Arlington Environmental, Inc.

Post Office Box 657
Okeechobee,
Florida 34973

Telephone: (863)467-0555
Fax: (520)569-8253
E-mail

August 7, 2000

Mr. Bill Leffler
Florida Department of
Environmental Protection
2600 Blair Stone Road
Tallahassee, Florida

RECEIVED
AUG 10 2000
BUREAU OF AIR REGULATION

Re: Better Roads, Inc. - Rock Crusher Permit Application

Dear Mr. Lefler:

According to your request, I am providing the following information regarding the above referenced application:

Manufactu Hazmage

Model No. KR131D2912

Serial No. HU-1470

Year Manufactured 1994

Picture to be sent separately

The unit is to be initially located at the Better Roads Asphalt - Babcock Plant site. The permit number of this plant is D150048-001-AO. 7770048-001-AO
← where is first AC?

Bad Number

Other possible sites include:

Better Roads - Collier County Plant - 0210041-002-AC — 003 - Crusher
Better Roads - Lake Placid Plant (Highlands County - 0550014-001-AC — 003 Crusher

If further information is needed, please do not hesitate to call.

Sincerely,

William D Arlington

Aug-10-00 11:13A BETTER ROADS INC 941 597 5632 P.01
Aug-10-00 10:06A Better-betters#-proaeEFp* 941 731 5180 P.01

RC124#

Rock CRUSHER

CAT 3406C

PERFORMANCE SPEC. — CF0565

ARRANGEMENT — CR4516

SER NO - 2MZ 00337

[illegible]

CN164#

CAT GEN 3306
RATING 256 KVA, 205 KW, 60 [illegible].
0.8 [illegible], 480 V, 308 AMPS, 446 FRAME,
1800 RPM.

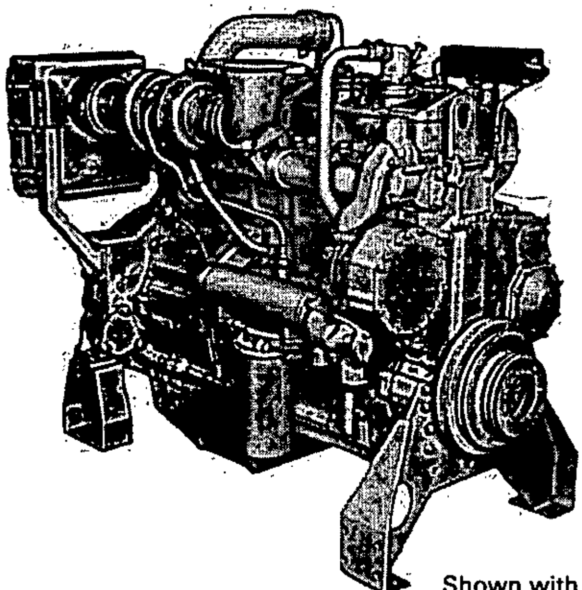
CAT MODEL NO SR4.
SER NO. 5EA 07822.

ARRANGEMENT 4W - 9763

CATERPILLAR®

Industrial Engine 3406C

322-525 bhp/240-392 bkW
1800-2100 rpm



Shown with Optional Equipment

CATERPILLAR® ENGINE SPECIFICATIONS

In-Line, 6 Cylinder, 4-Stroke-Cycle Diesel

Bore — in (mm)	5.4 (137)
Stroke — in (mm)	6.5 (165)
Displacement — cu in (L)	893 (14.6)
Low Idle (rpm)	600
Rotation (from flywheel end)	Counterclockwise
Capacity for Liquids — U.S. Gal (L)	
Cooling System (engine only)	9.0 (34.1)
Lube Oil System (refill)	9.0 (34.1)
Weight, Net Dry (approx) — lb (kg)	
Including Flywheel	2990 (1356)

FEATURES

- **FUEL ECONOMY**
  Consistent performance, variable-timed fuel injection, broad rpm turbocharger match, excellent fuel economy over entire operating range.
- **RELIABILITY AND DIESEL DURABILITY**
  Diesel tough components, precise balance, and conservative speed for smooth operation and long engine life.
- **FLEXIBLE APPLICATION RANGE**
  High torque rise, big displacement, convenient installation, more performance for your money.
- **WORLDWIDE PRODUCT SUPPORT AND PARTS AVAILABILITY**

STANDARD EQUIPMENT

Air intake
  single-stage, dry air cleaner
Cooling
  thermostats and housing, centrifugal gear-driven jacket water
Exhaust
  6-inch dry elbow
Fuel
  filter, priming and transfer pumps
Flywheel and flywheel housing, SAE No. 1
Instruments and gauges
  instrument panel, fuel pressure, lube oil pressure and water temperature gauge, service meter
Lube
  filter, oil cooler
Supports

CATERPILLAR FACILITIES ISO 9001 CERTIFIED

OPTIONAL EQUIPMENT

Air Compressor
Air Intake
  heavy-duty air cleaner, muffler, precleaner
Alternators
Cooling
  expansion tank, heat exchanger, radiator, fans, fan drives, auxiliary water pump, dry charge coolant conditioner
Exhaust
  flexible fittings, mufflers, watercooled manifolds and turbos, flanges
Instruments and gauges
  premium panel 8-gauge, tachometers, tach drives
Power Takeoffs
  auxiliary drives, enclosed clutches, hydraulic pumps, stub shaft
Protection Devices
  alarm switches, oil and water shutoffs, electric and mechanical
Starting
  air, electric

PERFORMANCE DATA

Turbocharged-Aftercooled PA5188

Rating Level	E	D	C	B	A
Rated rpm	2100	2100	2100	2000	1800
Engine Power @ rpm	525 bhp (392 bkW)	515 bhp (384 bkW)	460 bhp (343 bkW)	440 bhp (328 bkW)	420 bhp (313 bkW)

rpm	2100	1800	1500	2100	1800	1500	2100	1800	1500	2000	1800	1500	1800	1700	1500
bhp	525	501	456	515	499	451	460	446	403	440	429	391	420	431	415
lb/bhp-hr	.367	.355	.352	.339	.332	.334	.339	.330	.330	.335	.330	.330	.331	.332	.333
gal/hr	27.4	25.4	22.8	24.9	23.6	21.5	22.3	21.0	19.1	21.0	20.2	18.4	19.8	20.3	19.7

bkW	392	374	340	384	372	337	343	332	301	328	320	291	313	321	309
g/bkW-hr	223	216	214	206	202	203	206	201	201	204	201	201	201	202	203
L/hr	103.9	96.0	86.4	94.4	89.4	81.3	84.3	79.5	72.2	79.6	76.6	69.8	75.1	77.0	74.5

PERFORMANCE DATA

Turbocharged-Aftercooled PA2373

Rating Level	E	D	C	B	A
Rated rpm	2100	2100	2100	2000	1800
Engine Power @ rpm	500 bhp (373 bkW)	480 bhp (358 bkW)	400 bhp (298 bkW)	370 bhp (376 bkW)	325 bhp (242 bkW)

rpm	2100	1800	1500	2100	1800	1500	2100	1800	1500	2000	1800	1500	1800	1700	1500
bhp	500	483	437	480	464	419	400	377	341	370	356	324	325	327	310
lb/bhp-hr	.339	.332	.332	.339	.330	.332	.339	.329	.330	.334	.329	.332	.329	.329	.332
gal/hr	24.2	22.9	20.7	23.2	21.9	19.9	19.4	17.8	16.1	17.7	16.7	15.3	15.3	15.3	14.7

bkW	373	360	326	358	346	313	298	282	254	276	266	241	242	244	232
g/bkW-hr	206	202	202	206	201	202	206	200	201	203	200	202	200	200	202
L/hr	91.7	86.5	78.4	87.9	82.9	75.2	73.4	67.2	60.9	66.9	63.4	58.0	57.8	58.0	55.7

PERFORMANCE DATA

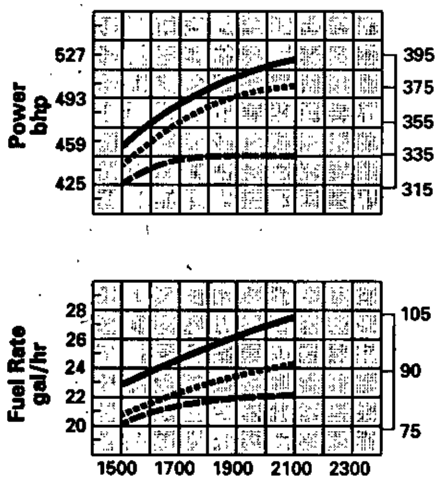
Turbocharged-Aftercooled PA2376

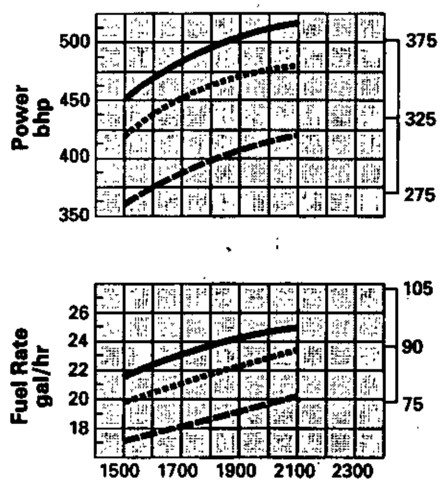
Rating Level	E	D	C	B	A
Rated rpm	2100	2100	2100	2000	1800
Engine Power @ rpm	450 bhp (336 bkW)	420 bhp (313 bkW)	360 bhp (269 bkW)	325 bhp (242 bkW)	322 bhp (240 bkW)

rpm	2100	1800	1500	2100	1800	1500	2100	1800	1500	2000	1800	1500	1800	1700	1500
bhp	450	426	386	420	398	360	360	339	306	325	312	293	322	318	296
lb/bhp-hr	.339	.330	.330	.339	.329	.330	.340	.329	.332	.337	.330	.334	.333	.332	.334
gal/hr	21.8	20.1	18.2	20.3	18.7	17.0	17.5	15.9	14.5	15.6	14.3	13.4	15.3	15.0	14.1

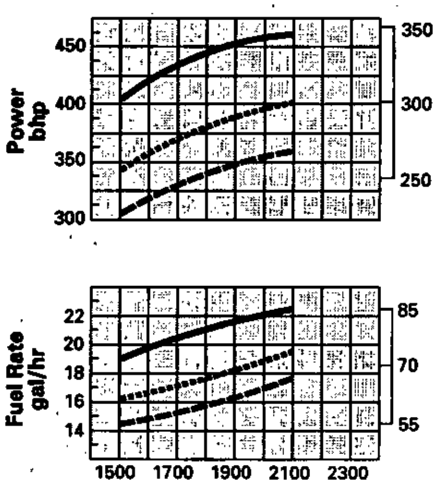
bkW	336	318	288	313	297	268	269	253	229	242	233	211	240	237	221
g/bkW-hr	206	201	201	206	200	201	207	200	202	205	201	203	203	202	203
L/hr	82.4	76.0	68.9	77.0	70.8	64.3	66.3	60.3	54.8	59.2	55.7	50.9	58.0	56.9	53.5

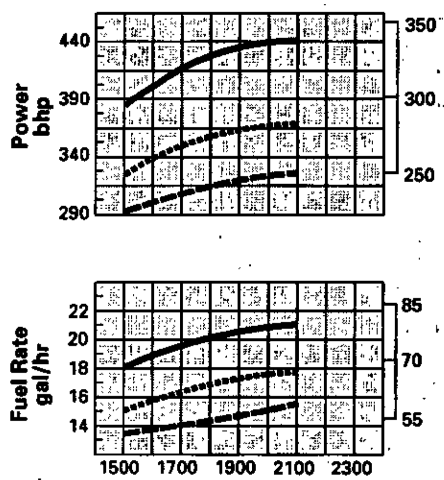
PERFORMANCE CURVES

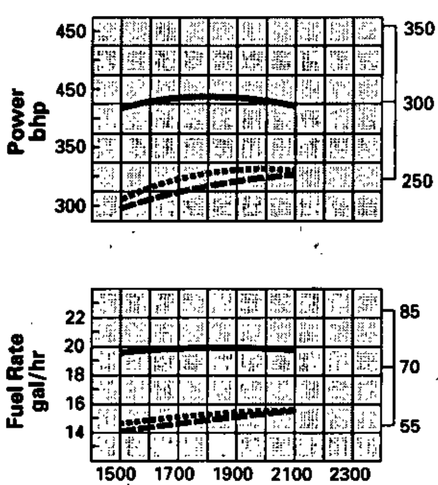




DITA, PA 5188 ————
DITA, PA 2373 ············
DITA, PA 2376 – – – – –







INDUSTRIAL RATINGS

IND-E

IND-E ratings are for service where power is required for a short time for initial starting or sudden overload. For emergency service where standard power is unavailable. The maximum horsepower and speed capability of the engine can be utilized for a maximum of 15 uninterrupted minutes followed by one hour at intermittent or duration of the emergency. Operating limits are:

1. Time at full load not to exceed 5% of the duty cycle or 15 minutes max.
2. Load factor limited to 35%.
3. The maximum horsepower and speed capability of the engine can be utilized for a maximum of 15 minutes followed by one hour at intermittent or duration of the emergency.
4. Typical operating hours per year is 500.

Examples of an IND-E industrial application are:

1. Standby centrifugal water pumps
2. Oil field well servicing
3. Crash trucks
4. Gas turbine starters

IND-D

IND-D ratings are for service where rated power is required for period overloads. The maximum horsepower and speed capability of the engine can be utilized for a maximum of 30 uninterrupted minutes followed by one hour at intermittent. Operating limits are:

1. Time at full load not to exceed 10% of the duty cycle or 30 min max.
2. Load factor limited to 50%.
3. Full load operation to a maximum of 30 minutes followed by one hour at intermittent.
4. Typical operating hours per year is 1500.

Examples of an IND-D industrial application are:

1. Offshore cranes
2. Runway snowblowers
3. Water well drills
4. Portable air compressors
5. Fire pump certification power (advertised power)

IND-C (INTERMITTENT)

IND-C ratings are for service where power and/or speed are cyclic. The horsepower and speed of the engine which can be utilized for one uninterrupted hour followed by one hour of operation at or below the continuous rating. Operating limits are:

1. Time at full load not to exceed 50% of the duty cycle or one hour max.
2. Load factor limited to 70%.
3. Full load operation limited to one uninterrupted hour followed by one hour of operation at or below the continuous rating.
4. Typical operating hours per year is 3000 hours.

Examples of an IND-C industrial application are:

1. Agricultural tractors, harvesters, and combines
2. Truck – off highway
3. Fire pump application power (90% of certified power)
4. Blast hole drills
5. Rock crushers and wood chippers with high torque rise
6. Oil field hoisting

IND-B

IND-B ratings are for moderate-duty service where power and/or speed are cyclic. Operating limits are:

1. Time at full load not to exceed 80% of the duty cycle.
2. Load factor limited to 85%.
3. Typical operating hours per year is 4000 hours.

Examples of an IND-B industrial application are:

1. Irrigation where normal pump demand is 85% of engine rating
2. Oil field mechanical pumping/drilling
3. Stationary/plant air compressors

IND-A (CONTINUOUS)

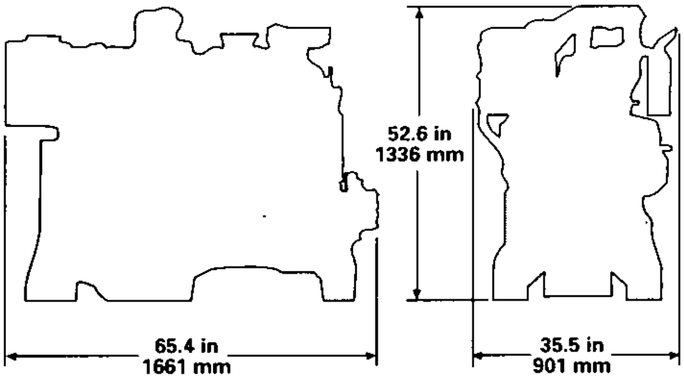
IND-A continuous ratings are for heavy-duty service when the engine is operated at rated load and speed up to 100% of the time without interruption or load cycling. Operating limits are:

1. No hour or load factor limitation.
2. Continuous operation at full load.
3. Average load factor to approach 100%.
4. Typical operating hours per year is over 4000 hrs.

Examples of an IND-A industrial application are:

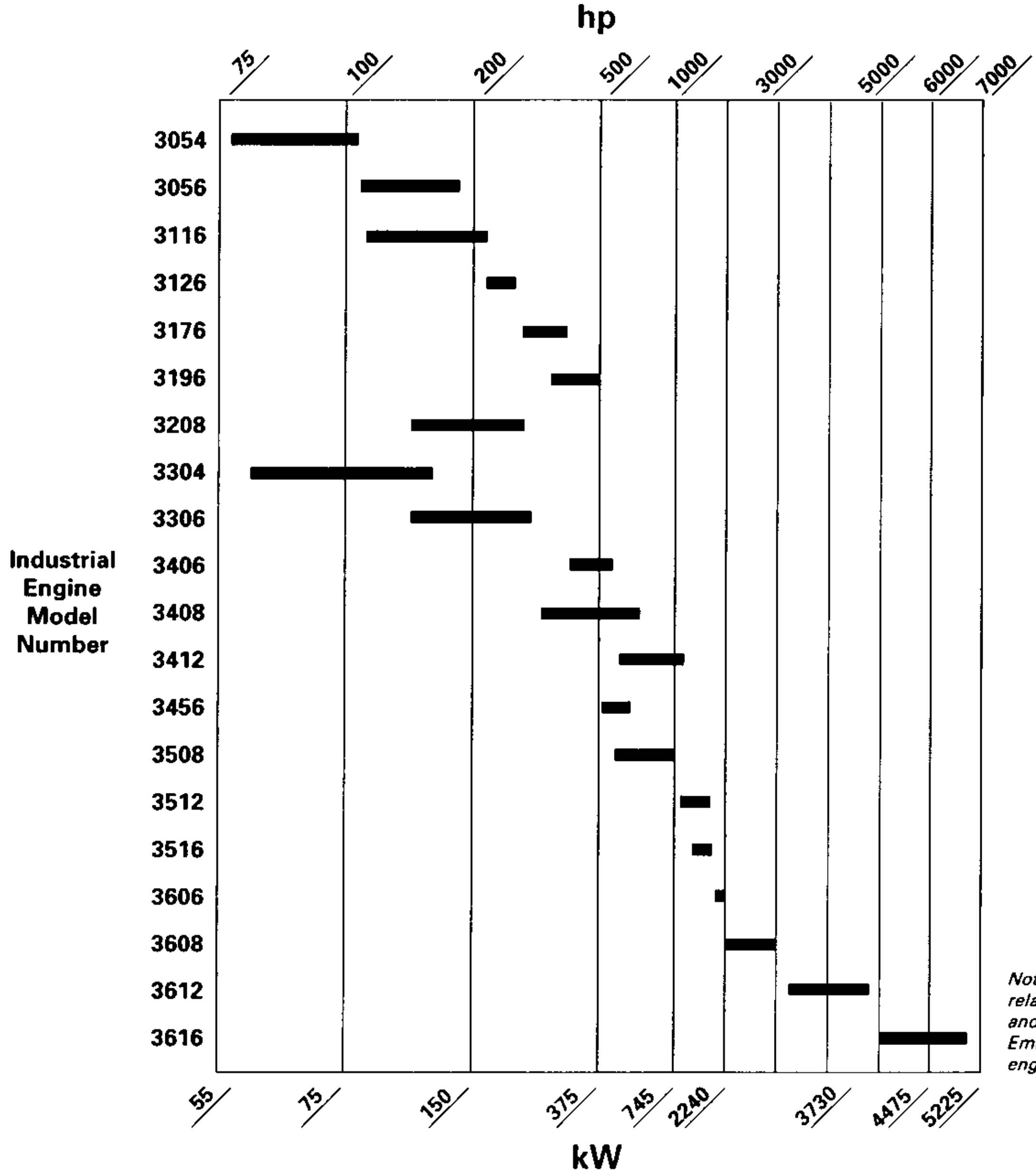
1. Pipeline pumping
2. Ventilation
3. Customer specs

DIMENSIONS



CATERPILLAR® **3406C** INDUSTRIAL ENGINE

Match a Reliable Cat® Diesel to Your Application.



Note: 175 hp - 750 hp relate to the 1996 EPA and Carb Non-Road Emissions Certified engines.

RATING DEFINITIONS AND CONDITIONS

Ratings are based on SAE J1349 standard conditions. These ratings also apply at ISO3046/1, DIN6271, and BS5514 standard conditions.

Additional ratings are available for specific customer requirements. Consult your Caterpillar dealer.

Fuel rates are based on ISO3046 and on fuel oil of 35° API (60° F or 16° C) gravity having an LHV of 18 390 Btu/lb (42 780 kJ/kg) when used at 85° F (29° C) and weighing 7.001 lbs/U.S. gal. (838.9 g/liter).

Materials and specifications are subject to change without notice.

The International System of Units (SI) is used in this publication.

LEHH8327
Supersedes LEHH5438

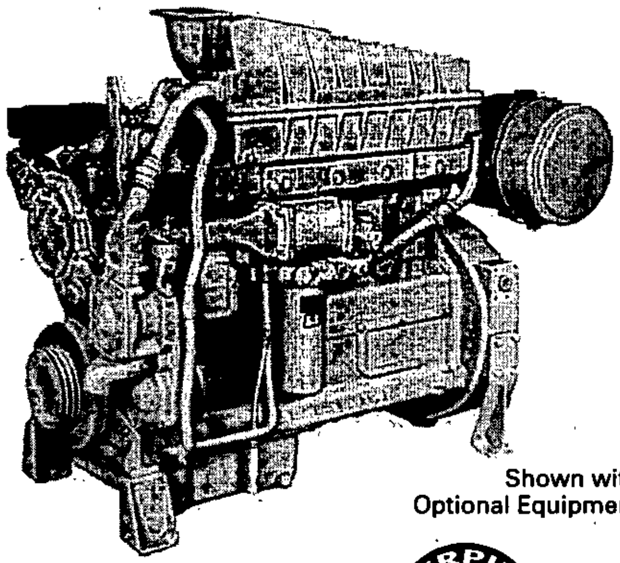
Printed in U.S.A.

CATERPILLAR

Industrial Engine

3306

125-325 bhp/93-243 kW
2000-2200 rpm



Shown with
Optional Equipment

ISO 9001 CERTIFIED — CATERPILLAR ENGINE FACILITIES

SPECIFICATIONS

In-Line, 6 Cylinder, 4-Stroke-Cycle Diesel	
Bore—in (mm)	4.75 (121)
Stroke—in (mm)	6.00 (152)
Displacement—cu in (L)	638 (10.5)
Combustion System	Direct injection
Rotation (from flywheel end)	Counterclockwise
Capacity for Liquids—U.S. Gal (L)	
Cooling System (engine only)	
DITA	4.8 (18.2)
DINA & DIT	4.2 (15.9)
Lube Oil System (refill)	7.3 (27.4)
Engine Weight, Net Dry (approx)—lb (kg)	
Turbocharged (T)	2160 (980)
Turbocharged-Aftercooled (TA)	2220 (1007)
Naturally Aspirated (NA)	2050 (930)

FEATURES

- **FUEL ECONOMY**
  Consistent performance . . . variable-timed fuel injection . . . broad rpm turbocharger match . . . excellent fuel economy over entire operating range.
- **RELIABILITY AND DIESEL DURABILITY**
  Diesel tough components . . . precise balance and conservative speed for smooth operation and long engine life.
- **FLEXIBLE APPLICATION RANGE**
  High torque rise . . . big displacement . . . convenient installation . . . more performance for your money.
- **WORLDWIDE PRODUCT SUPPORT AND PARTS AVAILABILITY**

STANDARD EQUIPMENT

Air intake
  single stage, dry air cleaner
Cooling
  lube oil, jacket water pump, thermostats
Exhaust
  dry, flanged outlet
Fuel
  priming and transfer pumps. filter
Instruments and Gauges
  instrument panel, fuel pressure and lube oil pressure gauges, service meter
Lubricating
  oil cooler, oil filter
Flywheel and Flywheel Housing, SAE No.1

OPTIONAL EQUIPMENT

Alternator
Cooling
  raditor, fan drive, belt tightener, Vee belt
Exhaust
  flexible fittings, mufflers, watercooled manifolds
Instruments and Gauges
  electric gauges, tachometer
Lubricating
  dipstick, oil filler, oil filter
Power Takeoffs
  auxiliary drive pulleys, front and rear enclosed clutches, hydraulic pump
Protection Devices
  electrical and mechanical shutoffs, oil pressure and water temperature alarm switches
Starting
  air, electric

PERFORMANCE DATA

Turbocharged-Aftercooled

Rating Level	E	D	C	B	A
Rated rpm	2200	2200	2200	2000	2000
Engine Power@rpm	335 bhp (250 kW)	330 bhp (249 kW)	325 bhp (242 kW)	295 bhp (220 kW)	275 bhp (194 kW)

rpm	2200	1800	1500	2200	1800	1500	2200	1800	1500	2000	1700	1500	2000	1700	1500
bhp	335	331	317	330	318	300	325	302	281	295	280	261	275	259	244
lb/hp-hr	.380	.358	.339	.381	.357	.349	.380	.353	.340	.357	.350	.340	.357	.345	.340
gal/hr	18.2	16.9	15.3	18.0	16.2	14.9	17.6	15.2	13.7	15.0	14.0	12.7	14.0	12.8	11.9

kW	250	247	236	249	240	226	242	225	210	220	209	195	205	193	182
g/kW-hr	231	218	206	232	217	212	231	215	207	217	213	207	217	210	207
L/hr	68.8	64.1	58.0	68.1	61.3	56.5	66.7	57.7	51.7	56.9	53.0	48.0	53.0	48.3	44.9

Turbocharged-Aftercooled

Rating Level	E	D	C	B	A
Rated rpm	2200	2200	2200	2000	2000
Engine Power@rpm	325 bhp (243 kW)	310 bhp (231 kW)	300 bhp (224 kW)	275 bhp (205 kW)	260 bhp (194 kW)

rpm	2200	1800	1500	2200	1800	1500	2200	1800	1500	2000	1700	1500	2000	1700	1500
bhp	325	323	310	310	307	281	300	285	250	275	261	213	260	230	180
lb/hp-hr	.385	.362	.362	.381	.360	.358	.380	.358	.357	.363	.355	.357	.363	.355	.360
gal/hr	17.9	16.7	16.0	16.9	15.8	14.4	16.3	14.6	12.7	14.3	13.2	10.9	13.5	11.7	9.3

kW	243	241	231	231	229	210	224	213	187	205	195	159	194	172	134
g/kW-hr	234	220	220	232	219	218	231	218	217	221	216	217	221	216	219
L/hr	67.6	63.2	60.6	63.9	59.8	54.5	61.6	55.2	48.2	54.0	50.1	41.1	51.1	44.2	35.0

Turbocharged

Rating Level	E	D	C	B	A
Rated rpm	2200	2200	2200	2000	2000
Engine Power@rpm	275 bhp (205 kW)	268 bhp (200 kW)	249 bhp (186 kW)	225 bhp (168 kW)	190 bhp (142 kW)

rpm	2200	1800	1500	2200	1800	1500	2200	1800	1500	2000	1700	1500	2000	1700	1500
bhp	275	255	219	268	244	205	249	214	178	225	191	169	190	165	145
lb/hp-hr	.385	.372	.373	.383	.368	.372	.378	.365	.368	.368	.365	.367	.373	.363	.365
gal/hr	15.1	13.5	11.7	14.7	12.8	10.9	13.4	11.2	9.4	11.8	10.0	8.8	10.1	8.6	7.6

kW	205	190	163	200	182	153	186	160	133	168	143	126	142	123	108
g/kW-hr	234	226	227	233	224	226	230	222	224	224	222	223	227	221	222
L/hr	57.2	51.2	44.2	55.5	48.6	41.2	50.9	42.2	35.4	44.8	37.7	33.5	38.3	32.4	28.6

NA

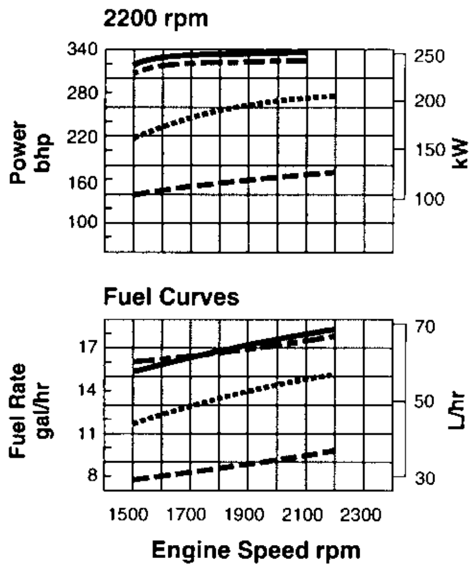
Rating Level	E	D	C	B	A
Rated rpm	2200	2200	2200	2000	2000
Engine Power@rpm	170 bhp (127 kW)	160 bhp (120 kW)	150 bhp (112 kW)	135 bhp (101 kW)	125 bhp (93 kW)

rpm	2200	1800	1500	2200	1800	1500	2200	1800	1500	2000	1700	1500	2000	1700	1500
bhp	170	156	140	160	149	135	150	129	107	135	115	102	125	106	94
lb/hp-hr	.406	.381	.388	.401	.376	.380	.399	.378	.367	.386	.376	.368	.386	.375	.368
gal/hr	9.9	8.5	7.8	9.2	8.0	7.3	8.6	7.0	5.6	7.4	6.2	5.4	6.9	5.7	4.9

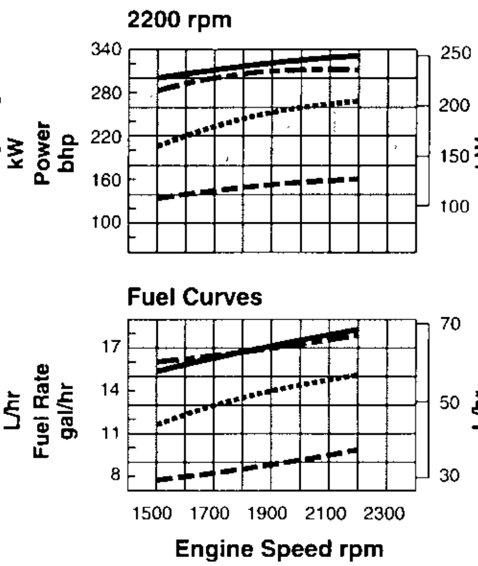
kW	127	116	104	120	111	100	112	96	80	101	86	76	93	79	70
g/kW-hr	247	232	236	244	229	231	243	230	223	235	229	224	235	228	224
L/hr	37.3	32.2	29.4	34.7	30.3	27.7	32.4	26.4	21.2	28.2	23.4	20.3	26.1	21.5	18.7

RATING CURVES

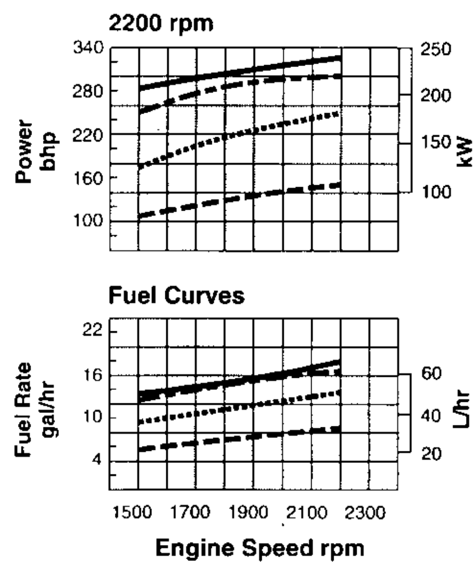
DITA ————
DITA — - — - —
DIT ··········
DINA - - - - - - -



IND-E



IND-D



IND-C

INDUSTRIAL RATINGS

IND-E

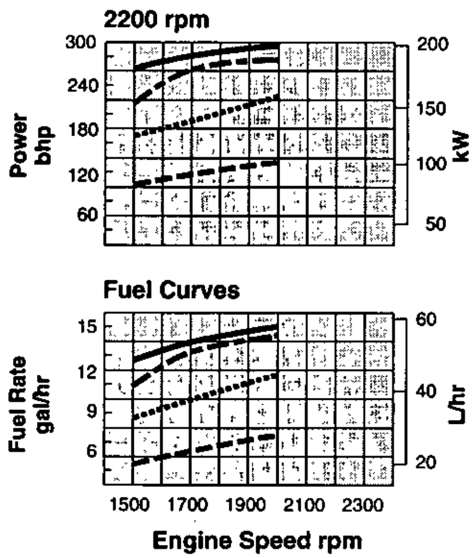
IND-E ratings are for service where speed and power are required for a short time for initial starting or sudden overload. For emergency service where standard power is unavailable. The maximum horsepower and speed capability of the engine can be utilized for a maximum of 15 uninterrupted minutes followed by one hour at intermittent or duration of the emergency. Operating limits are:

1. Time at full load not to exceed 5% of the duty cycle or 15 minutes max.
2. Load factor limited to 35%.
3. The maximum horsepower and speed capability of the engine can bc utilized for a maximum of 15 minutes followed by one hour at intermittent or duration of the emergency.
4. Typical operating hours per year is 500.

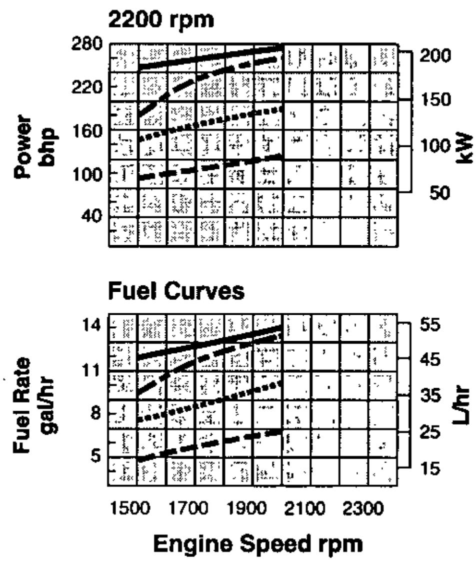
Examples of an IND-E industrial application are:

1. Standby centrifugal water pumps
2. Oil field well servicing
3. Crash trucks
4. Gas turbine starters

RATING CURVES



IND-B



IND-A

INDUSTRIAL RATINGS/cont'd

IND-D

IND-D ratings are for service where rated power is required by period overloads. The maximum horse-power and speed capability of the engine can be utilized for a minimum of 30 uninterrupted minutes followed by one hour at intermittent. Operating limits are:

1. Time at full load not to exceed 10% of the duty cycle or 30 min max
2. Load factor limited to 50%.
3. Full load operation to a maximum of 30 minutes followed by one hour at intermittent.
4. Typical operating hours per year is 1500.

Examples of an IND-D industrial application are:

1. Offshore cranes
2. Runway snowblowers
3. Water well drills
4. Portable air compressors
5. Fire pump certification power (advertised power)

IND-C (INTERMITTENT)

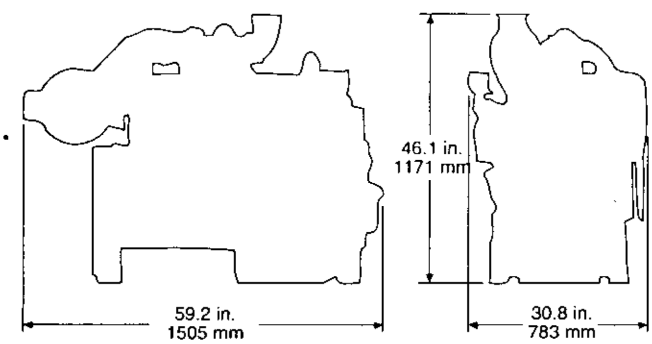
IND-C ratings are for service where power and/or speed are cyclic. The horsepower and speed of the engine which can be utilized for one uninterrupted hour followed by one hour of operation at or below the continuous rating. Operating limits are:

1. Time at full load not to exceed 50% of the duty cycle or one hour max.
2. Load factor limited to 70%.
3. Full load operation limited to one uninterrupted hour followed by one hour of operation at or below the continuous rating.
4. Typical operating hours per year is 3000 hours.

Examples of an IND-C industrial application are:

1. Agricultural tractors, harvesters, and combines
2. Truck – off highway
3. Fire pump application power (90% of certified power)
4. Blast hole drills
5. Rock crushers and wood chippers with high torque rise
6. Oil field hoisting

DIMENSIONS



INDUSTRIAL RATINGS

IND-B

IND-B ratings are for moderate-duty service where power and/or speed are cyclic.
Operating limits are:

1. Time at full load not to exceed 80% of the duty cycle.
2. Load factor limited to 85%.
3. Typical operating hours per year is 4000 hours.

Examples of an IND-B industrial application are:

1. Irrigation where normal pump demand is 85% of engine rating
2. Oil field mechanical pumping/drilling
3. Stationary/plant air compressors

IND-A (CONTINUOUS)

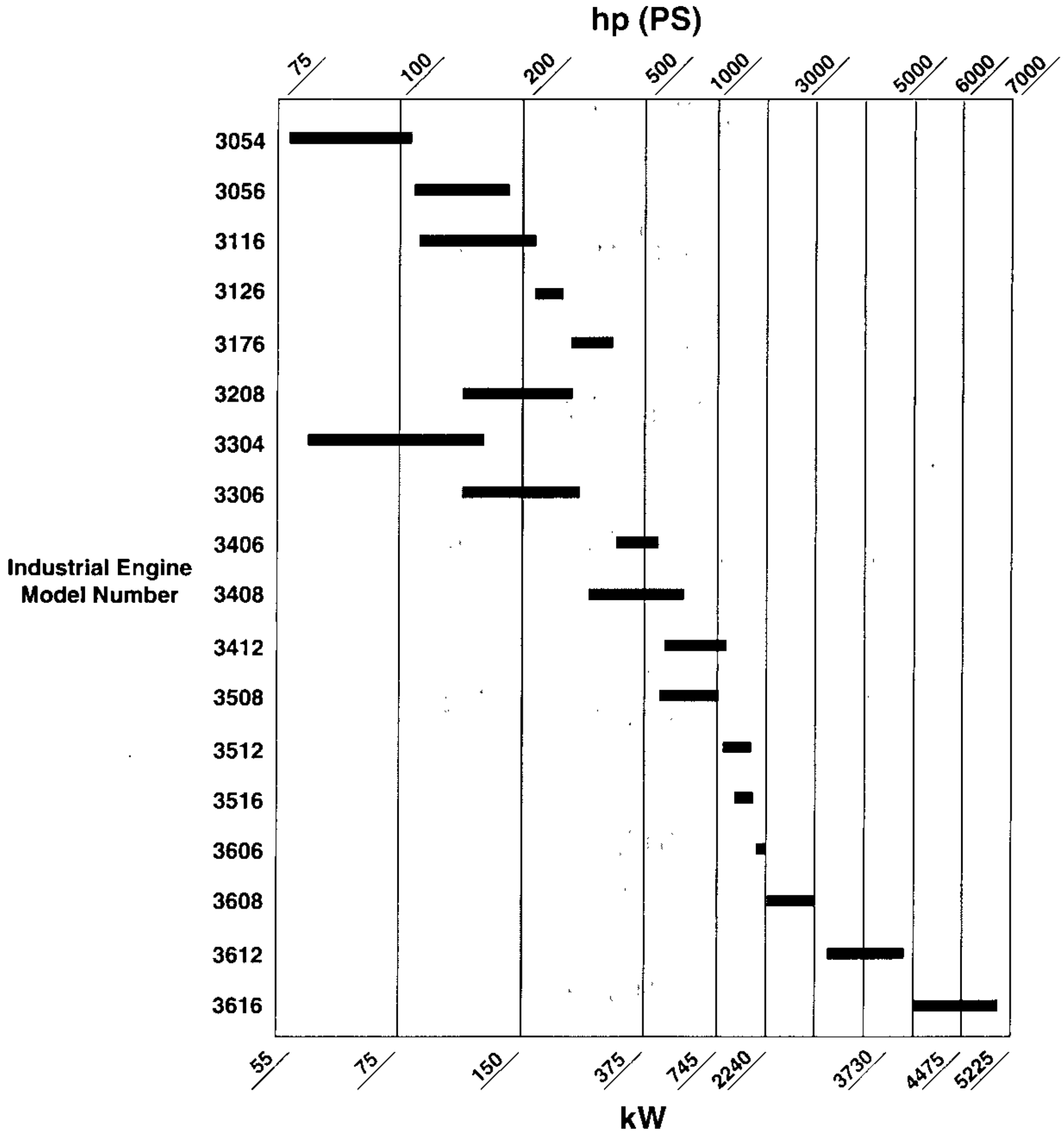
Continuous ratings are for heavy-duty service when the engine is operated at rated load and speed up to 100% of the time without interruption or load cycling. Operating limits are:

1. No hour or load factor limitation.
2. Continuous operation at full load.
3. Average load factor to approach 100%.
4. Typical operating hours per year is over 4000 hours.

Examples of an IND-A industrial application are:

1. Pipeline pumping
2. Ventilation
3. Customer specs

Match a Reliable Cat® Diesel to Your Application.



RATING DEFINITIONS & CONDITIONS

Ratings are based on SAE J1349 standard conditions. These ratings also apply at ISO3046/1, DIN6271, and BS5514 standard conditions.

Additional ratings are available for specific customer requirements. Consult your Caterpillar dealer.

Fuel rates are based on ISO3046 and on fuel oil of 35° API (60° F or 16° C) gravity having an LHV of 18 390 Btu/lb (42 780 kJ/kg) when used at 85° F (29° C) and weighing 7.001 lbs/U.S. gal. (838.9 g/L).

LEHH5448 (10-95)
Supersedes LEHA8583, LEHH2214, LEHH2215, LEHH2216, LEHH4119, LEHH6238, LEHH8586

under § 111(c) of the Act, the authorities contained in paragraph (b) of this section shall be retained by the Administrator and not transferred to a State.

(b) Authorities which will not be delegated to States: § 60.663(e).

Subpart OOO—Standards of Performance for Nonmetallic Mineral Processing Plants

SOURCE: 51 FR 31337, Aug. 1, 1985, unless otherwise noted.

§ 60.670 Applicability and designation of affected facility.

(a) Except as provided in paragraphs (b), (c) and (d) of this section, the provisions of this subpart are applicable to the following affected facilities in fixed or portable nonmetallic mineral processing plants: each crusher, grinding mill, screening operation, bucket elevator, belt conveyor, bagging operation, storage bin, enclosed truck or railcar loading station.

(b) An affected facility that is subject to the provisions of subpart F or I or that follows in the plant process any facility subject to the provisions of subparts F or I of this part is not subject to the provisions of this subpart.

(c) Facilities at the following plants are not subject to the provisions of this subpart:

(1) Fixed sand and gravel plants and crushed stone plants with capacities, as defined in § 60.671, of 23 megagrams per hour (25 tons per hour) or less;

(2) Portable sand and gravel plants and crushed stone plants with capacities, as defined in § 60.671, of 136 megagrams per hour (150 tons per hour) or less; and

(3) Common clay plants and pumice plants with capacities, as defined in § 60.671, of 9 megagrams per hour (10 tons per hour) or less.

(d)(1) When an existing facility is replaced by a piece of equipment of equal or smaller size, as defined in § 60.671, having the same function as the existing facility, the new facility is exempt from the provisions of §§ 60.672, 60.674, and 60.675 except as provided for in paragraph (d)(3) of this section.

(2) An owner or operator seeking to comply with this paragraph shall comply with the reporting requirements of § 60.676 (a) and (b).

(3) An owner or operator replacing all existing facilities in a production line with new facilities does not qualify for the exemption described in paragraph (d)(1) of this section and must comply with the provisions of §§ 60.672, 60.674 and 60.675.

(e) An affected facility under paragraph (a) of this section that commences construction, reconstruction, or modification after August 31, 1983 is subject to the requirements of this part.

§ 60.671 Definitions.

All terms used in this subpart, but not specifically defined in this section, shall have the meaning given them in the Act and in subpart A of this part.

Bagging operation means the mechanical process by which bags are filled with nonmetallic minerals.

Belt conveyor means a conveying device that transports material from one location to another by means of an endless belt that is carried on a series of idlers and routed around a pulley at each end.

Bucket elevator means a conveying device of nonmetallic minerals consisting of a head and foot assembly which supports and drives an endless single or double strand chain or belt to which buckets are attached.

Building means any frame structure with a roof.

Capacity means the cumulative rated capacity of all initial crushers that are part of the plant.

Capture system means the equipment (including enclosures, hoods, ducts, fans, dampers, etc.) used to capture and transport particulate matter generated by one or more process operations to a control device.

Control device means the air pollution control equipment used to reduce particulate matter emissions released to the atmosphere from one or more process operations at a nonmetallic mineral processing plant.

Conveying system means a device for transporting materials from one piece of equipment or location to another location within a plant. Conveying systems include but are not limited to the following: Feeders, belt conveyors, bucket elevators and pneumatic systems.

Crusher means a machine used to crush any nonmetallic minerals, and includes, but is not limited to, the following types: jaw, gyratory, cone, roll, rod mill, hammermill, and impactor.

Enclosed truck or railcar loading station means that portion of a nonmetallic mineral processing plant where nonmetallic minerals are loaded by an enclosed conveying system into enclosed trucks or railcars.

Fixed plant means any nonmetallic mineral processing plant at which the processing equipment specified in § 60.670(a) is attached by a cable, chain, turnbuckle, bolt or other means (except electrical connections) to any anchor, slab, or structure including bedrock.

Fugitive emission means particulate matter that is not collected by a capture system and is released to the atmosphere at the point of generation.

Grinding mill means a machine used for the wet or dry fine crushing of any nonmetallic mineral. Grinding mills include, but are not limited to, the following types: hammer, roller, rod, pebble and ball, and fluid energy. The grinding mill includes the air conveying system, air separator, or air classifier, where such systems are used.

Initial crusher means any crusher into which nonmetallic minerals can be fed without prior crushing in the plant.

Nonmetallic mineral means any of the following minerals or any mixture of which the majority is any of the following minerals:

(a) Crushed and Broken Stone, including Limestone, Dolomite, Granite, Traprock, Sandstone, Quartz, Quartzite, Marl, Marble, Slate, Shale, Oil Shale, and Shell.

(b) Sand and Gravel.

(c) Clay including Kaolin, Fireclay, Bentonite, Fuller's Earth, Ball Clay, and Common Clay.

(d) Rock Salt.

(e) Gypsum.

(f) Sodium Compounds, including Sodium Carbonate, Sodium Chloride, and Sodium Sulfate.

(g) Pumice.

(h) Gilsonite.

(i) Talc and Pyrophyllite.

(j) Boron, including Borax, Kernite, and Colemanite.

(k) Barite.

(l) Fluorospar.

(m) Feldspar.

(n) Diatomite.

(o) Perlite.

(p) Vermiculite.

(q) Mica.

(r) Kyanite, including Andalusite, Sillimanite, Topaz, and Dumortierite.

Nonmetallic mineral processing plant means any combination of equipment that is used to crush or grind any nonmetallic mineral wherever located, including lime plants, power plants, steel mills, asphalt concrete plants, portland cement plants, or any other facility processing nonmetallic minerals except as provided in § 60.670 (b) and (c).

Portable plant means any nonmetallic mineral processing plant that is mounted on any chassis or skids and may be moved by the application of a lifting or pulling force. In addition, there shall be no cable, chain, turnbuckle, bolt or other means (except electrical connections) by which any piece of equipment is attached or clamped to any anchor, slab, or structure, including bedrock that must be removed prior to the application of a lifting or pulling force for the purpose of transporting the unit.

Production line means all affected facilities (crushers, grinding mills, screening operations, bucket elevators, belt conveyors, bagging operations, storage bins, and enclosed truck and railcar loading stations) which are directly connected or are connected together by a conveying system.

Screening operation means a device for separating material according to size by passing undersize material through one or more mesh surfaces (screens) in series, and retaining oversize material on the mesh surfaces (screens).

Size means the rated capacity in tons per hour of a crusher, grinding mill, bucket elevator, bagging operation, or enclosed truck or railcar loading station; the total surface area of the top screen of a screening operation; the width of a conveyor belt; and the rated capacity in tons of a storage bin.

Stack emission means the particulate matter that is released to the atmosphere from a capture system.

Storage bin means a facility for storage (including surge bins) or nonmetallic minerals prior to further processing or loading.

Transfer point means a point in a conveying operation where the nonmetallic mineral is transferred to or from a belt conveyor except where the nonmetallic mineral is being transferred to a stockpile.

Truck dumping means the unloading of nonmetallic minerals from movable vehicles designed to transport nonmetallic minerals from one location to another. Movable vehicles include but are not limited to: trucks, front end loaders, skip hoists, and railcars.

Vent means an opening through which there is mechanically induced air flow for the purpose of exhausting from a building air carrying particulate matter emissions from one or more affected facilities.

§ 60.672 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any transfer point on belt conveyors or from any other affected facility any stack emissions which:

(1) Contain particulate matter in excess of 0.05 g/dscm; or

(2) Exhibit greater than 7 percent opacity, unless the stack emissions are discharged from an affected facility using a wet scrubbing control device. Facilities using a wet scrubber must comply with the reporting provisions of § 60.676 (c), (d), and (e).

(b) On and after the sixtieth day after achieving the maximum production rate at which the affected facility will be operated, but not later than 180 days after initial startup, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any transfer point on belt conveyors or from any other affected facility any fugitive emissions which exhibit greater than 10 percent opacity, except as provided in paragraphs (c), (d) and (e) of this section.

(c) On and after the sixtieth day after achieving the maximum production rate at which the affected facility will be operated, but not later than 180 days after initial startup, no owner or operator shall cause to be discharged into the atmosphere from any crusher, at which a capture system is not used, fugitive emissions which exhibit greater than 15 percent opacity.

(d) Truck dumping of nonmetallic minerals into any screening operation, feed hopper, or crusher is exempt from the requirements of this section.

(e) If any transfer point on a conveyor belt or any other affected facility is enclosed in a building, then each enclosed affected facility must comply with the emission limits in paragraphs (a), (b) and (c) of this section, or the building enclosing the affected facility or facilities must comply with the following emission limits:

(1) No owner or operator shall cause to be discharged into the atmosphere from any building enclosing any transfer point on a conveyor belt or any other affected facility any visible fugitive emissions except emissions from a vent as defined in § 60.671.

(2) No owner or operator shall cause to be discharged into the atmosphere from any vent of any building enclosing any transfer point on a conveyor belt or any other affected facility emissions which exceed the stack emissions limits in paragraph (a) of this section.

§ 60.673 Reconstruction.

(a) The cost of replacement of ore-contact surfaces on processing equipment shall not be considered in calculating either the "fixed capital cost c the new components" or the "fixe capital cost that would be required construct a comparable new facili' under § 60.15. Ore-contact surfaces crushing surfaces; screen meshes, b and plates; conveyor belts; and e' tor buckets.

(b) Under § 60.15, the "fixed capital cost of the new components" includes the fixed capital cost of all depreciable components (except components specified in paragraph (a) of this section) which are or will be replaced pursuant to all continuous programs of component replacement commenced within any 2-year period following August 31, 1983.

§ 60.674 Monitoring of operations.

The owner or operator of any affected facility subject to the provisions of this subpart which uses a wet scrubber to control emissions shall install, calibrate, maintain and operate the following monitoring devices:

(a) A device for the continuous measurement of the pressure loss of the gas stream through the scrubber. The monitoring device must be certified by the manufacturer to be accurate within ±250 pascals ±1 inch water gauge pressure and must be calibrated on an annual basis in accordance with manufacturer's instructions.

(b) A device for the continuous measurement of the scrubbing liquid flow rate to the wet scrubber. The monitoring device must be certified by the manufacturer to be accurate within ±5 percent of design scrubbing liquid flow rate and must be calibrated on an annual basis in accordance with manufacturer's instructions.

§ 60.675 Test methods and procedures.

(a) In conducting the performance sts required in § 60.8, the owner or erator shall use as reference meth- and procedures the test methods ppendix A of this part or other ds and procedures as specified section, except as provided in). Acceptable alternative meth- procedures are given in para-) of this section.

e owner or operator shall de- compliance with the particu- er standards in § 60.272(a) as

hod 5 or Method 17 shall be determine the particulate ncentration. The sample l be at least 1.70 dscm (60 ethod 5, if the gas stream d is at ambient tempera- pling probe and filter may be operated without heaters. If the gas stream is above ambient temperature, the sampling probe and filter may be operated at a temperature high enough, but no higher than 121 °C (250 °F), to prevent water condensation on the filter.

(2) Method 9 and the procedures in § 60.11 shall be used to determine opacity.

(c) In determining compliance with the particulate matter standards in § 60.672 (b) and (c), the owner or operator shall use Method 9 and the procedures in § 60.11, with the following additions:

(1) The minimum distance between the observer and the emission source shall be 4.57 meters (15 feet).

(2) The observer shall, when possible, select a position that minimizes interference from other fugitive emission sources (e.g., road dust). The required observer position relative to the sun (Method 9, Section 2.1) must be followed.

(3) For affected facilities using wet dust suppression for particulate matter control, a visible mist is sometimes generated by the spray. The water mist must not be confused with particulate matter emissions and is not to be considered a visible emission. When a water mist of this nature is present, the observation of emissions is to be made at a point in the plume where the mist is no longer visible.

(d) In determining compliance with § 60.672(e), the owner or operator shall use Method 22 to determine fugitive emissions. The performance test shall be conducted while all affected facilities inside the building are operating. The performance test for each building shall be at least 75 minutes in duration, with each side of the building and the roof being observed for at least 15 minutes.

(e) The owner or operator may use the following as alternatives to the reference methods and procedures specified in this section:

(1) For the method and procedure of paragraph (c) of this section, if emissions from two or more facilities continuously interfere so that the opacity of fugitive emissions from an individual affected facility cannot be read,

either of the following procedures may be used:

(i) Use for the combined emission stream the highest fugitive opacity standard applicable to any of the individual affected facilities contributing to the emissions stream.

(ii) Separate the emissions so that the opacity of emissions from each affected facility can be read.

(f) To comply with § 60.676(d), the owner or operator shall record the measurements as required § 60.676(c) using the monitoring devices in § 60.674 (a) and (b) during each particulate matter run and shall determine the averages.

[54 FR 6680, Feb. 14, 1989]

§ 60.676 Reporting and recordkeeping.

(a) Each owner or operator seeking to comply with § 60.670(d) shall submit to the Administrator the following information about the existing facility being replaced and the replacement piece of equipment.

(1) For a crusher, grinding mill, bucket elevator, bagging operation, or enclosed truck or railcar loading station:

(i) The rated capacity in tons per hour of the existing facility being replaced and

(ii) The rated capacity in tons per hour of the replacement equipment.

(2) For a screening operation:

(i) The total surface area of the top screen of the existing screening operation being replaced and

(ii) The total surface area of the top screen of the replacement screening operation.

(3) For a conveyor belt:

(i) The width of the existing belt being replaced and

(ii) The width of the replacement conveyor belt.

(4) For a storage bin:

(i) The rated capacity in tons of the existing storage bin being replaced and

(ii) The rated capacity in tons of replacement storage bins.

(b) Each owner or operator seeking to comply with § 60.670(d) shall submit the following data to the Director of the Emission Standards and Engineering Division, (MD-13), U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711.

(1) The information described in § 60.676(a).

(2) A description of the control device used to reduce particulate matter emissions from the existing facility and a list of all other pieces of equipment controlled by the same control device; and

(3) The estimated age of the existing facility.

(c) During the initial performance test of a wet scrubber, and daily thereafter, the owner or operator shall record the measurements of both the change in pressure of the gas stream across the scrubber and the scrubbing liquid flow rate.

(d) After the initial performance test of a wet scrubber, the owner or operator shall submit semiannual reports to the Administrator of occurrences when the measurements of the scrubber pressure loss (or gain) and liquid flow rate differ by more than ±30 percent from the averaged determined during the most recent performance test.

(e) The reports required under paragraph (d) shall be postmarked within 30 days following end of the second and fourth calendar quarters.

(f) The owner or operator of any affected facility shall submit written reports of the results of all performance tests conducted to demonstrate compliance with the standards set forth in § 60.672, including reports of opacity observations made using Method 9 to demonstrate compliance with § 60.672 (b) and (c) and reports of observations using Method 22 to demonstrate compliance with § 60.672(e).

(g) The requirements of this paragraph remain in force until and unless the Agency, in delegating enforcement authority to a State under section 111(c) of the Act, approves reporting requirements or an alternative means of compliance surveillance adopted by such States. In that event, affected sources within the State will be relieved of the obligation to comply with paragraphs (a), (c), (d), (e), and (f) of this section, provided that they comply with requirements established by the State. Compliance with paragraph (b) of this section will still be required.

(Approved by the Office of Management and Budget under control number 2060-0050)

[51 FR 31337, Aug. 1, 1985, as amended at 54 FR 6680, Feb. 14, 1989]

Subpart PPP—Standard of Performance for Wool Fiberglass Insulation Manufacturing Plants

SOURCE: 50 FR 7699, Feb. 25, 1985, unless otherwise noted.

§ 60.680 Applicability and designation of affected facility.

(a) The affected facility to which the provisions of this subpart apply is each rotary spin wool fiberglass insulation manufacturing line.

(b) The owner or operator of any facility under paragraph (a) of this section that commences construction, modification, or reconstruction after February 7, 1984, is subject to the requirements of this subpart.

§ 60.681 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

Glass pull rate means the mass of molten glass utilized in the manufacture of wool fiberglass insulation at a single manufacturing line in a specified time period.

Manufacturing line means the manufacturing equipment comprising the forming section, where molten glass is fiberized and a fiberglass mat is formed; the curing section, where the binder resin in the mat is thermally "set;" and the cooling section, where the mat is cooled.

Rotary spin means a process used to produce wool fiberglass insulation by forcing molten glass through numerous small orifices in the side wall of a spinner to form continuous glass fibers that are then broken into discrete lengths by high velocity air flow.

Wool fiberglass insulation means a thermal insulation material composed of glass fibers and made from glass produced or melted at the same facility where the manufacturing line is located.

§ 60.682 Standard for particulate matter.

On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which contain particulate matter in excess of 5.5 kg/Mg (11.0 lb/ton) of glass pulled.

§ 60.683 Monitoring of operations.

(a) An owner or operator subject to the provisions of this subpart who uses a wet scrubbing control device to comply with the mass emission standard shall install, calibrate, maintain, and operate monitoring devices that measure the gas pressure drop across each scrubber and the scrubbing liquid flow rate to each scrubber. The pressure drop monitor is to be certified by its manufacturer to be accurate within ±250 pascals (±1 inch water gauge) over its operating range, and the flow rate monitor is to be certified by its manufacturer to be accurate within ±5 percent over its operating range.

(b) An owner or operator subject to the provisions of this subpart who uses a wet electrostatic precipitator control device to comply with the mass emission standard shall install, calibrate, maintain, and operate monitoring devices that measure the primary and secondary current (amperes) and voltage in each electrical field and the inlet water flow rate. In addition, the owner or operator shall determine the total residue (total solids) content of the water entering the control device once per day using Method 209A, "Total Residue Dried at 103-105 °C," in *Standard Methods for the Examination of Water and Wastewater*, 15th Edition, 1980 (incorporated by reference—see § 60.17). Total residue shall be reported as percent by weight. All monitoring devices required under this paragraph are to be certified by their manufacturers to be accurate within ±5 percent over their operating range.

(c) All monitoring devices required under this section are to be recalibrat-

PERFORMANCE DATA

Turbocharged-Aftercooled PA5188

Rating Level	E			D			C			B			A		
Rated rpm	2100			2100			2100			2000			1800		
Engine Power @ rpm	525 bhp (392 bkW)			515 bhp (384 bkW)			460 bhp (343 bkW)			440 bhp (328 bkW)			420 bhp (313 bkW)		
rpm	2100	1800	1500	2100	1800	1500	2100	1800	1500	2000	1800	1500	1800	1700	1500
bhp	525	501	456	515	499	451	460	446	403	440	429	391	420	431	415
lb/bhp-hr	.367	.355	.352	.339	.332	.334	.339	.330	.330	.335	.330	.330	.331	.332	.333
gal/hr	27.4	25.4	22.8	24.9	23.6	21.5	22.3	21.0	19.1	21.0	20.2	18.4	19.8	20.3	19.7
bkW	392	374	340	384	372	337	343	332	301	328	320	291	313	321	309
g/bkW-hr	223	216	214	206	202	203	206	201	201	204	201	201	201	202	203
L/hr	103.9	96.0	86.4	94.4	89.4	81.3	84.3	79.5	72.2	79.6	76.6	69.8	75.1	77.0	74.5

PERFORMANCE DATA

Turbocharged-Aftercooled PA2373

Rating Level	E			D			C			B			A		
Rated rpm	2100			2100			2100			2000			1800		
Engine Power @ rpm	500 bhp (373 bkW)			480 bhp (358 bkW)			400 bhp (298 bkW)			370 bhp (376 bkW)			325 bhp (242 bkW)		
rpm	2100	1800	1500	2100	1800	1500	2100	1800	1500	2000	1800	1500	1800	1700	1500
bhp	500	483	437	480	464	419	400	377	341	370	356	324	325	327	310
lb/bhp-hr	.339	.332	.332	.339	.330	.332	.339	.329	.330	.334	.329	.332	.329	.329	.332
gal/hr	24.2	22.9	20.7	23.2	21.9	19.9	19.4	17.8	16.1	17.7	16.7	15.3	15.3	15.3	14.7
bkW	373	360	326	358	346	313	298	282	254	276	266	241	242	244	232
g/bkW-hr	206	202	202	206	201	202	206	200	201	203	200	202	200	200	202
L/hr	91.7	86.5	78.4	87.9	82.9	75.2	73.4	67.2	60.9	66.9	63.4	58.0	57.8	58.0	55.7

PERFORMANCE DATA

Turbocharged-Aftercooled PA2376

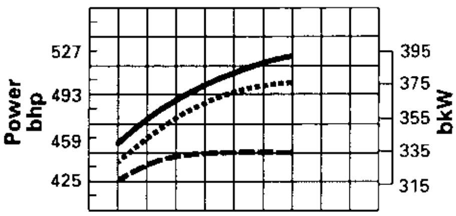
Rating Level	E			D			C			B			A		
Rated rpm	2100			2100			2100			2000			1800		
Engine Power @ rpm	450 bhp (336 bkW)			420 bhp (313 bkW)			360 bhp (269 bkW)			325 bhp (242 bkW)			322 bhp (240 bkW)		
rpm	2100	1800	1500	2100	1800	1500	2100	1800	1500	2000	1800	1500	1800	1700	1500
bhp	450	426	386	420	398	360	360	339	306	325	312	293	322	318	296
lb/bhp-hr	.339	.330	.330	.339	.329	.330	.340	.329	.332	.337	.330	.334	.333	.332	.334
gal/hr	21.8	20.1	18.2	20.3	18.7	17.0	17.5	15.9	14.5	15.6	14.3	13.4	15.3	15.0	14.1
bkW	336	318	288	313	297	268	269	253	229	242	233	211	240	237	221
g/bkW-hr	206	201	201	206	200	201	207	200	202	205	201	203	203	202	203
L/hr	82.4	76.0	68.9	77.0	70.8	64.3	66.3	60.3	54.8	59.2	55.7	50.9	58.0	56.9	53.5

3406C INDUSTRIAL ENGINE

CATERPILLAR

PERFORMANCE CURVES

E Rating



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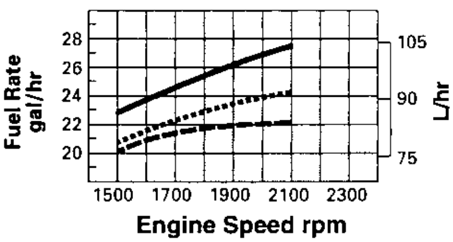
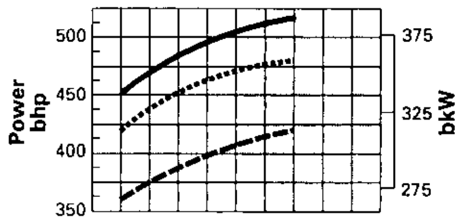


D Rating



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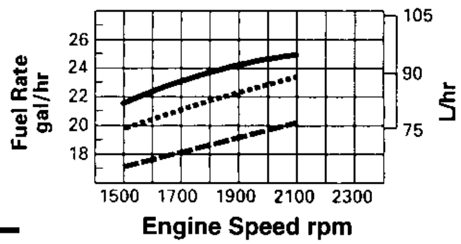
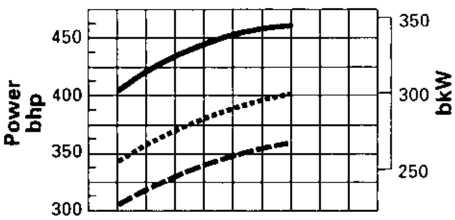


DITA, PA 5188
DITA, PA 2373
DITA, PA 2376

C Rating



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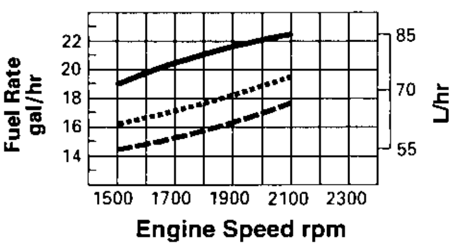
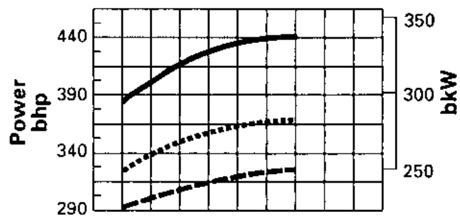
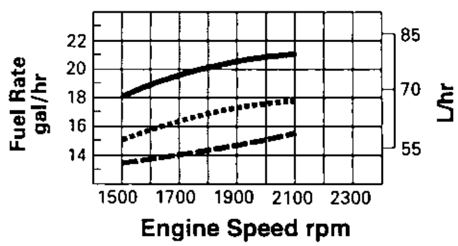


B Rating

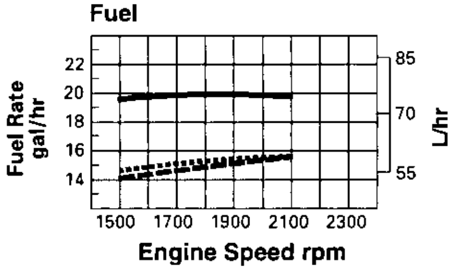


Fuel



A Rating

Fuel



INDUSTRIAL RATINGS

IND-E

IND-E ratings are for service where power is required for a short time for initial starting or sudden overload. For emergency service where standard power is unavailable. The maximum horsepower and speed capability of the engine can be utilized for a maximum of 15 uninterrupted minutes followed by one hour at intermittent or duration of the emergency. Operating limits are:

1. Time at full load not to exceed 5% of the duty cycle or 15 minutes max.
2. Load factor limited to 35%.
3. The maximum horsepower and speed capability of the engine can be utilized for a maximum of 15 minutes followed by one hour at intermittent or duration of the emergency.
4. Typical operating hours per year is 500.

Examples of an IND-E industrial application are:

1. Standby centrifugal water pumps
2. Oil field well servicing
3. Crash trucks
4. Gas turbine starters

IND-D

IND-D ratings are for service where rated power is required for period overloads. The maximum horsepower and speed capability of the engine can be utilized for a maximum of 30 uninterrupted minutes followed by one hour at intermittent. Operating limits are:

1. Time at full load not to exceed 10% of the duty cycle or 30 min max.
2. Load factor limited to 50%.
3. Full load operation to a maximum of 30 minutes followed by one hour at intermittent.
4. Typical operating hours per year is 1500.

Examples of an IND-D industrial application are:

1. Offshore cranes
2. Runway snowblowers
3. Water well drills
4. Portable air compressors
5. Fire pump certification power (advertised power)

IND-C (INTERMITTENT)

IND-C ratings are for service where power and/ or speed are cyclic. The horsepower and speed of the engine which can be utilized for one uninterrupted hour followed by one hour of operation at or below the continuous rating.

Operating limits are:

1. Time at full load not to exceed 50% of the duty cycle or one hour max.
2. Load factor limited to 70%.
3. Full load operation limited to one uninterrupted hour followed by one hour of operation at or below the continuous rating.
4. Typical operating hours per year is 3000 hours.

Examples of an IND-C industrial application are:

1. Agricultural tractors, harvesters, and combines
2. Truck – off highway
3. Fire pump application power (90% of certified power)
4. Blast hole drills
5. Rock crushers and wood chippers with high torque rise
6. Oil field hoisting

IND-B

IND-B ratings are for moderate-duty service where power and/or speed are cyclic. Operating limits are:

1. Time at full load not to exceed 80% of the duty cycle.
2. Load factor limited to 85%.
3. Typical operating hours per year is 4000 hours.

Examples of an IND-B industrial application are:

1. Irrigation where normal pump demand is 85% of engine rating
2. Oil field mechanical pumping/drilling
3. Stationary/plant air compressors

IND-A (CONTINUOUS)

IND-A continuous ratings are for heavy-duty service when the engine is operated at rated load and speed up to 100% of the time without interruption or load cycling. Operating limits are:

1. No hour or load factor limitation.
2. Continuous operation at full load.
3. Average load factor to approach 100%.
4. Typical operating hours per year is over 4000 hrs.

Examples of an IND-A industrial application are:

1. Pipeline pumping
2. Ventilation
3. Customer specs

FIRE Database- Version 6.22

SCC	30502001	
Level One	Industrial Processes	
Level Two	Mineral Products	
Level Three	Stone Quarrying - Processing (See also 305320)	
Level Four	Primary Crushing	
Standard AFS Unit	Tons Raw Material	
Pollutant	PM, total	**CAS**
Primary Control	UNCONTROLLED	
Secondary Control		
Emission Factor	7.000E-4	Lb Tons Raw Material Processed
Standard AFS Unit?	Yes	**QUALITY** E
References	EPA 1995. Section 11.19.2, Construction Aggregate Processing: Crushed Stone Processing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	
Notes		
Multiple Factor Info		

SCC	30502002	
Level One	Industrial Processes	
Level Two	Mineral Products	
Level Three	Stone Quarrying - Processing (See also 305320)	
Level Four	Secondary Crushing/Screening	
Standard AFS Unit	Tons Raw Material	
Pollutant	PM10, total	**CAS**
Primary Control	WET SUPPRESSION	
Secondary Control		
Emission Factor	8.400E-4	Lb Tons Raw Material Processed
Standard AFS Unit?	Yes	**QUALITY** C
References	EPA 1995. Section 11.19.2, Construction Aggregate Processing: Crushed Stone Processing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	
Notes	This entry has 2 SCC's: 30502002 and 30502003	
Multiple Factor Info		

FIRE Database- Version 6.22

SCC	30502001
Level One	Industrial Processes
Level Two	Mineral Products
Level Three	Stone Quarrying - Processing (See also 305320)
Level Four	Primary Crushing
Standard AFS Unit	Tons Raw Material

Pollutant PM, total **CAS**

Primary Control UNCONTROLLED
Secondary Control

Emission Factor 7.000E-4 Lb
Tons
Raw Material
Processed

Standard AFS Unit? Yes **QUALITY** E

References EPA 1995. Section 11.19.2, Construction Aggregate Processing: Crushed Stone Processing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.

Notes

Multiple Factor Info

SCC	30502002
Level One	Industrial Processes
Level Two	Mineral Products
Level Three	Stone Quarrying - Processing (See also 305320)
Level Four	Secondary Crushing/Screening
Standard AFS Unit	Tons Raw Material

Pollutant PM10, total **CAS**

Primary Control WET SUPPRESSION
Secondary Control

Emission Factor 8.400E-4 Lb
Tons
Raw Material
Processed

Standard AFS Unit? Yes **QUALITY** C

References EPA 1995. Section 11.19.2, Construction Aggregate Processing: Crushed Stone Processing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.

Notes This entry has 2 SCC's: 30502002 and 30502003

Multiple Factor Info

11.19 Construction Aggregate Processing[1-2]

The construction aggregate industry covers a range of subclassifications of the nonmetallic minerals industry (see Section 11.24, Metallic Minerals Processing, for information on that similar activity). Many operations and processes are common to both groups, including mineral extraction from the earth, loading, unloading, conveying, crushing, screening, and loadout. Other operations are restricted to specific subcategories. These include wet and dry fine milling or grinding, air classification, drying, calcining, mixing, and bagging. The latter group of operations is not generally associated with the construction aggregate industry but can be conducted on the same raw materials used to produce aggregate. Two examples are processing of limestone and sandstone. Both substances can be used as construction materials and may be processed further for other uses at the same location. Limestone is a common source of construction aggregate, but it can be further milled and classified to produce agricultural limestone. Sandstone can be processed into construction sand and also can be wet and/or dry milled, dried, and air classified into industrial sand.

The construction aggregate industry can be categorized by source, mineral type or form, wet versus dry, washed or unwashed, and end uses, to name but a few. The industry is divided in this document into Section 11.19.1, Sand And Gravel Processing, and Section 11.19.2, Crushed Stone Processing. Sections on other categories of the industry will be published when data on these processes become available.

Uncontrolled construction aggregate processing can produce nuisance problems and can have an effect upon attainment of ambient particulate standards. However, the generally large particles produced often can be controlled readily. Some of the individual operations such as wet crushing and grinding, washing, screening, and dredging take place with "high" moisture (more than about 1.5 to 4.0 weight percent). Such wet processes do not generate appreciable particulate emissions.

References For Section 11.19

1. *Air Pollution Control Techniques For Nonmetallic Minerals Industry*, EPA-450/3-82-014, U. S. Environmental Protection Agency, Research Triangle Park, NC, August 1982.

2. *Review Emissions Data Base And Develop Emission Factors For The Construction Aggregate Industry*, Engineering-Science, Inc., Arcadia, CA, September 1984.

11.19.1 Sand And Gravel Processing

11.19.1.1 Process Description[1-6]

Deposits of sand and gravel, the unconsolidated granular materials resulting from the natural disintegration of rock or stone, are generally found in near-surface alluvial deposits and in subterranean and subaqueous beds. Sand and gravel are siliceous and calcareous products of the weathering of rocks and unconsolidated or poorly consolidated materials. Such deposits are common throughout the country. The six-digit Source Classification Code (SCC) for construction sand and gravel processing is 3-05-025, and the six-digit SCC for industrial sand and gravel is 3-05-027.

Construction Sand And Gravel -

Sand and gravel typically are mined in a moist or wet condition by open pit excavation or by dredging. Open pit excavation is carried out with power shovels, draglines, front end loaders, and bucket wheel excavators. In rare situations, light charge blasting is done to loosen the deposit. Mining by dredging involves mounting the equipment on boats or barges and removing the sand and gravel from the bottom of the body of water by suction or bucket-type dredges. After mining, the materials are transported to the processing plant by suction pump, earth mover, barge, truck, belt conveyors, or other means.

Although significant amounts of sand and gravel are used for fill, bedding, subbase, and basecourse without processing, most domestic sand and gravel are processed prior to use. The processing of sand and gravel for a specific market involves the use of different combinations of washers, screens, and classifiers to segregate particle sizes; crushers to reduce oversized material; and storage and loading facilities. A process flow diagram for construction sand and gravel processing is presented in Figure 11.19.1-1. The following paragraphs describe the process in more detail.

After being transported to the processing plant, the wet sand and gravel raw feed is stockpiled or emptied directly into a hopper, which typically is covered with a "grizzly" of parallel bars to screen out large cobbles and boulders. From the hopper, the material is transported to fixed or vibrating scalping screens by gravity, belt conveyors, hydraulic pump, or bucket elevators. The scalping screens separate the oversize material from the smaller, marketable sizes. Oversize material may be used for erosion control, reclamation, or other uses, or it may be directed to a crusher for size reduction, to produce crushed aggregate, or to produce manufactured sands. Crushing generally is carried out in one or two stages, although three-stage crushing may also be performed. Following crushing, the material is returned to the screening operation for sizing.

The material that passes through the scalping screen is fed into a battery of sizing screens, which generally consists of either horizontal or sloped, and either single or multideck, vibrating screens. Rotating trommel screens with water sprays are also used to process and wash wet sand and gravel. Screening separates the sand and gravel into different size ranges. Water is sprayed onto the material throughout the screening process. After screening, the sized gravel is transported to stockpiles storage bins, or, in some cases, to crushers by belt conveyors, bucket elevators, or screw conveyors.

The sand is freed from clay and organic impurities by log washers or rotary scrubbers. After scrubbing, the sand typically is sized by water classification. Wet and dry screening is rarely used to size the sand. After classification, the sand is dewatered using screws, separatory cones, or

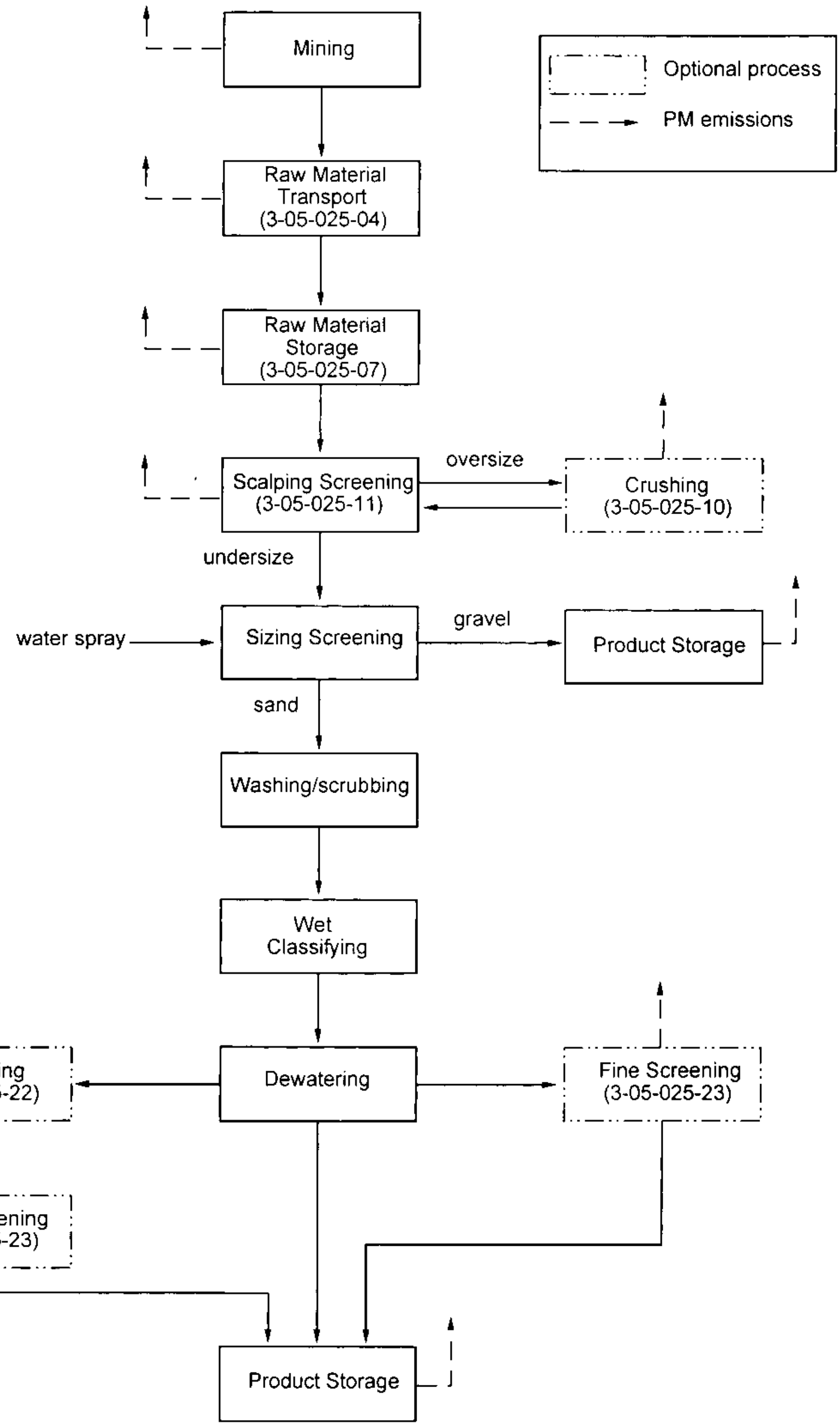


Figure 11.19.1-1. Process flow diagram for construction sand and gravel processing.
(Source Classification Codes in parentheses.)

hydroseparators. Material may also be rodmilled to produce smaller sized fractions, although this practice is not common in the industry. After processing, the sand is transported to storage bins or stockpiles by belt conveyors, bucket elevators, or screw conveyors.

Industrial Sand And Gravel -

Industrial sand and gravel typically are mined from open pits of naturally occurring quartz-rich sand and sandstone. Mining methods depend primarily on the degree of cementation of the rock. In some deposits, blasting is required to loosen the material prior to processing. The material may undergo primary crushing at the mine site before being transported to the processing plant. Figure 11.19.1-2 is a flow diagram for industrial sand and gravel processing.

The mined rock is transported to the processing site and stockpiled. The material then is crushed. Depending on the degree of cementation, several stages of crushing may be required to achieve the desired size reduction. Gyratory crushers, jaw crushers, roll crushers, and impact mills are used for primary and secondary crushing. After crushing, the size of the material is further reduced to 50 micrometers (μm) or smaller by grinding, using smooth rolls, media mills, autogenous mills, hammer mills, or jet mills. The ground material then is classified by wet screening, dry screening, or air classification. At some plants, after initial crushing and screening, a portion of the sand may be diverted to construction sand use.

After initial crushing and screening, industrial sand and gravel are washed to remove unwanted dust and debris and are then screened and classified again. The sand (now containing 25 to 30 percent moisture) or gravel then goes to an attrition scrubbing system that removes surface stains from the material by rubbing in an agitated, high-density pulp. The scrubbed sand or gravel is diluted with water to 25 to 30 percent solids and is pumped to a set of cyclones for further desliming. If the deslimed sand or gravel contains mica, feldspar, and iron bearing minerals, it enters a froth flotation process to which sodium silicate and sulfuric acid are added. The mixture then enters a series of spiral classifiers where the impurities are floated in a froth and diverted to waste. The purified sand, which has a moisture content of 15 to 25 percent, is conveyed to drainage bins where the moisture content is reduced to about 6 percent. The material is then dried in rotary or fluidized bed dryers to a moisture content of less tha 0.5 percent. The dryers generally are fired with natural gas or oil, although other fuels such as propane or diesel also may be used. After drying, the material is cooled and then undergoes final screening and classification prior to being stored and packaged for shipment.

11.19.1.2 Emissions And Controls[6-14]

Emissions from the production of sand and gravel consist primarily of particulate matter (PM) and particulate matter less than 10 micrometers (PM-10) in aerodynamic diameter, which are emitted by many operations at sand and gravel processing plants, such as conveying, screening, crushing, and storing operations. Generally, these materials are wet or moist when handled, and process emissions are often negligible. A substantial portion of these emissions may consist of heavy particles that settle out within the plant. Other potentially significant sources of PM and PM-10 emissions are haul roads. Emissions from dryers include PM and PM-10, as well as typical combustion products including CO, CO_2, and NO_x. In addition, dryers may be sources of volatile organic compounds (VOC) or sulfur oxides (SO_x) emissions, depending on the type of fuel used to fire the dryer.

With the exception of drying, emissions from sand and gravel operations primarily are in the form of fugitive dust, and control techniques applicable to fugitive dust sources are appropriate. Some successful control techniques used for haul roads are dust suppressant application, paving, route

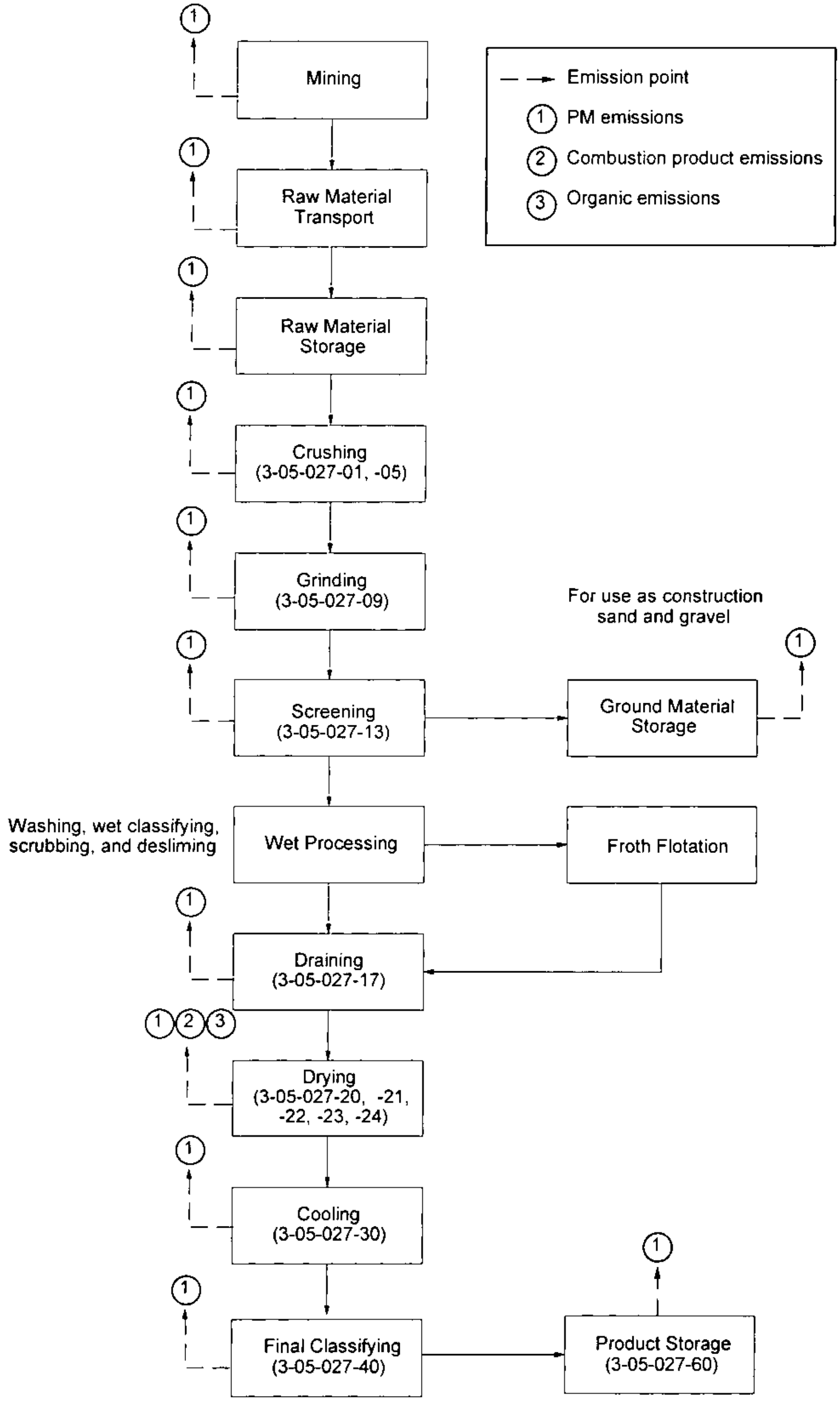


Figure 11.19.1-2. Process flow diagram for industrial sand and gravel processing. (Source Classification Codes in parentheses.)

modifications, and soil stabilization; for conveyors, covering and wet suppression; for storage piles, wet suppression, windbreaks, enclosure, and soil stabilizers; for conveyor and batch transfer points, wet suppression and various methods to reduce freefall distances (e. g., telescopic chutes, stone ladders, and hinged boom stacker conveyors); and for screening and other size classification, covering and wet suppression.

Wet suppression techniques include application of water, chemicals and/or foam, usually at crusher or conveyor feed and/or discharge points. Such spray systems at transfer points and on material handling operations have been estimated to reduce emissions 70 to 95 percent. Spray systems can also reduce loading and wind erosion emissions from storage piles of various materials 80 to 90 percent. Control efficiencies depend upon local climatic conditions, source properties and duration of control effectiveness. Wet suppression has a carryover effect downstream of the point of application of water or other wetting agents, as long as the surface moisture content is high enough to cause the fines to adhere to the larger rock particles.

In addition to fugitive dust control techniques, some facilities use add-on control devices to reduce emissions of PM and PM-10 from sand and gravel processing operations. Controls in use include cyclones, wet scrubbers, venturi scrubbers, and fabric filters. These types of controls are rarel used at construction sand and gravel plants, but are more common at industrial sand and gravel processing facilities.

Emission factors for criteria pollutant emissions from industrial sand and gravel processing are presented in Table 11.19.1-1 (metric and English units), and emission factors for organic pollutant emissions from industrial sand and gravel processing are presented in Table 11.19.1-2 (metric and English units). Although no emission factors are presented for construction sand and gravel processing, emission factors for the crushing, screening, and handling and transfer operations associated with stone crushing can be found in Section 11.19.2, "Crushed Stone Processing." In the absence of other data, the emission factors presented in Section 11.19.2 can be used to estimate emissions from corresponding sand and gravel processing sources. The background report for this AP-42 section also presents factors for the combined emissions of total suspended particulate from construction gravel storage pile wind erosion, material handling, and vehicle traffic. However, because the applicability of those emission factors to other storage piles is questionable, they are not presented here. To estimate emissions from fugitive sources, refer to AP-42 Chapter 13, "Miscellaneous Sources". The emission factors for industrial sand storage and screening presented in Table 11.19.1-1 are not recommended as surrogates for construction sand and gravel processing, because they are based on emissions from dried sand and may result in overestimates of emissions from those sources. Construction sand and gravel are processed at much higher moisture contents.

Table 11.19.1-1 (Metric And English Units).
EMISSION FACTORS FOR INDUSTRIAL SAND AND GRAVEL PROCESSING[a]

EMISSION FACTOR RATING: D

Source	Total PM		NO_x		CO_2	
	kg/Mg	lb/ton	kg/Mg	lb/ton	kg/Mg	lb/ton
Sand dryer (SCC 3-05-027-20)	0.98[b,c]	2.0[b,c]	0.016[d]	0.031[d]	14[e]	27[e]
Sand dryer with wet scrubber (SCC 3-05-027-20)	0.019[b,f]	0.039[b,f]	[g]	[g]	[g]	[g]
Sand dryer with fabric filter (SCC 3-05-027-20)	0.0053[b,h]	0.010[b,h]	[g]	[g]	[g]	[g]
Sand handling, transfer, and storage with wet scrubber (SCC 3-05-027-60)	0.00064[j]	0.0013[j]	ND	ND	ND	ND
Sand screening with venturi scrubber (SCC 3-05-027-13)	0.0042[k]	0.0083[k]	ND	ND	ND	ND

[a] Factors represent uncontrolled emissions unless noted. Dryer emission factors in units of kg/Mg and lb/ton of dried material produced; other factors in units of kg/Mg and lb/ton of material stored or screened. SCC = Source Classification Code.
[b] Factors are for filterable PM only. Filterable PM is that PM collected on or prior to the filter of an EPA Method 5 (or equivalent) sampling train. Condensible organic and inorganic PM emission factors are not available. Factors presented can be considered a conservative underestimate of total PM.
[c] Reference 12. EMISSION FACTOR RATING: E.
[d] Reference 10.
[e] References 10,13.
[f] References 5,13. EMISSION FACTOR RATING: C.
[g] Control device has no effect on emissions. See factor for uncontrolled emissions.
[h] References 7,11.
[j] Reference 9. For dried sand.
[k] Reference 14. Screening of dried sand.

Table 11.19.1-2 (Metric And English Units).
EMISSION FACTORS FOR INDUSTRIAL SAND AND GRAVEL PROCESSING--
ORGANIC POLLUTANTS[a]

EMISSION FACTOR RATING: D

Source	Pollutant		Emission factor	
	CASRN[b]	Name	kg/Mg	lb/ton
Diesel-fired rotary sand dryer with fabric filter (SCC 3-05-027-22)	50-00-0	Formaldehyde	0.0021	0.0043
	206-44-0	Fluoranthene	3.0×10^{-6}	6.0×10^{-6}
	91-20-3	Naphthalene	2.9×10^{-5}	5.9×10^{-5}
	85-01-8	Phenanthrene	7.5×10^{-6}	1.5×10^{-5}

[a] Reference 8. Factors represent uncontrolled emissions unless noted. Dryer emission factors in units of kg/Mg and lb/ton of material dried. SCC = Source Classification Code.
[b] Chemical Abstract Service Registry Number.

References For Section 11.19.1

1. *Air Pollution Control Techniques For Nonmetallic Minerals Industry*, EPA-450/3-82-014, U. S. Environmental Protection Agency, Research Triangle Park, NC, August 1982.

2. S. Walker, "Production Of Sand And Gravel", Circular Number 57, National Sand And Gravel Association, Washington, DC, 1954.

3. "Construction Sand And Gravel", *U. S. Minerals Yearbook 1989, Volume I: Metals And Minerals*, Bureau Of Mines, U. S. Department Of The Interior, Washington, DC.

4. "Industrial Sand And Gravel", *U. S. Minerals Yearbook 1989, Volume I: Metals And Minerals*, Bureau Of Mines, U. S. Department Of The Interior, Washington, DC.

5. *Calciners And Dryers In Mineral Industries - Background Information For Proposed Standards*, EPA-450/3-85-025a, U. S. Environmental Protection Agency, Research Triangle Park, NC, October 1985.

6. Written communication from R. Morris, National Aggregates Association, Silver Spring, MD, to R. Myers, U. S. Environmental Protection Agency, Research Triangle Park, NC, December 30, 1994.

7. *Stack Test Report For Redi-Crete Corporation*, Trace Technologies, Inc. Bridgewater, NJ, December 19, 1988.

8. *P. W. Gillebrand Company, Toxic Emissions Testing, Specialty Sand Dryer*, BTC Environmental, Inc., Ventura, CA, November 8, 1991.

9. *U. S. Silica Company, Newport, New Jersey, Emission Compliance Test Program*, AirNova, Inc., Collingswood, NJ, April 1990.

10. *The Morie Company, Inc., Mauricetown Plant, Emission Compliance Test Program*, AirNova, Inc., Collingswood, NJ, November 1989.

11. *Source Emissions Compliance Test Report, Number Two Sand Dryer, Jesse S. Morie & Son, Inc., Mauricetown, New Jersey*, Roy F. Weston, Inc., West Chester, PA, August 1987.

12. *Source Emissions Compliance Test Report, Sand Dryer System, New Jersey Pulverizing Company, Bayville, New Jersey*, Roy F. Weston, Inc., West Chester, PA, January 1988.

13. *Compliance Stack Sampling Report For Richard Ricci Company, Port Norris, NJ*, Recon Systems, Inc., Three Bridges, NJ, July 31, 1987.

14. *Report To Badger Mining Corporation, Fairwater, Wisconsin, For Stack Emission Test, Particulate Matter, Sand Rescreening System, St. Marie Plant, April 7, 1987*, Environmental Technology & Engineering Corporation, Elm Grove, WI, June 17, 1987.

11.19.2 Crushed Stone Processing

11.19.2.1 Process Description[1-2]

Major rock types processed by the rock and crushed stone industry include limestone, granite, dolomite, traprock, sandstone, quartz, and quartzite. Minor types include calcareous marl, marble, shell, and slate. Industry classifications vary considerably and, in many cases, do not reflect actual geological definitions.

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

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

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

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

Some stone crushing plants produce manufactured sand. This is a small-sized rock product with a maximum size of 0.50 centimeters (3/16th inch). Crushed stone from the tertiary sizing screen is sized in a vibrating inclined screen (fines screen) with relatively small mesh sizes. Oversized material is processed in a cone crusher or a hammermill (fines crusher) adjusted to produce small diameter material. The output is then returned to the fines screen for resizing.

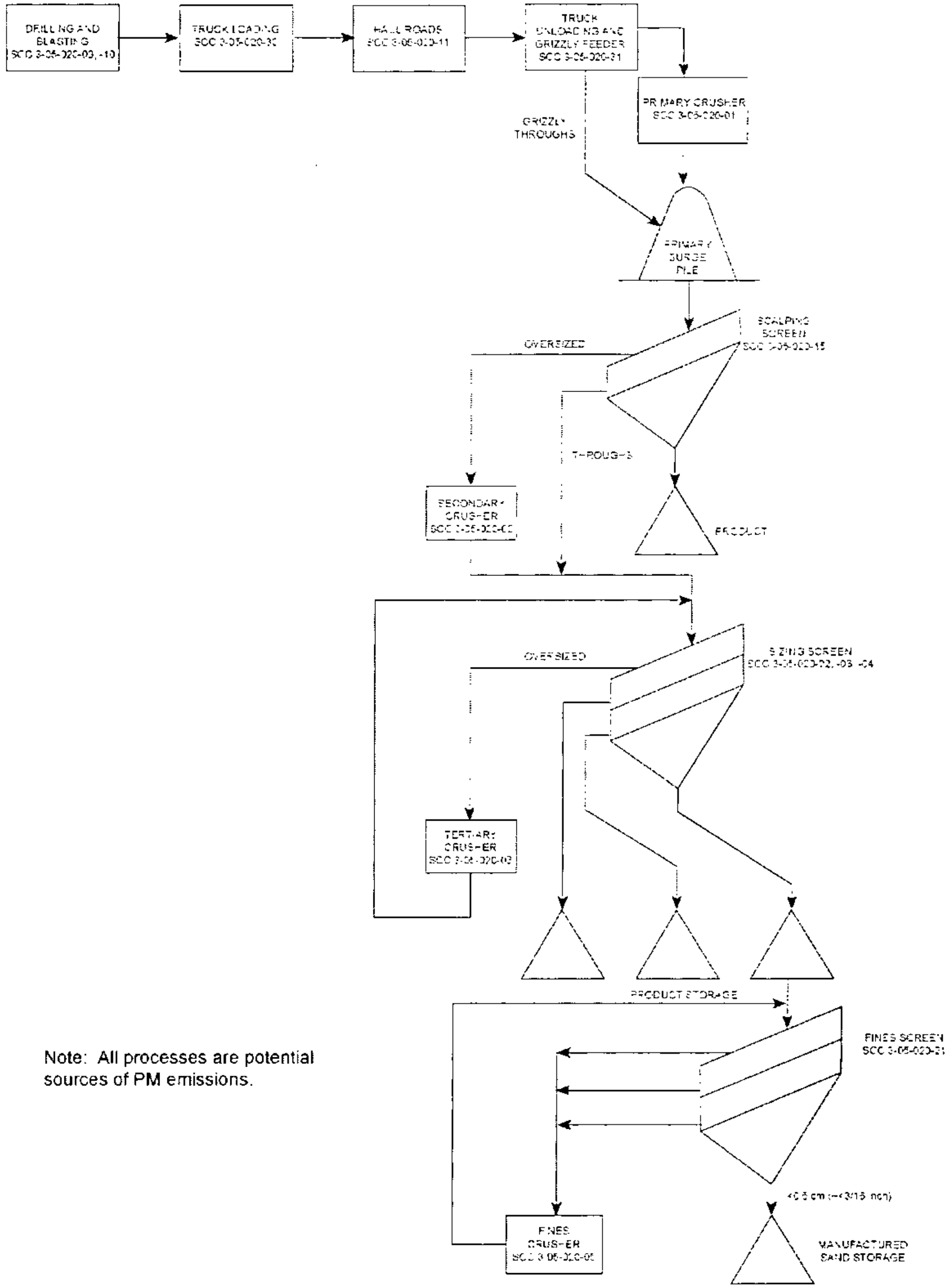


Figure 11.19.2-1. Typical stone processing plant.[2]
(SCC = Source Classification Code.)

In certain cases, stone washing is required to meet particular end product specifications or demands as with concrete aggregate processing. Crushed and broken stone normally is not milled but is screened and shipped to the consumer after secondary or tertiary crushing.

11.19.2.2 Emissions And Controls[1-8]

Emissions of PM and PM-10 occur from a number of operations in stone quarrying and processing. A substantial portion of these emissions consists of heavy particles that may settle out within the plant. As in other operations, crushed stone emission sources may be categorized as either process sources or fugitive dust sources. Process sources include those for which emissions are amenable to capture and subsequent control. Fugitive dust sources generally involve the reentrainment of settled dust by wind or machine movement. Emissions from process sources should be considered fugitive unless the sources are vented to a baghouse or are contained in an enclosure with a forced-air vent or stack. Factors affecting emissions from either source category include the stone size distribution and surface moisture content of the stone processed; the process throughput rate; the type of equipment and operating practices used; and topographical and climatic factors.

Of geographic and seasonal factors, the primary variables affecting uncontrolled PM emissions are wind and material moisture content. Wind parameters vary with geographical location, season, and weather. It can be expected that the level of emissions from unenclosed sources (principally fugitive dust sources) will be greater during periods of high winds. The material moisture content also varies with geographic location, season, and weather. Therefore, the levels of uncontrolled emissions from both process emission sources and fugitive dust sources generally will be greater in arid regions of the country than in temperate ones, and greater during the summer months because of a higher evaporation rate.

The moisture content of the material processed can have a substantial effect on emissions. This effect is evident throughout the processing operations. Surface wetness causes fine particles to agglomerate on, or to adhere to, the faces of larger stones, with a resulting dust suppression effect. However, as new fine particles are created by crushing and attrition, and as the moisture content is reduced by evaporation, this suppressive effect diminishes and may disappear. Plants that use wet suppression systems (spray nozzles) to maintain relatively high material moisture contents can effectively control PM emissions throughout the process. Depending on the geographic and climatic conditions, the moisture content of mined rock may range from nearly zero to several percent. Because moisture content is usually expressed on a basis of overall weight percent, the actual moisture amount per unit area will vary with the size of the rock being handled. On a constant mass-fraction basis, the per-unit area moisture content varies inversely with the diameter of the rock. Therefore, the suppressive effect of the moisture depends on both the absolute mass water content and the size of the rock product. Typically, wet material contains 1.5 to 4 percent water or more.

A variety of material, equipment, and operating factors can influence emissions from crushing. These factors include (1) stone type, (2) feed size and distribution, (3) moisture content, (4) throughput rate, (5) crusher type, (6) size reduction ratio, and (7) fines content. Insufficient data are available to present a matrix of rock crushing emission factors detailing the above classifications and variables. Available data indicate that PM-10 emissions from limestone and granite processing operations are similar. Therefore, the emission factors developed from the emission data gathered at limestone and granite processing facilities are considered to be representative of typical crushed stone processing operations. Emission factors for filterable PM and PM-10 emissions from crushed stone processing operations are presented in Tables 11.19-1 (metric units) and 11.19-2 (English units).

Table 11.19.2-1 (Metric Units). EMISSION FACTORS FOR CRUSHED STONE PROCESSING OPERATIONS[a]

Source[b]	Total Particulate Matter	EMISSION FACTOR RATING	Total PM-10[c]	EMISSION FACTOR RATING
Screening (SCC 3-05-020-02,-03)	—[d]		0.0076[e]	C
Screening (controlled) (SCC 3-05-020-02-03)	—[d]		0.00042[e]	C
Primary crushing (SCC 3-05-020-01)	0.00035[f]	E	ND[g]	
Secondary crushing (SCC 3-05-020-02)	ND		ND[g]	
Tertiary crushing (SCC 3-05-020-03)	—[d]		0.0012[h]	C
Primary crushing (controlled) (SCC 3-05-020-01)	ND		ND[g]	
Secondary crushing (controlled) (SCC 3-05-020-02)	ND		ND[g]	
Tertiary crushing (controlled) (SCC 3-05-020-03)	—[d]		0.00029[h]	C
Fines crushing[j] (SCC 3-05-020-05)	—[d]		0.0075	E
Fines crushing (controlled)[j] (SCC 3-05-020-05)	—[d]		0.0010	E
Fines screening[j] (SCC 3-05-020-21)	—[d]		0.036	E
Fines screening (controlled)[j] (SCC 3-05-020-21)	—[d]		0.0011	E
Conveyor transfer point[k] (SCC 3-05-020-06)	—[d]		0.00072	D
Conveyor transfer point (controlled)[k] (SCC 3-05-020-06)	—[d]		2.4×10^{-5}	D
Wet drilling: unfragmented stone[m] (SCC 3-05-020-10)	ND		4.0×10^{-5}	E
Truck unloading: fragmented stone[m] (SCC 3-05-020-31)	ND		8.0×10^{-6}	E
Truck loading--conveyor: crushed stone[n] (SCC 3-05-020-32)	ND		5.0×10^{-5}	E

[a] Emission factors represent uncontrolled emissions unless noted. Emission factors in kg/Mg of material throughput. SCC = Source Classification Code. ND = no data.

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

[c] 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.

Table 11.19.2-1 (cont.).

[d] Emission factors for total particulate are not presented pending a re-evaluation of the EPA Method 201a test data and/or results of emission testing. This re-evaluation is expected to be completed by July 1995.
[e] References 9, 11, 15-16.
[f] Reference 1.
[g] No data available, but emission factors for PM-10 emission factors for tertiary crushing can be used as an upper limit for primary or secondary crushing.
[h] References 10-11, 15-16.
[j] Reference 12.
[k] References 13-14.
[m] Reference 3.
[n] Reference 4.

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

Source[b]	Total Particulate Matter	EMISSION FACTOR RATING	Total PM-10[c]	EMISSION FACTOR RATING
Screening (SCC 3-05-020-02,-03)	—[d]		0.015[e]	C
Screening (controlled) (SCC 3-05-020-02-03)	—[d]		0.00084[e]	C
Primary crushing (SCC 3-05-020-01)	0.00070[f]	E	ND[g]	
Secondary crushing (SCC 3-05-020-02)	ND		ND[g]	
Tertiary crushing (SCC 3-05-020-03)	—[d]		0.0024[h]	C
Primary crushing (controlled) (SCC 3-05-020-01)	ND		ND[g]	NA
Secondary crushing (controlled) (SCC 3-05-020-02)	ND		ND[g]	NA
Tertiary crushing (controlled) (SCC 3-05-020-03)	—[d]		0.00059[h]	C
Fines crushing[j] (SCC 3-05-020-05)	—[d]		0.015	E
Fines crushing (controlled)[j] (SCC 3-05-020-05)	—[d]		0.0020	E
Fines screening[j] (SCC 3-05-020-21)	—[d]		0.071	E
Fines screening (controlled)[j] (SCC 3-05-020-21)	—[d]		0.0021	E
Conveyor transfer point[k] (SCC 3-05-020-06)	—[d]		0.0014	D
Conveyor transfer point (controlled)[k] (SCC 3-05-020-06)	—[d]		4.8×10^{-5}	D
Wet drilling: unfragmented stone[m] (SCC 3-05-020-10)	ND		8.0×10^{-5}	E
Truck unloading: fragmented stone[m] (SCC 3-05-020-31)	ND		1.6×10^{-5}	E
Truck loading--conveyor: crushed stone[n] (SCC 3-05-020-32)	ND		0.00010	E

[a] Emission factors represent uncontrolled emissions unless noted. Emission factors in lb/ton of material throughput. SCC = Source Classification Code. ND = no data.

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

[c] 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.

Table 11.19.2-2 (cont.).

[d] Emission factors for total particulate are not presented pending a re-evaluation of the EPA Method 201a test data and/or results of emission testing. This re-evaluation is expected to be completed by July 1995.
[e] References 9, 11, 15-16.
[f] Reference 1.
[g] No data available, but emission factors for PM-10 emission factors for tertiary crushing can be used as an upper limit for primary or secondary crushing.
[h] References 10-11, 15-16.
[j] Reference 12.
[k] References 13-14.
[m] Reference 3.
[n] Reference 4.

Emission factor estimates for stone quarry blasting operations are not presented here because of the sparsity and unreliability of available test data. While a procedure for estimating blasting emissions is presented in Section 11.9, Western Surface Coal Mining, that procedure should not be applied to stone quarries because of dissimilarities in blasting techniques, material blasted, and size of blast areas. Milling of fines is not included in this section as this operation is normally associated with nonconstruction aggregate end uses and will be covered elsewhere when information is adequate. Emission factors for fugitive dust sources, including paved and unpaved roads, materials handling and transfer, and wind erosion of storage piles, can be determined using the predictive emission factor equations presented in AP-42 Section 13.2.

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11.28 Vermiculite Processing

11.28.1 Process Description[1-9]

Vermiculite is the geological name given to a group of hydrated laminar minerals that are aluminum-iron-magnesium silicates and that resemble mica in appearance. The chemical formula for vermiculite is $(Mg,Ca,K,Fe^{+2})_3(Si,Al,Fe^{+3})_4O_{10}(OH)_2 \bullet 4H_2O$. When subjected to heat, vermiculite has the unusual property of exfoliating, or expanding, due to the interlaminar generation of steam. Uses of unexpanded vermiculite include muds for oil-well drilling and fillers in fire-resistant wallboard. The six-digit source classification code (SCC) for vermiculite processing is 3-05-033.

Vermiculite ore is mined using open-pit methods. Beneficiation includes screening, flotation, drying in rotary or fluid bed dryers, and expansion by exposure to high heat. All mined vermiculite is dried and sized at the mine site prior to exfoliation.

Crude Ore Processing -

Figure 11.28-1 is a process flow diagram for vermiculite processing. Crude ore from open-pit mines is brought to the mill by truck and is loaded onto outdoor stockpiles. Primary processing consists of screening the raw material to remove the waste rock greater than 1.6 centimeters (cm) (5/8 inch [in.]) and returning the raw ore to stockpiles. Blending is accomplished as material is removed from stockpiles and conveyed to the mill feed bin. The blended ore is fed to the mill, where it is separated into fractions by wet screening and then concentrated by gravity. All concentrates are collected, dewatered, and dried in either a fluidized bed or rotary dryer. Drying reduces the moisture content of the vermiculite concentrate from approximately 15 to 20 percent to approximately 2 to 6 percent. At least one facility uses a hammermill to crush the material exiting the dryer. However, at most facilities, the dryer products are transported by bucket elevators to vibrating screens, where the material is classified. The dryer exhaust generally is ducted to a cyclone for recovering the finer grades of vermiculite concentrate. The classified concentrate then is stored in bins or silos for later shipment or exfoliation.

The rotary dryer is the more common dryer type used in the industry, although fluidized bed dryers also are used. Drying temperatures are 120° to 480°C (250° to 900°F), and fuel oil is the most commonly used fuel. Natural gas and propane also are used to fuel dryers.

Exfoliation -

After being transported to the exfoliation plant, the vermiculite concentrate is stored. The ore concentrate then is conveyed by bucket elevator or other means and is dropped continuously through a gas- or oil-fired vertical furnace. Exfoliation occurs after a residence time of less than 8 seconds in th furnace, and immediate removal of the expanded material from the furnace prevents damage to the structure of the vermiculite particle. Flame temperatures of more than 540°C (1000°F) are used for exfoliation. Proper exfoliation requires both a high rate of heat transfer and a rapid generation of steam within the vermiculite particles. The expanded product falls through the furnace and is air conveyed to a classifier system, which collects the vermiculite product and removes excessive fines. The furnace exhaust generally is ducted through a product recovery cyclone, followed by an emission control device. At some facilities, the exfoliated material is ground in a pulverizer prior to being classified. Finally, the material is packaged and stored for shipment.

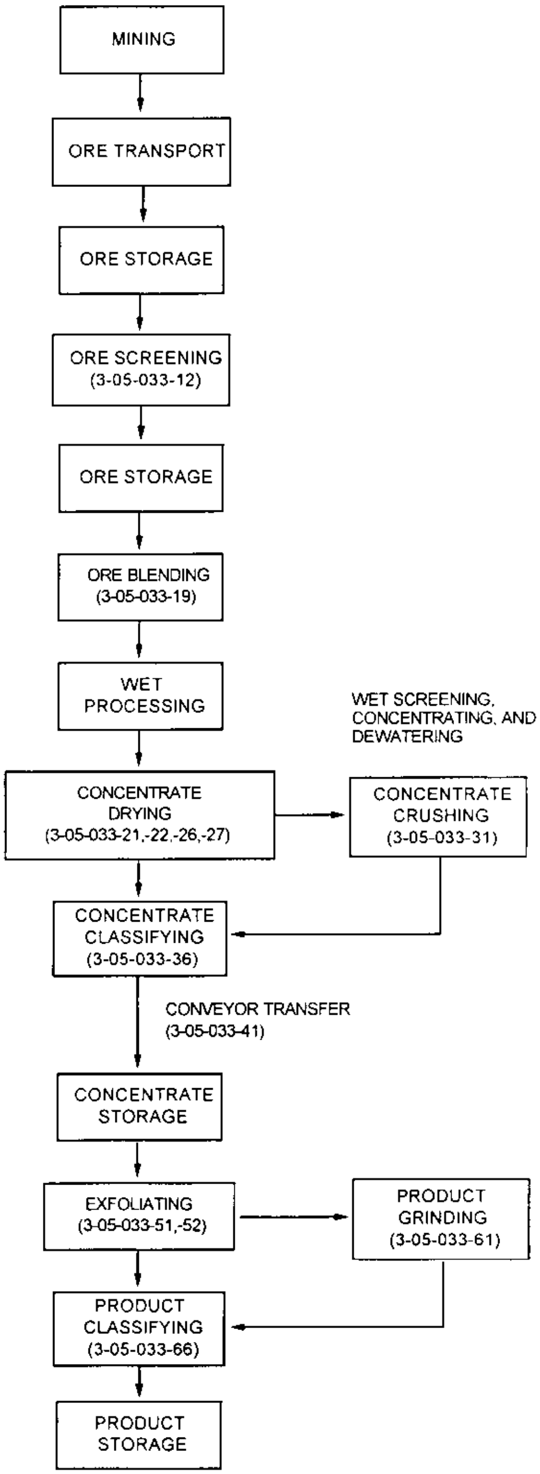

Figure 11.28-1. Process flow diagram for vermiculite processing.
(Source Classification Codes in parentheses.)

11.28.2 Emissions And Controls[1,4-11]

The primary pollutants of concern in vermiculite processing are particulate matter (PM) and PM less than 10 micrometers (PM-10). Particulate matter is emitted from screening, drying, exfoliating, and materials handling and transfer operations. Emissions from dryers and exfoliating furnaces, in addition to filterable and condensible PM and PM-10, include products of combustion, such as carbon monoxide (CO), carbon dioxide (CO_2), nitrogen oxides (NO_x), and sulfur oxides (SO_x).

Wet scrubbers are typically used to control dryer emissions. The majority of expansion furnaces are ducted to fabric filters for emission control. However, wet scrubbers also are used to control the furnace emissions. Cyclones and fabric filters also are used to control emissions from screening, milling, and materials handling and transfer operations.

Table 11.28-1 summarizes the emission factors for vermiculite processing.

Table 11.28-1 EMISSION FACTORS FOR VERMICULITE PROCESSING[a]

EMISSION FACTOR RATING: D

	Filterable PM[b]	Condensible organic PM[c]	Total PM[d]	CO_2
Process	kg/Mg	kg/Mg	kg/Mg	kg/Mg
Rotary dryer, with wet collector (SCC 3-05-033-21,-22)	0.29[e]	ND	ND	50[f]
Concentrate screening, with cyclone (SCC 3-05-033-36)	0.30[g]	NA	0.30[g]	NA
Concentrate conveyor transfer, with cyclone (SCC 3-05-033-41)	0.013[g]	NA	0.013[g]	NA
Exfoliation - gas-fired vertical furnace, with fabric filter (SCC 3-05-033-51)	0.32[h]	0.18[j]	0.50[k]	ND
Product grinding, with fabric filter (SCC 3-05-033-61)	0.18[m]	NA	0.18[m]	NA

[a] Factors represent uncontrolled emissions unless noted. Emission factor units for drying are kg/Mg of material feed; emission factor units for other processes are kg/Mg of product. 1 kg/Mg is equivalent to 1 lb/1,000 lb. SCC = Source Classification Code. ND = no data. NA = not applicable.

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

[c] Condensible PM is that PM collected in the impinger portion of a PM sampling train. Condensible organic PM is the organic fraction of the condensible PM.

[d] Total PM equals the sum of the filterable PM, condensible organic PM, and condensible inorganic PM.

[e] Reference 8. EMISSION FACTOR RATING: E.

[f] References 8,11. Factor represents uncontrolled emissions of CO_2.

[g] Reference 11. For dried ore concentrate.

[h] Reference 10.

[j] Reference 10. Emissions may be largely from volatilization of oil used in ore beneficiation.

[k] Sum of factors for filterable PM and condensible organic PM; does not include condensible inorganic PM.

[m] Reference 9.

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