

CEMENT & FLY ASH STORAGE SILOS

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PROCESS DESCRIPTIONS:

Concrete batch plants are sources of particulate emissions containing arsenic, beryllium, cadmium, chromium, lead, manganese, nickel, selenium, zinc, and crystalline silica. Concrete is a mixture of water, sand, aggregate, and cement occasionally supplemented by small quantities of fly ash and organic additives. The composition of a typical yd³ (4000 lbs) is; 1900 lbs course aggregate, 1240 lbs sand, 500 lbs cement / fly ash, and 360 lbs water. Production equipment usually consists of aggregate bins, conveyors, cement storage silos, fly ash storage silos, a weigh hopper, a mixer, and transport trucks. The concrete may be centrally mixed (at batch plants), transit mixed (added wet to trucks and mixed enroute), or dry batch loaded (mixed with water at destination). All of these concrete batch plants utilize enclosed silos with sock (bag) filters for cement and fly ash storage.

Particulate emissions occur during both bucket and pneumatic loading of the storage silos. Table 11.12-2 in Section 11.12 of AP-42 (1/95) includes TSP emission factors for both uncontrolled pneumatic loading and controlled bucket loading of cement storage silos. An estimated weight fraction of 92% PM₁₀ is applied to the storage silo TSP emissions based on an ARB report titled "Information for Applying the State Ambient Air Quality Standards for PM₁₀ to the Permitting of New and Modified Stationary Sources" dated December 1987. Speciation of cement and fly ash dust was performed locally ~1996 for AB2588 purposes. The following District emission estimation techniques are used to estimate emissions from cement and fly ash storage silos at concrete batch plants;

$$E_a = U_a \times EF \times C_i$$

$$E_h = U_h \times EF \times C_i$$

Where:

Ea = Annual emissions of each listed substance, (lbs/year)

Eh = Maximum hourly emissions of each listed substance, (lbs/hour)

Ua = Annual quantity of cement or fly ash used, (tons/year)

Uh = Maximum quantity of cement or fly ash delivered in one hour, (tons/hour)

EF = Emission factor after controls, (lbs/ton of material used or delivered)

Ci = Concentration of listed substance in cement or fly ash dust, (lbs/lb)

Annual emission estimates for the storage silos are based upon annual material usage. The maximum hourly estimates are based upon the maximum amount of material that can be delivered at a time. In general, a typical delivery vehicle has a maximum capacity of 26 tons. Assuming the storage silo capacity exceeds 26 tons, this value should be used for maximum hourly calculations. The AP-42 emission factor for pneumatic loading represents uncontrolled emissions. An average capture efficiency of 100% and an average removal efficiency of 90% will be assumed for the typical silo sock filter. The AP-42 bucket loading emission factor represents controlled emissions and already accounts for the silo particulate controls. Default emission factors are as follows;

DEFAULT VALUES - CEMENT / FLY ASH STORAGE SILOS

Variable	Variable Description	Default Values and Ranges
Uh	Maximum cement delivery	26 tons/hour (typical tanker size)
EF	Pneumatic, uncontrolled	0.27 lbs TSP/ton (AP-42 Table 11.12-2)
		0.248 lbs PM10/ton (assume 92% PM10)
EF	Pneumatic, controlled	0.027 lbs TSP/ton (assume 90% efficiency)
		0.025 lbs PM10/ton (assume 92% PM10)
EF	Bucket elevator, controlled	0.24 lbs TSP/ton (AP-42 Table 11.12-2)
		0.221 lbs PM10/ton (assume 92% PM10)

The trace metal composition of cement and fly ash may vary between loads dependent upon the source of the materials. A representative sample of each material was analyzed by the local mineral products industry in 1996 for AB2588 purposes. These default compositions should be used unless more accurate information is available.

DEFAULT VALUES - TRACE METAL CONCENTRATIONS

Trace Metals	Cement Dust	Fly Ash
Asbestos	0	0
Aluminum	16000	17500

Arsenic	22	15
Beryllium	1	2
Cadmium	1	1
Chromium (total)	58	26
Chromium (hexavalent)	5	3
Copper	30	23
Lead	12	15
Manganese	400	80
Mercury	0	0
Nickel	25	12
Selenium	1	1
Zinc	92	30

EMISSIONS INFORMATION:

AP-42 contains general information regarding estimation techniques, emission factors, control efficiencies, and default values. Values not present in AP-42 were evaluated by a 1992 - 1996 District / Industry work group. Additional information has been obtained from ARB reports and test data submitted to the District. Engineering judgment is often necessary to assign realistic control efficiencies to individual processes, devices, and techniques. AP-42 factors should be reviewed to determine the material characteristics and control methods in use during development of emission factors. Field observations should support the process and device emission estimates calculated for each facility.

ASSUMPTIONS / LIMITATIONS:

- Control efficiencies are included in the emission factors for storage silo particulate releases. The AP-42 factor for uncontrolled pneumatic loading has been adjusted to include a 90% removal efficiency for the silo sock filter.
- An average weight fraction of 92% is assumed for the PM10 portion of the TSP emissions. Average material compositions are based on local material analyses.
- Emissions from other batch plant operations including open material storage, transfer points, weigh hoppers, mixing, loading, and haul roads must be quantified separately from silo emissions.

FORMS:

Each material storage silo should be identified as a unique device and emissions should be calculated separately. Silos which are used to store multiple materials throughout the reporting year must report each material individually.