-mol}} \cdot \frac{1}{(325+459.67)^\circ\text{R}}$$

$$\cdot 2,000 \frac{\text{hr}}{\text{yr}} \cdot \frac{1 \text{ ton}}{2,000 \text{ lb}} = \underline{0.115777 \text{ ton/yr}}$$

$$\text{PM: } (10.822971 + 5.820 + 0.165189 + 0.175767 + 0.156581) \frac{\text{tons}}{\text{yr}} \\ = 17.14 \text{ tons/yr}$$

$$\text{NO}_x: (10.725 + 0.80592) \frac{\text{tons}}{\text{yr}} = 11.53 \text{ tons/yr}$$

$$\text{CO: } (39.0 + 0.259296 + 0.353994 + 0.404772) \text{ tons/yr} \\ = 40.02 \text{ tons/yr}$$

$$\text{VOC: } (9.60 + 0.266304 + 3.656006 + 1.247684 + 0.115777) \\ \frac{\text{tons}}{\text{yr}} = 14.89 \text{ tons/yr}$$

$$\text{SO}_x: (2.121429 + 0.360411) \frac{\text{tons}}{\text{yr}} = 2.48 \text{ tons/yr}$$

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Table 11.1-7. EMISSION FACTORS FOR CO, CO₂, NO_x, AND SO₂ 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 CO₂ and SO₂ 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 CO₂ 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 SO₂) of 0.1 lb/ton of product, is expected to be retained in the product, with the remainder emitted as SO₂.
- ^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 11.1-14. 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.

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:

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

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:

$$\begin{aligned} A &= 75,350.06 \\ B &= 9.00346 \end{aligned}$$

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

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

where:

$$\begin{aligned} P &= \text{vapor pressure, mm Hg} \\ T &= \text{absolute temperature, Kelvin} \end{aligned}$$

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.

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- All emission factors were revised and new factors were added. For selected pollutant emissions, separate factors were developed for distillate 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.



TEMPERATURE-VOLUME CORRECTIONS FOR ASPHALTIC MATERIALS (CUSTOMARY UNITS)

GROUP 0 – SPECIFIC GRAVITY AT 60°F ABOVE 0.966

LEGEND: **t** = Observed Temperature in Degrees Fahrenheit

M = Multiplier for Correcting Oil Volumes to the Basis of 60°F

t	M	t	M	t	M	t	M	t	M
0	1.0211	50	1.0035	100	0.9861	150	0.9689	200	0.9520
1	1.0208	51	1.0031	101	0.9857	151	0.9686	201	0.9516
2	1.0204	52	1.0028	102	0.9854	152	0.9682	202	0.9513
3	1.0201	53	1.0024	103	0.9851	153	0.9679	203	0.9509
4	1.0197	54	1.0021	104	0.9847	154	0.9675	204	0.9506
5	1.0194	55	1.0017	105	0.9844	155	0.9672	205	0.9503
6	1.0190	56	1.0014	106	0.9840	156	0.9669	206	0.9499
7	1.0186	57	1.0010	107	0.9837	157	0.9665	207	0.9496
8	1.0183	58	1.0007	108	0.9833	158	0.9662	208	0.9493
9	1.0179	59	1.0003	109	0.9830	159	0.9658	209	0.9489
10	1.0176	60	1.0000	110	0.9826	160	0.9655	210	0.9486
11	1.0172	61	0.9997	111	0.9823	161	0.9652	211	0.9483
12	1.0169	62	0.9993	112	0.9819	162	0.9648	212	0.9479
13	1.0165	63	0.9990	113	0.9816	163	0.9645	213	0.9476
14	1.0162	64	0.9986	114	0.9813	164	0.9641	214	0.9472
15	1.0158	65	0.9983	115	0.9809	165	0.9638	215	0.9469
16	1.0155	66	0.9979	116	0.9806	166	0.9635	216	0.9466
17	1.0151	67	0.9976	117	0.9802	167	0.9631	217	0.9462
18	1.0148	68	0.9972	118	0.9799	168	0.9628	218	0.9459
19	1.0144	69	0.9969	119	0.9795	169	0.9624	219	0.9456
20	1.0141	70	0.9965	120	0.9792	170	0.9621	220	0.9452
21	1.0137	71	0.9962	121	0.9788	171	0.9618	221	0.9449
22	1.0133	72	0.9958	122	0.9785	172	0.9614	222	0.9446
23	1.0130	73	0.9955	123	0.9782	173	0.9611	223	0.9442
24	1.0126	74	0.9951	124	0.9778	174	0.9607	224	0.9439
25	1.0123	75	0.9948	125	0.9775	175	0.9604	225	0.9436
26	1.0119	76	0.9944	126	0.9771	176	0.9601	226	0.9432
27	1.0116	77	0.9941	127	0.9768	177	0.9597	227	0.9429
28	1.0112	78	0.9937	128	0.9764	178	0.9594	228	0.9426
29	1.0109	79	0.9934	129	0.9761	179	0.9590	229	0.9422
30	1.0105	80	0.9930	130	0.9758	180	0.9587	230	0.9419
31	1.0102	81	0.9927	131	0.9754	181	0.9584	231	0.9416
32	1.0098	82	0.9923	132	0.9751	182	0.9580	232	0.9412
33	1.0095	83	0.9920	133	0.9747	183	0.9577	233	0.9409
34	1.0091	84	0.9916	134	0.9744	184	0.9574	234	0.9405
35	1.0088	85	0.9913	135	0.9740	185	0.9570	235	0.9402
36	1.0084	86	0.9909	136	0.9737	186	0.9567	236	0.9399
37	1.0081	87	0.9906	137	0.9734	187	0.9563	237	0.9395
38	1.0077	88	0.9902	138	0.9730	188	0.9560	238	0.9392
39	1.0074	89	0.9899	139	0.9727	189	0.9557	239	0.9389
40	1.0070	90	0.9896	140	0.9723	190	0.9553	240	0.9385
41	1.0067	91	0.9892	141	0.9720	191	0.9550	241	0.9382
42	1.0063	92	0.9889	142	0.9716	192	0.9547	242	0.9379
43	1.0060	93	0.9885	143	0.9713	193	0.9543	243	0.9375
44	1.0056	94	0.9882	144	0.9710	194	0.9540	244	0.9372
45	1.0053	95	0.9878	145	0.9706	195	0.9536	245	0.9369
46	1.0049	96	0.9875	146	0.9703	196	0.9533	246	0.9365
47	1.0046	97	0.9871	147	0.9699	197	0.9530	247	0.9362
48	1.0042	98	0.9868	148	0.9696	198	0.9526	248	0.9359
49	1.0038	99	0.9864	149	0.9693	199	0.9523	249	0.9356

TEMPERATURE-VOLUME CORRECTIONS FOR ASPHALTIC MATERIALS (CUSTOMARY UNITS)

GROUP 0 – SPECIFIC GRAVITY AT 60°F ABOVE 0.966
LEGEND: t = Observed Temperature in Degrees Fahrenheit
M = Multiplier for Correcting Oil Volumes to the Basis of 60°F

t	M	t	M	t	M	t	M	t	M
250	0.9352	300	0.9187	350	0.9024	400	0.8864	450	0.8705
251	0.9349	301	0.9184	351	0.9021	401	0.8861	451	0.8702
252	0.9346	302	0.9181	352	0.9018	402	0.8857	452	0.8699
253	0.9342	303	0.9177	353	0.9015	403	0.8854	453	0.8696
254	0.9339	304	0.9174	354	0.9011	404	0.8851	454	0.8693
255	0.9336	305	0.9171	355	0.9008	405	0.8848	455	0.8690
256	0.9332	306	0.9167	356	0.9005	406	0.8845	456	0.8687
257	0.9329	307	0.9164	357	0.9002	407	0.8841	457	0.8683
258	0.9326	308	0.9161	358	0.8998	408	0.8838	458	0.8680
259	0.9322	309	0.9158	359	0.8995	409	0.8835	459	0.8677
260	0.9319	310	0.9154	360	0.8992	410	0.8832	460	0.8674
261	0.9316	311	0.9151	361	0.8989	411	0.8829	461	0.8671
262	0.9312	312	0.9148	362	0.8986	412	0.8826	462	0.8668
263	0.9309	313	0.9145	363	0.8982	413	0.8822	463	0.8665
264	0.9306	314	0.9141	364	0.8979	414	0.8819	464	0.8661
265	0.9302	315	0.9138	365	0.8976	415	0.8816	465	0.8658
266	0.9299	316	0.9135	366	0.8973	416	0.8813	466	0.8655
267	0.9296	317	0.9132	367	0.8969	417	0.8810	467	0.8652
268	0.9293	318	0.9128	368	0.8966	418	0.8806	468	0.8649
269	0.9289	319	0.9125	369	0.8963	419	0.8803	469	0.8646
270	0.9286	320	0.9122	370	0.8960	420	0.8800	470	0.8643
271	0.9283	321	0.9118	371	0.8957	421	0.8797	471	0.8640
272	0.9279	322	0.9115	372	0.8953	422	0.8794	472	0.8636
273	0.9276	323	0.9112	373	0.8950	423	0.8791	473	0.8633
274	0.9273	324	0.9109	374	0.8947	424	0.8787	474	0.8630
275	0.9269	325	0.9105	375	0.8944	425	0.8784	475	0.8827
276	0.9266	326	0.9102	376	0.8941	426	0.8781	476	0.8624
277	0.9263	327	0.9099	377	0.8937	427	0.8778	477	0.8621
278	0.9259	328	0.9096	378	0.8934	428	0.8775	478	0.8618
279	0.9256	329	0.9092	379	0.8931	429	0.8772	479	0.8615
280	0.9253	330	0.9089	380	0.8928	430	0.8768	480	0.8611
281	0.9250	331	0.9086	381	0.8924	431	0.8765	481	0.8608
282	0.9246	332	0.9083	382	0.8921	432	0.8762	482	0.8605
283	0.9243	333	0.9079	383	0.8918	433	0.8759	483	0.8602
284	0.9240	334	0.9076	384	0.8915	434	0.8756	484	0.8599
285	0.9236	335	0.9073	385	0.8912	435	0.8753	485	0.8596
286	0.9233	336	0.9070	386	0.8908	436	0.8749	486	0.8593
287	0.9230	337	0.9066	387	0.8905	437	0.8746	487	0.8590
288	0.9227	338	0.9063	388	0.8902	438	0.8743	488	0.8587
289	0.9223	339	0.9060	389	0.8899	439	0.8740	489	0.8583
290	0.9220	340	0.9057	390	0.8896	440	0.8737	490	0.8580
291	0.9217	341	0.9053	391	0.8892	441	0.8734	491	0.8577
292	0.9213	342	0.9050	392	0.8889	442	0.8731	492	0.8574
293	0.9210	343	0.9047	393	0.8886	443	0.8727	493	0.8571
294	0.9207	344	0.9044	394	0.8883	444	0.8724	494	0.8568
295	0.9204	345	0.9040	395	0.8880	445	0.8721	495	0.8565
296	0.9200	346	0.9037	396	0.8876	446	0.8718	496	0.8562
297	0.9197	347	0.9034	397	0.8873	447	0.8715	497	0.8559
298	0.9194	348	0.9031	398	0.8870	448	0.8712	498	0.8556
299	0.9190	349	0.9028	399	0.8867	449	0.8709	499	0.8552