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Rock Crushing Plants

Air Permits Division

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Technical Guidance for
Rock Crushing Plants

This Package Is Intended For Instructional Use Only

The intent of this guidance document is to provide the applicant information on how to calculate emission rates for rock crushing plants. Emission rate calculations are required to be submitted during the permit application process. It is the goal of the Air Permits Division to provide the most current emission rate factors and calculation methods in this document; however, the applicant should contact the Mechanical Team of the Air Permits Division to ensure these methods have not been superceded. Alternate calculation methods may be equally acceptable if they are based on, and adequately demonstrate, sound engineering assumptions or data.

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Section I

A. Introduction

This document provides guidance specifically for **rock crushing plant permit applications**. Use of this document helps streamline the Texas Commission on Environmental Quality (TCEQ) permitting process and decreases the time required for a permit review. This document may also be used for any nonmetallic mineral crushing/screening facility. It is important to remember that all application representations, such as production rates, crushing rates, number of screens, become conditions upon which a permit is issued or renewed.

B. Best Available Control Technology Analysis

Texas Commission on Environmental Quality, 30 Texas Administrative Code Chapter116 § 116.111(3) requires that to be granted a permit or a permit amendment to construct or modify a facility that the applicant must use Best Available Control Technology (BACT). Best Available Control Technology is the emission reduction method which provides the most effective reduction of emissions yet is technically feasible and economically reasonable. The control technology determinations are always subject to adjustment in consideration of specific process requirements and recent developments in abatement technology and can be modified on a case-by-case basis. Additionally, specific health effects concerns may require stricter control methods than imposed by the BACT determination. The applicant is required to discuss the BACT proposals in the permit application. The TCEQ offers a BACT guidance document entitled, to aid the applicant in this process. Any questions concerning the BACT review process may be directed to a TCEQ Air Permit Division Permit Reviewer. Current practices to meet BACT expected performance levels include:

1. A minimum of 70% reduction of fugitive dust emissions from the crushing, conveying, and stockpiling of aggregate material (sufficient application of water by sprays or fog rings).

2. A minimum of 70% reduction of fugitive dust emissions from all vibrating screens.

3. The implementation of best management practices to reduce fugitive dust emissions from roads and traffic areas (watering, application of environmentally safe chemicals, wet or dry sweeping, in certain locations paving may be required) as stated in the Special Conditions of the permit.

These are guidelines to help the applicant get an idea of what the TCEQ is currently considering as BACT; however these control levels are subject to change. Any BACT proposal that is different from the current guidelines stated above must be explained in detail. Any control system alternative is expected to be well designed, engineered for its application, and detailed in the permit application.

C. Rock Crushers

Rock and crushed stone products are generally loosened at the quarry site by drilling and/or blasting. At the quarry, the materials are loaded by power shovel or front end loader and transported by heavy earth moving equipment to the location of the processing equipment. Further processing may include crushing, screening, other size classification, material handling and storage operations. All of these processes can be significant sources of dust emissions if uncontrolled. Emissions rates must be determined for each point, beginning with the initial loading of rock and fractured stone products into the processing area and every point through the storage and loading of the final product. Emission points at these facilities occur at all feed hoppers, crushers, screens, transfer and drop points, conveyors, and material stockpiles. The quarry, mine, or blasting event is not a required emission point and not included in the calculations.

D. Control Factors

The applicant must be cautious in the use of control factors. Control factors are parameters used to give credit for certain emission reduction techniques. A control factor may be applied to each applicable emission point when calculating the emission rates. The emission factor table (Table 6) supplied with this document lists both uncontrolled and controlled emission factors. The use of the appropriate controlled emission factor from this table implies the material has a minimum of 1.5% moisture content. When the controlled factor is used then no further control is allowed for the addition of water from sprays (sprays will be required to be installed on certain emission points) or for the fact the material is wet. Any additional control must come from a different mechanism, such as enclosure, saturation, foam surfactant. When the applicant is using the controlled emission factor only, the proper numerical entry into the calculation table for the control factor (CF) parameter is one.

E. Engines And Generator Sets

Occasionally, a rock crushing plant requires the use of diesel fueled engines to operate plant equipment (not including trucks or front-end loaders) and/or a diesel fueled generator set for electrical power. These engines are a source of air contaminants and must be permitted. The appropriate table (Table 29) must be submitted with the application, as well as, emission calculations for each engine. When a permit for a portable rock crushing plant is being applied for and the expected stay at any one location is less than 12 consecutive months, then the portable generator set may not require permitting. However, if a diesel engine is attached to a crusher (or other equipment) as its sole source of power then an authorization for this engine is required regardless of the length of stay at a site. An alternative method of getting an authorization for an engine is through Chapter 106, Exemptions from Permitting, under Permit by Rule 106.512. The application requirements for Permit by Rule 106.512 are stated in the rule and must be submitted in a separate application package.

Section III

Emission Calculation Instructions

A. Introduction

The following is a list of required TCEQ Tables. The tables are available through the TCEQ web site or in hard copy form from the Air Permits Division. Include the completed tables with the permit application.

Table	*Title*
1(a)	Emission Sources
2	Material Balance
17	Rock Crushers

B. Crusher Emissions

The data required in the upper portion of Table 1- Crusher Emissions on the next page, is used to calculate the hourly and annual emissions at each crusher. Use equations E_1-E_4 that follow the table to perform crusher emission calculations and record the results in the lower portion of the table. Use Table 6 to select an appropriate emission factor for each crusher type at the site.

Table 1 - Crusher Emissions

	Crusher*	Crusher	Crusher
HP = maximum hourly production rate (tons/hr)			
AP = maximum annual production rate (tons/yr)			
EF (PM) = emission factor (lb PM/ton) - ***see Table 6***			
EF (PM_{10}) = emission factor (lb PM_{10}/ton)- ***see Table 6***			
CF = control factor - ***see Table 7***			
E_1 = hourly PM emissions (lbs/hr)			
E_2 = hourly PM_{10} emissions (lbs/hr)			
E_3 = annual PM emissions (tons/yr)			
E_4 = annual PM_{10} emissions (tons/yr)			

Table 1 Equations:

***Note:** There are often differences in industry regarding the identification of crushers. Typically, the first crusher in a series is the "Primary" crusher. However, the applicant shall use the Primary Crushing (Jaw) emission factor for jaw crushers only. All other types of crushers are considered either "Secondary" or "Tertiary." The corresponding emission factors are selec
ted.

$$E_1 = HP \times EF(PM) \times CF$$

$$E_2 = HP \times EF(PM_{10}) \times CF$$

$$E_3 = AP \times EF(PM) \times CF \times \left(\frac{1\ ton}{2000\ lbs} \right)$$

$$E_4 = AP \times EF(PM_{10}) \times CF \times \left(\frac{1\ ton}{2000\ lbs} \right)$$

C. Screen Emissions

Repeat the maximum hourly and annual throughput information to calculate the hourly and annual emissions for each vibrating and/or stationary screen. Use the factors from Tables 7 and 8 and the equations following Table 2. Record the results in the lower portion.

NOTE: if the material being crushed is considered to be "fines," the "fines" emission factors on Table 6 need to be used.

Table 2 - Screen Emissions

	Screen #1	**Screen #2**	**Screen #3**
HP = maximum hourly throughput rate (tons/hr)			
AP = maximum annual throughput rate (tons/yr)			
EF(PM) = emission factor (lb PM/ton) - ***see Table 6***			
EF(PM_{10}) = emission factor (lb PM_{10}/ton) - ***see Table 6***			
CF = control factor - ***see Table 7***			
E_5 = hourly PM emissions (lbs/hr)			
E_6 = hourly PM_{10} emissions (lbs/hr)			
E_7 = annual PM emissions (tons/yr)			
E_8 = annual PM_{10} emissions (tons/yr)			

$$E_5 = HP \times EF(PM) \times CF$$

$$E_7 = AP \times EF(PM) \times CF \times \left(\frac{1\ ton}{2000\ lbs} \right)$$

$$E_8 = AP \times EF(PM_{10}) \times CF \times \left(\frac{1\ ton}{2000\ lbs} \right)$$

$$E_6 = HP \times EF(PM_{10}) \times CF$$

D. Loading and Unloading Emissions

Repeat the maximum hourly and annual throughput information to calculate the hourly and annual emissions for each loading point (truck and/or rail car). Use the factors from Tables 7 and 8 and the equations following Table 3. Record the results in the lower portion.

Table 3 - Loading and Unloading Emissions

	Unloading (Fragmented Stone)	**Loading (Crushed Stone)**	**Front-End Loaders**
HP = maximum hourly throughput rate (tons/hr)			
AP = maximum annual throughput rate (tons/yr)			
EF(PM) = emission factor (lb PM/ton) - ***see Table 6***			
EF(PM_{10})= emission factor (lb PM_{10}/ton) - ***see Table 6***			
CF = control factor - ***see Table 7***			
E_9 = hourly PM emissions (lbs/hr)			
E_{10} = hourly PM_{10} emissions (lbs/hr)			
E_{11} = annual PM emissions (tons/yr)			
E_{12} = annual PM_{10} emissions (tons/yr)			

$$E_9 = HP \times EF(PM) \times CF$$

$$E_{12} = AP \; x \; EF(PM_{10}) \; x \; CF \; x \; \left(\frac{1 \; ton}{2000 \; lbs} \right)$$

$$E_{10} = HP \times EF(PM_{10}) \times CF$$

$$E_{11} = AP \; x \; EF(PM) \; x \; CF \; x \; \left(\frac{1 \; ton}{2000 \; lbs} \right)$$

E. Transfer Point Emissions

Batch and continuous transfer points occur at various locations in the process. Use the maximum hourly and annual throughput through each transfer point to calculate the hourly and annual emissions. If several points have the same characteristics (controls, through puts) enter the number (“N”) of like points to decrease the number of calculations required. A second table is provided for additional transfer point calculations, as necessary.

Use the appropriate emission factors for conveyor transfer from Table 6. If a single conveyor belt length exceeds 300 feet in length, use an additional calculation labeled “Conveying.” Use the equations that follow Table 4. Record the results in the lower portion.

Note: The applicant may use the drop point equation from AP-42 (Chapter 13) to evaluate drop/transfer points (continuous or batch) if so desired

The material transfer point onto a stockpile either from a conveyor or a radial stacker is not considered in these calculations. Emissions generated due to a transfer (either continuous or batch) onto a stockpile are considered in the stockpile emissions calculations. The emission factor identified for stockpiles includes emissions from the transfer onto the stockpile. Further discussion of this concept is found in the stockpile calculation instructions.

Table 4 - Transfer Point Emissions

	#1	#2	#3	#4	#5	#6
Transfer Point Identification						
HP = max. hourly throughput rate for the transfer point (tons material / hour)						
AP = max. annual throughput rate for the transfer point (tons material / year)						
N = number of like transfer points						
Percentage of total throughput thru like transer points	100%					
EF(PM) = emission factor (lb PM/ton) - ***see Table 6***						
EF(PM_{10})=emission factor (lb PM_{10}/ton) ***-see Table 6***						
CF = control factor - ***see Table 7***						
E_{13} = hourly PM emissions (lbs/hr)						
E_{14} = hourly PM_{10} emissions (lbs/hr)						
E_{15} = annual PM emissions (tons/yr)						
E_{16} = annual PM_{10} emissions (tons/yr)						

Table 4 Continued - Transfer Point Emissions

	#7	#8	#9	#10	#11	#12
Transfer Point Identification						
HP = max. hourly throughput rate for the transfer point (tons material / hour)						
AP = max. annual throughput rate for the transfer point (tons material / year)						
N = number of like transfer points						
Percentage of total throughput thru like transfer points						
EF(PM) = emission factor (lb PM/ton) - ***see Table 6***						
EF(PM_{10})=emission factor (lb PM_{10}/ton) -***see Table 6***						
CF = control factor - ***see Table 7***						
E_{13} = hourly PM emissions (lbs/hr)						
E_{14} = hourly PM_{10} emissions (lbs/hr)						
E_{15} = annual PM emissions (tons/yr)						
E_{16} = annual PM_{10} emissions (tons/yr)						

$$E_{13} = HP \times EF(PM) \times CF \times N$$

$$E_{15} = AP \ x \ EF(PM) \ x \ CF \ x \ \left(\frac{1 \ ton}{2000 \ lbs} \right) \times N$$

$$E_{14} = HP \times EF(PM_{10}) \times CF \times N$$

$$E_{16} = AP \ x \ EF(PM_{10}) \ x \ CF \ x \ \left(\frac{1 \ ton}{2000 \ lbs} \right) \times N$$

F. Stockpile Emissions

Material stockpiles are a potential source of fugitive emissions due to maintenance of the stockpile and wind erosion. Inactive stockpiles are those affected by wind erosion only. Active stockpiles are those piles that have 8 to 12 hours of activity per 24 hours. Active stockpiles include the following distinct source operations in the storage cycle: loading of rock onto storage piles (batch or continuous drop), equipment traffic in storage areas, and wind erosion of the pile. The active stockpile emission factor includes all three operations above. Calculate stockpile emissions on an hourly and annual basis. Please note, only the annual emission rate will be annotated in the permit.

Record the maximum acreage expected to be covered by stockpiles and the maximum expected active days to calculate the hourly and annual emissions for the stockpile. Use the equations following Table 5. Record the results in the lower portion.

Table 5 - Stockpile Emissions

A = Stockpile Area (acres) *	
CF = Control Factor - ***see Table 7***	
D = number of active days per year	
E_{17H} = PM emission for inactive stockpiles (lbs/hr)	
E_{17} = PM emissions for inactive stockpiles (tons/yr)	
E_{18H} = PM_{10} emissions for inactive stockpiles (lbs/hr)	
E_{18} = PM_{10} emissions for inactive stockpiles (tons/yr)	
E_{19H} = PM emissions for active stockpiles (lbs/hr)	
E_{19} = PM emissions for active stockpiles (tons/yr)	
E_{20H} = PM_{10} emissions for active stockpiles (lbs/hr)	
E_{20} = PM_{10} emissions for active stockpiles (tons/yr)	

* Acreage may be estimated by dividing the stockpile square footage by 43,560.

$$E_{17_H} = (\frac{3.5\ lb\ PM}{acre\ day}) \times (\frac{day}{24\ hours}) \times A \times CF$$

$$E_{17} = (\frac{3.5\ lb\ PM}{acre\ day}) \times (\frac{365\ days - D}{year}) \times A \times (\frac{1\ ton}{2000\ lbs}) \times CF$$

$$E_{18_H} = 0.5 \times E_{17_H}$$

$$E_{18} = 0.5 \times E_{17}$$

$$E_{19_H} = (\frac{13.2\ lb\ PM}{acre\ day}) \times (\frac{day}{24\ hours}) \times A \times CF$$

$$E_{19_H} = (\frac{13.2\ lb\ PM}{acre\ day}) \times (\frac{day}{24\ hours}) \times A \times CF$$

$$E_{19_H} = (\frac{13.2\ lb\ PM}{acre\ day}) \times (\frac{day}{24\ hours}) \times A \times CF$$

$$E_{19_H} = (\frac{13.2\ lb\ PM}{acre\ day}) \times (\frac{day}{24\ hours}) \times A \times CF$$

$$E_{20_H} = 0.5 \times E_{19_H}$$

$$E_{20} = 0.5 \times E_{19}$$

Table 6 - Summary of Rock Crushing Plant Emission Factors

Emission Source[a]	Emission Factors	
	PM, lb/ton	PM_{10}, lb/ton
Primary Crushing(Jaw)-Dry[b]	0.0007	0.00033
Primary Crushing(Jaw)-Wet[c]	0.00021	0.0001
Secondary Crushing(All crushers)-Dry[d,e]	0.00504	0.0024
Secondary Crushing(All crushers)-Wet[d,e]	0.0012	0.00059
Tertiary Crushing(All crushers)-Dry[d]	0.00504	0.0024
Tertiary Crushing(All crushers)-Wet[d]	0.0012	0.00059
Fines Crushing-Dry[d]	0.0315	0.015
Fines Crushing-Wet[d]	0.0042	0.002
Screening(All)-Dry[d]	0.0315	0.015
Screening(All)-Wet[d]	0.001764	0.00084
Fines Screening-Dry[d]	0.149	0.071
Fines Screening-Wet[d]	0.0044	0.0021
Front-End Loader/Truck Unloading-Fragmented Stone[d]	0.000034	0.000016
Truck Loading-Crushed Stone[d]	0.00021	0.00010
Conveyor Transfer-Dry[d]	0.0029	0.0014
Conveyor Transfer - Wet[d]	0.00011	0.000048
Conveying (per 300 feet of a single conveyor)[f]	0.0029	0.0014

[a] Sources controlled with wet suppression maintain a material moisture content of ≥1.5 percent. Sources that process material with a moisture content of < 1.5 percent are considered dry and uncontrolled.

[b] PM from AP-42, PM_{10} = PM/2.1

[c] PM = PM(dry) x 0.3 for water spray conditions, PM_{10} = PM/2.1

[d] PM_{10} from AP-42, PM = PM_{10} x 2.1,

[e] Emission factors for tertiary crushing are used for secondary crushing per EPA guidance, see Table 11.19.2-2, note c (1/95).

[f] PM from AP-42, Table 7.19.2-2 (9/88). Conveying length based on results of CHEER Workshop 5/16/96.

Mechanical Section Notes:

g. Emission factors for crushers and screens include drops to equipment and drops off equipment.

H. Radial stacker emissions are included in the stockpile equation calculations.

9. Although total suspended particulate (TSP) is not a measurable property from a process, some states may require estimates of TSP emissions. No data are available to make these estimates. However, relative ratios in AP-42

Sections 13.2.2 and 13.2.4 indicate that TSP emission factors may be estimated by multiplying PM_{10} by 2.1. (The Air Permits Division considers PM to be the same as TSP and replaces the TSP nomenclature with PM.)Updated: 10/9/2000 J:/mech/rock/emission rates 10-9-00 Previous updates: 9/29/98, 5/29/96, 4/22/94

Note: Do Not Use a Wet Material or Water Control Factor If the Emission Factor Selected from Table 6 Is a Controlled Factor.

Table 7 - Controls[2]

	Control Efficiency	Control Factor (1 - Control Eff.)
No controls	0%	1.0
Wet Material	50%	0.50
Water	70%	0.30
Chemical Foam	80%	0.20
Partial Enclosure (screen or crusher)	85%	0.15
Full Enclosure	90%	0.10
Enclosed by building	90%	0.10
Building under negative pressure	100%	0.00

*__Note__: A 99% control efficiency may be allowed when a facility (emission point) operates under saturated conditions with no visible emissions. Specific operating conditions will become part of the permit's special conditions.

Table 8 - Average Wind Speeds

City	Speed (mph)
Abilene	12.1
Amarillo	13.6
Austin	9.2
Brownsville	11.5
Corpus Christi	12.0
Dallas - Fort Worth	10.8
Del Rio	9.9
El Paso	9.0
Galveston	11.0
Houston	7.8
Lubbock	12.4
Midland	11.0
Port Arthur	9.8
San Angelo	10.4
San Antonio	9.4
Victoria	10.0
Waco	11.3
Wichita Falls	11.7

***Note**: Choose the wind speed of the closest city to the plant's location.

References

1. *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition*

2. AP-42, Chapter 11, 11.19.2 Crushed Stone Processing (last modified 1/95)

3. Mechanical Team Meeting, Dtd 10/09/2000

4. CHEER Workshop Manual, Dtd 05/16/1996

Example Calculations

The following information is provided as an example to assist facilities in estimating their maximum allowable emission rates.

Table 1 - Rock Crusher Emissions

	Crusher*	**Crusher**	**Crusher**
HP = maximum hourly production rate (tons/hr)	300	150	
AP = maximum annual production rate (tons/yr)	300000	200000	
EF (PM) = emission factor (lb PM/ton) - ***see Table 6***	0.0012	0.0012	
EF (PM_{10}) = emission factor (lb PM_{10}/ton)- ***see Table 6***	0.00059	0.00059	
CF = control factor - ***see Table 7***	1	1	
E_1 = hourly PM emissions (lbs/hr)	0.36	0.18	
E_2 = hourly PM_{10} emissions (lbs/hr)	0.177	0.089	
E_3 = annual PM emissions (tons/yr)	0.18	0.12	
E_4 = annual PM_{10} emissions (tons/yr)	0.089	0.059	

Table 1 Equations:

$$E_1 = HP \times EF(PM) \times CF$$

$$E_3 = AP \times EF(PM) \times CF \times \left(\frac{1\ ton}{2000\ lbs} \right)$$

E_1 = 300 tons/hr x 0.0012 lbs/ton x 1 = 0.36 lbs/hr   E3 = 300,000 tpy x 0.0012 lbs/ton x 1 x 1/2000 = 0.18 tpy

$$E_2 = HP \times EF(PM_{10}) \times CF$$

$$E_4 = AP \times EF(PM_{10}) \times CF \times \left(\frac{1\ ton}{2000\ lbs} \right)$$

E2 = 300 tons/hr x 0.00059 lbs/ton x 1 = 0.177 lbs/hr E4 = 300,000 tpy x 0.00059 lbs/ton x 1 x 1/2000 = 0.089 tpy

Screen Emissions

Table 2 - Screen Emissions

	Screen #1	**Screen #2**	**Screen #3**
HP = maximum hourly throughput rate (tons/hr)	300		
AP = maximum annual throughput rate (tons/yr)	300000		
EF(PM) = emission factor (lb PM/ton) - ***see Table 6***	0.001764		
$EF(PM_{10})$ = emission factor (lb PM_{10}/ton) - ***see Table 6***	0.00084		
CF = control factor - ***see Table 7***	1		
E_5 = hourly PM emissions (lbs/hr)	0.529		
E_6 = hourly PM_{10} emissions (lbs/hr)	0.252		
E_7 = annual PM emissions (tons/yr)	0.265		
E_8 = annual PM_{10} emissions (tons/yr)	0.126		

$$E_5 = HP \times EF(PM) \times CF$$

$$E_6 = HP \times EF(PM_{10}) \times CF$$

E_5 = 300 tons/hr x 0.001764 x 1 = 0.529 lbs/hr

E_6 = 300 x 0.00084 x 1 = 0.252 lbs/hr

$$E_8 = AP \times EF(PM_{10}) \times CF \times \left(\frac{1\ ton}{2000\ lbs} \right)$$

E_8 = 300,000 x 0.00084 x 1 x 1/2000 = 0.126 tpy

E_7 = 300,000 x 0.00084 x 1 x 1/2000 = 0.265 tpy

$$E_7 = AP \times EF(PM) \times CF \times \left(\frac{1\ ton}{2000\ lbs} \right)$$

Loading and Unloading Emissions

Table 3 - Loading and Unloading Emissions

	Unloading (Fragmented Stone)	**Loading (Crushed Stone)**	**Front-End Loaders**
HP = maximum hourly throughput rate (tons/hr)	300	300	
AP = maximum annual throughput rate (tons/yr)	300,000	300,000	
EF(PM) = emission factor (lb PM/ton) - ***see Table 6***	0.000034	0.0001	
$EF(PM_{10})$ = emission factor (lb PM_{10}/ton) - ***see Table 6***	0.000016	0.00021	
CF = control factor - ***see Table 7***	0.30	0.30	
E_9 = hourly PM emissions (lbs/hr)	0.00306	0.009	
E_{10} = hourly PM_{10} emissions (lbs/hr)	0.000146	0.0043	
E_{11} = annual PM emissions (tons/yr)	0.0015	0.0045	
E_{12} = annual PM_{10} emissions (tons/yr)	0.0007	0.00021	

$$E_9 = HP \times EF(PM) \times CF$$

$$E_{11} = AP \ x \ EF(PM) \ x \ CF \ x \ \left(\frac{1 \ ton}{2000 \ lbs} \right)$$

E_9 = 300 x 0.000034 x .3 = 0.00306 lbs/hr

E_{11} = 300,000 x 0.000034 x .3 x 1/2000 = 0.0015 tpy

$$E_{10} = HP \times EF(PM_{10}) \times CF$$

$$E_{12} = AP \ x \ EF(PM_{10}) \ x \ CF \ x \ \left(\frac{1 \ ton}{2000 \ lbs} \right)$$

E10 = 300 x 0.000016 x .3 = 0.000146 lbs/hr

E12 = 300,000 x 0.000016 x .3 x 1/2000 = 0.00021 tpy

Transfer Point Emissions

Table 4 - Transfer Point Emissions

	#1	#2	#3	#4	#5	#6
Transfer Point Identification	1 thru 4					
HP = max. hourly throughput rate for the transfer point (tons material / hour)	300					
AP = max. annual throughput rate for the transfer point (tons material / year)	300000					
N = number of like transfer points	4					
Percentage of total throughput thru like transfer points	100%					
EF(PM) = emission factor (lb PM/ton) - ***see Table 6***	0.00011					
EF(PM_{10})=emission factor (lb PM_{10}/ton) ***-see Table 6***	0.000048					
CF = control factor - ***see Table 7***	1					
E_{13} = hourly PM emissions (lbs/hr)	0.132					
E_{14} = hourly PM_{10} emissions (lbs/hr)	0.063					
E_{15} = annual PM emissions (tons/yr)	0.066					
E_{16} = annual PM_{10} emissions (tons/yr)	0.031					

$$E_{13} = HP \times EF(PM) \times CF \times N$$

$$E_{15} = AP \ x \ EF(PM) \ x \ CF \ x \ (\frac{1 \ to}{2000 \ l}$$

E_{13} = 300 x 0.00011 x 1 x 4 = 0.132 lbs/hr

E_{15} = 300,000 x 0.00011 x 1 x 4 = 0.066 tpy

$$E_{14} = HP \times EF(PM_{10}) \times CF \times N$$

$$E_{16} = AP \ x \ EF(PM_{10}) \ x \ CF \ x \ (\frac{1 \ ton}{2000 \ lbs}) \times N$$

E_{14} = 300 x 0.000048 x 1 x 4 = 0.063 lbs/hr

E_{16} =300,000 x 0.000048 x 1 x 1/2000 x 4 = 0.031 tpy

Stockpiles Emissions

Table 5 - Stockpile Emissions Data

A = Stockpile Area (acres) *	2
CF = Control Factor - ***see Table 7***	.3
D = number of active days per year	200
E_{17} = PM emissions for inactive stockpiles (tons/yr)	0.173
E_{18} = PM_{10} emissions for inactive stockpiles (tons/yr)	0.087
E_{19} = PM emissions for active stockpiles (tons/yr)	0.792
E_{20} = PM_{10} emissions for active stockpiles (tons/yr)	0.396

*Acreage may be estimated by dividing the stockpile square footage by 43,560.

$$E_{17} = (\frac{3.5 \ lb \ PM}{acre \ day}) \times (\frac{365 \ days \ - \ D}{year}) \times A \times (\frac{1 \ ton}{2000 \ lbs}) \times CF$$

E_{17} = 3.5 x (365-200) x 2 x 1/2000 x .3 = 0.173 tons/yr

$$E_{18} = 0.5 \times E_{17}$$

E_{18} = 0.173 x .5 = 0.087 tpy

$$E_{19} = (\frac{13.2\ lb\ PM}{acre\ day}) \times D \times A \times (\frac{1\ ton}{2000\ lbs}) \times CF$$

E_{19} = 13.2 x 200 x 2 x 1/2000 x .3 = 0.792 tpy

$$E_{20} = 0.5 \times E_{19}$$

E_{20} = 0.5 x 0.792 = 0.396 tpy