

Silicon Grinding Project Emission Calculations

Wacker Polysilicon North America, LLC

AP-42, Chapter 13.2.4, Equation 1

$$E = k(0.0032) \frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \text{ (pound [lb]/ton)}$$

where:

E = emission factor

k = particle size multiplier (dimensionless)

U = mean wind speed, meters per second (m/s) (miles per hour [mph])

M = material moisture content (%)

The particle size multiplier in the equation, k, varies with aerodynamic particle size range, as follows:

Aerodynamic Particle Size Multiplier (k) For Equation 1				
< 30 µm	< 15 µm	< 10 µm	< 5 µm	< 2.5 µm
0.74	0.48	0.35	0.20	0.053 ^a

^a Multiplier for < 2.5 µm taken from Reference 14.

Ranges Of Source Conditions For Equation 1			
Silt Content (%)	Moisture Content (%)	Wind Speed	
		m/s	mph
0.44 - 19	0.25 - 4.8	0.6 - 6.7	1.3 - 15

Material Handling Emission Factors

Variable	Value	Units
k ₁₀	0.35	-
k _{2.5}	0.20	-
U ¹	1.3	mph
M ²	0.25	%
E _{PM 10}	3.57E-03	lb/ton
E _{PM 2.5}	2.04E-03	lb/ton

¹ The material unloading area and the silicon grinding process area are located indoors. Therefore, the minimum wind speed per the range of source conditions for Equation 1 was chosen to estimate emissions.

² The raw silicon used in the silicon grinding process is anticipated to be dry; therefore, a minimal moisture content was assumed per the range of source conditions for Equation 1.

Material Processing Emission Factors

Process	Emission Factor ¹ (lb/ton)		
	PM	PM ₁₀	PM _{2.5} ²
Conveyor Transfer Point	0.0030	0.0011	0.0011
Impact Crusher	0.0054	0.0024	0.0024
Screener	0.3000	0.0720	0.0720

¹ Emission factors per AP-42, Chapter 11.19.2, Table 11.19.2-2. All factors represent uncontrolled emissions.

² PM_{2.5} emissions are conservatively assumed to equal PM₁₀ emissions.

Actual Material Handling and Processing Emissions, Silicon Grinding Plant

Transfer Point	Material Throughput ¹	Emissions ²									Emission Pt.
		PM			PM ₁₀			PM _{2.5}			
	(tpy)	(lb/yr)	(lb/hr) ³	(tpy)	(lb/yr)	(lb/hr) ³	(tpy)	(lb/yr)	(lb/hr) ³	(tpy)	
Truck to Material Handling Area	27,007	151.63	0.02	0.08	96.49	0.01	0.05	55.14	0.01	0.03	C218E35
Front End Loaders to Hopper	27,007	151.63	0.02	0.08	96.49	0.01	0.05	55.14	0.01	0.03	
Raw Feed Hopper	27,007	151.63	0.02	0.08	96.49	0.01	0.05	55.14	0.01	0.03	
Hopper to Conveyor 1	27,007	81.02	0.01	0.04	29.71	0.00	0.01	29.71	0.00	0.01	
Conveyor 1 to Impact Crusher	27,007	81.02	0.01	0.04	29.71	0.00	0.01	29.71	0.00	0.01	
Impact Crusher and Downstream Conveyor	27,007	145.84	0.02	0.07	64.82	0.01	0.03	64.82	0.01	0.03	C218E36
Impact Crusher to Conveyor	27,007	81.02	0.01	0.04	29.71	0.00	0.01	29.71	0.00	0.01	
Screening	27,007	8102.10	1.08	4.05	1944.50	0.26	0.97	1944.50	0.26	0.97	
Screening to Conveyor	27,007	81.02	0.01	0.04	29.71	0.00	0.01	29.71	0.00	0.01	
Total		9026.91	1.21	4.51	2417.62	0.32	1.21	2293.56	0.31	1.15	

¹ Material throughput based on the impact crusher capacity of 24,500 metric tons/year.

² Emissions from the material handling area were estimated using material handling emission factors per AP-42, Chapter 13.2.4.

All other emissions estimated using material processing emission factors per AP-42, Chapter 11.19.2. These estimates are uncontrolled for demonstrating permit applicability. Particulate controls will be used.

³ lb/hr emissions were calculated assuming 7,488 hours of operation per year (2 shifts at 12 hours each, 6 days per week, 52

Potential Material Handling and Processing Emissions, Silicon Grinding Plant

Transfer Point	Material Throughput ¹	Emissions ²									Emission Pt.
		PM			PM ₁₀			PM _{2.5}			
	(tpy)	(lb/yr)	(lb/hr) ³	(tpy)	(lb/yr)	(lb/hr) ³	(tpy)	(lb/yr)	(lb/hr) ³	(tpy)	
Truck to Material Handling Area	38,581	216.61	0.02	0.11	137.84	0.02	0.07	78.77	0.01	0.04	C218E35
Front End Loaders to Hopper	38,581	216.61	0.02	0.11	137.84	0.02	0.07	78.77	0.01	0.04	
Raw Feed Hopper	38,581	216.61	0.02	0.11	137.84	0.02	0.07	78.77	0.01	0.04	
Hopper to Conveyor 1	38,581	115.74	0.01	0.06	42.44	0.00	0.02	42.44	0.00	0.02	
Conveyor 1 to Impact Crusher	38,581	115.74	0.01	0.06	42.44	0.00	0.02	42.44	0.00	0.02	
Impact Crusher and Downstream Conveyor	38,581	208.34	0.02	0.10	92.59	0.01	0.05	92.59	0.01	0.05	C218E36
Impact Crusher to Conveyor	38,581	115.74	0.01	0.06	42.44	0.00	0.02	42.44	0.00	0.02	
Screening	38,581	11574.30	1.32	5.79	2777.83	0.32	1.39	2777.83	0.32	1.39	
Screening to Conveyor	38,581	115.74	0.01	0.06	42.44	0.00	0.02	42.44	0.00	0.02	
Total		12895.44	1.47	6.45	3453.71	0.39	1.73	3276.48	0.37	1.64	

¹ Material throughput based on the impact crusher capacity of 35,000 metric tons/year.

² Emissions from the material handling area were estimated using material handling emission factors per AP-42, Chapter 13.2.4.

All other emissions estimated using material processing emission factors per AP-42, Chapter 11.19.2. These estimates are uncontrolled for demonstrating permit applicability. Particulate controls will be used.

³ lb/hr emissions were calculated assuming 8,760 hours of operation per year.

Allowable Material Handling and Processing Emissions, Silicon Grinding Plant

1200-03-07-03 Table 2

P= 8.27 tons/hr

E=3.59P^{0.62}

E= 13.30 lb/hr
58.25 TPY

	C218E35	C218E36	Combined
0.02 gr/dscf	9700	7600	17300 cfm
E=	1.66	1.30	2.97 lb/hr
	7.27	5.69	13.01 TPY

		C218E35	C218E36	Combined	
0.25 gr/dscf		9700	7600	17300	cfm
	E=	20.79	16.29	37.07	lb/hr
		91.06	71.35	162.37	TPY
Facility Calculated Actual					
0.004 gr/dscf		9700	7600	17300	cfm
	E=	0.33	0.26	0.59	lb/hr
		1.45	1.14	2.58	TPY
Facility Calculated Potential					
0.005 gr/dscf		9700	7600	17300	cfm
	E=	0.42	0.33	0.74	lb/hr
		1.84	1.45	3.24	TPY
				Facility has agreed to this limitation 9/21/2022	
				Facility has agreed to this limitation 9/21/2022	