11.7 CRUSHING AND GRINDING

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Process Description

Crushing and grinding operations are performed typically at quarries. A thorough explanation of the crushed stone processing and pulverized mineral processing is available from Chapter 11.19.2, Crushed Stone Processing and Pulverized Mineral Processing of AP-42 (Fifth Edition, Volume I).

Crushing and grinding operations are generally made up a number of sources of air pollution which store, convey, measure, and discharge its constituents. Per District policy, the following sources at the plants shall be permitted:

Sand and Aggregate Storage Piles (grouped as one source if they are all in the same general area)
Storage Silos (each silo is a separate source)
Conveyors (grouped as one source if they are all in the same general area)
Crushers (each crusher is a separate source)
Screens (each screen is a separate source)

Completeness Determination

The following District forms should be completed and fees provided for crushing and grinding h plants. Use the Completeness Determination Checklist to verify completeness. Use the Data Form Guidance to ensure that the forms are completed correctly. Use the Fee Calculation Guidance to ensure that the fees are calculated accurately. There is a specific policy for the grouping of sources and the calculation of fees at concrete batch plants and quarrying/crushing operations.

1. Form 101-B (one for facility).
2. Form G (one per source).
3. Process Diagram and Map of the Crushing and Grinding Plant.
4. Form A for watering system (one per facility)
5. Form A (one per device) for any particulate abatement device (i.e., baghouse).
6. If Health Risk Screening is triggered, Form HRSA (one per source).
7. Fees, calculated per Regulation 3 (Schedule F for all sources except, crushers and grinders, which is subject to Schedule G-1).
8. See the Emissions Calculations section for additional information that should be provided by the applicant regarding the crushing and grinding plant.

Emission Calculations

Particulate matter, consisting primarily of cement and cement supplement dust but including some aggregate and sand dust, is the primary pollutant of concern. In addition, there are emissions of metals that are associated with this particulate matter. Particulate emission factors for crushing and grinding are given in Table 11.19.2-2 in Chapter 11.19.2, Crushed Stone Processing and Pulverized Mineral Processing of AP-42 (Fifth Edition, Volume I).

Crushing Process	**Unabated PM10 Emission Factor (lb/ton)**	**Abated PM10 Emission Factor (lb/ton)**
Tertiary Crushing	0.0024	0.00054
Fines Crushing	0.0150	0.0012
Screening	0.0087	0.00074
Fines Screening	0.072	0.0022
Conveyor Transfer Point	0.0011	4.6e-5
Drop Unloading	0.00010	*

* = If watering is used to suppress dust, a maximum abatement efficiency of 70% may be used.

The permit engineer should obtain information from the applicant regarding maximum annual quantity of the stone to be crushed.

Emissions from vehicle traffic on unpaved roads to and from the storage piles should also be accounted in the emissions for the storage piles. An unpaved roads emission factor equation is provided in Chapter 13.2.2, Unpaved Roads of AP-42 (Fifth Edition, Volume I) for vehicles traveling on unpaved surfaces at industrial sites:

$$E = k(s/12)^a(W/3)^b((365-P)/365)\ \text{lb/VMT} \qquad \text{[Equation 1a]}$$

and for vehicles traveling on publicly accessible roads, dominated by light duty vehicles:

$$E = [k(s/12)^a(S/30)^d/(M/0.5)^c - C]((365-P)/365)\ \text{lb/VMT} \qquad \text{[Equation 1b]}$$

The following provides an explanation of the variables in the equation and the average values recommended for use (only if actual more specific and precise values are not available), if the source-specific values are not known:

E = Emission Factor (lb/VMT)
k = Particle size multiplier (dimensionless); PM_{10}, k = 1.5 for Equation 1a, 1.8 for Equation 1.b
a = Empirical Constants; a = 0.9 for Equation 1a, 1 for Equation 1b
b = Empirical Constants; b = 0.45
c = Empirical Constants; c = 0.2 for Equation 1b
d = Empirical Constants; d = 0.5 for Equation 1b
s = Silt content of road surface (%); s = See Table 13.2.2-1[1] and use the mean value for the applicable industry. (For example, for stone and gravel processing s=4.8 for plant roads, 7.1 for material storage areas.)
W = Mean vehicle weight (tons); W=146 tons for Equation 1a, 2 tons for Equation 1b
M = surface material moisture content (%); M = 6.5
S = Mean vehicle speed (mph); S = 24 for Equation 1a, 33 for Equation 1b
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear; C = 0.00047[2]
P = Number of days with greater than, or equal to, 0.01 inches of precipitation per year; 70[3]

For example, at stone and gravel processing sources, the emission factors used for unpaved roads are calculated as follows:

$E_{1a} = (1.5)(4.8/12)^{0.9}(146/3)^{0.45}(365-70/365)$
E_{1a} = 3.05 lb/VMT [for unpaved plant roads at stone and gravel processing]

$E_{1a} = (1.5)(7.1/12)^{0.9}(146/3)^{0.45}(365-70/365)$
E_{1a} = 4.34 lb/VMT [for unpaved material storage areas]

[1] Chapter 13.2.2, Unpaved Roads of AP-42 (Fifth Edition, Volume I), pg. 3.
[2] Chapter 13.2.2, Unpaved Roads of AP-42 (Fifth Edition, Volume I), pg. 6.
[3] Chapter 13.2.2, Unpaved Roads of AP-42 (Fifth Edition, Volume I), pg. 9.

The permit engineer should determine which emission factor equation (1a or 1b) is most appropriate depending on the unpaved surfaces or roads where the sources will be situated. The permit engineer should also obtain information from the applicant regarding the maximum vehicle weight and miles traveled per year by all vehicles involved on driving on the unpaved roads at the facility. If watering is used to suppress dust, a maximum abatement efficiency of 70% may be used. If chemical dust suppressants are used, a maximum abatement efficiency of 80% may be used[4].

Emission factors for storage piles at crushing and grinding plants are taken from Chapter 13.2.4, Aggregate Handling and Storage Piles, of AP-42 (Fifth Edition, Volume I). These emission factors include emissions from drop operations into storage piles:

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

The following provides an explanation of the variables in the equation and the mean values recommended for use, if the source-specific values are not known:

E = Emission Factor (lb/ton)
k = Particle size multiplier (dimensionless); PM_{10}, k = 0.35
U = mean wind speed (miles/hr); U = 8.2
M = material moisture content (%); M = 2.1

$$E = (0.35)(0.0032)(8.2/5)^{1.3}/(2.1/2)^{1.4}$$
E = 0.002 lb/ton [for storage piles]

For emissions from equipment traffic (truck, front-end loaders, dozer, etc.) traveling between or on piles, it is recommended that the equation for vehicle traffic on unpaved surfaces be used (see Equation 1a). The emissions from equipment traffic around the piles should be calculated using the same emission factors noted previously for unpaved roads by including the VMT around these piles and including it in the total estimated VMT on unpaved roads within the facility.

Emission factors for wind erosion for storage piles at crushing and grinding plants may be taken from AP-42, Fourth Edition, Section 8.19, Table 8.19.1-1. These emission factors include emissions from wind erosion. Assuming the 3.5 lb/acre/day emission is for TSP emissions, the wind blown PM10 emissions would be approximately 50% or:

$$E_{PM10} = 1.7 \text{ lb/acre/day}$$

The permit engineer should obtain information from the applicant regarding the maximum area (in acres) and throughput (in tons) that the storage piles will occupy and the number of days per year that the storage piles will exist at the crushing and plant. If watering is used to suppress dust, a maximum abatement efficiency of 70% may be used.

Furthermore, if railcars or ships are involved in the transportation of materials, then also the combustion emissions from the use of these transport vehicles should also be calculated and included in the facilities cumulative increase.

Applicable Requirements

District Rules and Regulations

In general, the particulate sources at crushing and grinding plants are subject to the operating standards of Regulation 6. All but the transfer points of cement and cement supplement into the storage silos are fugitive in nature. The storage silos are generally abated by a fabric filter or baghouse device. Fugitive sources include the transfer of sand and aggregate, truck loading, mixer loading, vehicle traffic, and wind erosion from sand and aggregate storage piles. The amount of fugitive emissions generated during the

[4] Chapter 13.2.2, Unpaved Roads of AP-42 (Fifth Edition, Volume I), pg. 13.

transfer operations depend primarily on the surface moisture content of these materials. Types of controls used may include water sprays, enclosures, and baghouse devices. With these controls of the equipment and good maintenance and wetting of unpaved road surfaces, particulate emissions should comply with the operating standards of Regulation 6. Permit conditions are imposed to ensure compliance with Regulation 6.

Best Available Control Technology (BACT)
BACT for the particulate sources at crushing and grinding plants are specified in the BACT/TBACT Workbook. The following are applicable BACT requirements for:

Crushing and Grinding
- Rock - Aggregate Processing
- Solid Material Handling - Dry
- Solid Material Handling - Wet
- Solid Material Storage - Enclosed
- Solid Material Storage - Open
- Wood Processing Equipment

Inform the BACT Coordinator of updates to the BACT/TBACT Workbook.

New Source Performance Standards (NSPS)
Subpart OOO of the NSPS standard covers nonmetallic mineral processing, which includes regulations for emissions from operating equipment that was manufactured, modified or reconstructed after August 31, 1983. Processing equipment regulated under Subpart OOO affecting the crushed stone, sand and gravel industry includes crushers, grinding mills, screens, bucket elevators, bagging operations, storage bins, enclosed truck and railcars and transfer points on belt conveyors.

Under Subpart OOO, aggregate facilities are required to conduct performance testing on stationary equipment in accordance with EPA Reference Method 9. Method 9 is a visual emissions test that determines opacity or the percentage of the light that is prevented from passing through a plume or fugitive emission. Individuals performing the opacity readings are required to be trained and certified in accordance with the method. EPA has set specific limits for the aggregates industry based on opacity readings designated to various processing equipment ranging from 7-15 percent (%). Among the requirements of Method 9 is determining the average of twenty-four readings over a six-minute period for a total of one hour for each piece of equipment that falls under the purview of NSPS.

The permit engineer should determine whether the source is subject to Subpart OOO. An applicability flow chart of Subpart OOO is available from the Texas Commission on Environmental Quality. If applicable, the permit engineer should ensure that the facility has conducted or will be required to conduct the performance testing required by the NSPS.

California Environmental Quality Act (CEQA)
Permit applications which are reviewed following the specific procedures, fixed standards and objective measurements set forth in this chapter (11.7) are classified as ministerial and will accordingly be exempt from CEQA review per Regulation 2-1-311.

In addition to the above-mentioned source-specific applicable requirements, other requirements may also be applicable depending on the facility, its application emissions, and its source location:

- ❑ Offsets
- ❑ Prevention of Significant Deterioration
- ❑ School Notification
- ❑ Risk Screening Analysis

Permit Conditions
Standardized conditions for crushing and grinding operations are available from the Permit Condition Guidance. Refer to the Evaluation Report Template Guidance to obtain the Microsoft Word formatted permit conditions for this source category.