12.18 Leadbearing Ore Crushing And Grinding

12.18.1 General[1]

Leadbearing ore is mined from underground or open pit mines. After extraction, the ore is processed by crushing, screening, and milling. Domestic lead mine production for 1991 totaled 480,000 megagrams (Mg) (530,000 tons) of lead in ore concentrates, a decrease of some 15,000 Mg (16,500 tons) from 1990 production.

Except for mines in Missouri, lead ore is closely interrelated with zinc and silver. Lead ores from Missouri mines are primarily associated with zinc and copper. Average grades of metal from Missouri mines have been reported as high as 12.2 percent lead, 1 percent zinc, and 0.6 percent copper. Due to ore body formations, lead and zinc ores are normally deep-mined (underground), whereas copper ores are mined in open pits. Lead, zinc, copper, and silver are usually found together (in varying percentages) in combination with sulfur and/or oxygen.

12.18.2 Process Description[2,5-7]

In underground mines the ore is disintegrated by percussive drilling machines, processed through a primary crusher, and then conveyed to the surface. In open pit mines, ore and gangue are loosened and pulverized by explosives, scooped up by mechanical equipment, and transported to the concentrator. A trend toward increased mechanical excavation as a substitute for standard cyclic mine development, such as drill-and-blast and surface shovel-and-truck routines has surfaced as an element common to most metal mine cost-lowering techniques.

Standard crushers, screens, and rod and ball mills classify and reduce the ore to powders in the 65 to 325 mesh range. The finely divided particles are separated from the gangue and are concentrated in a liquid medium by gravity and/or selective flotation, then cleaned, thickened, and filtered. The concentrate is dried prior to shipment to the smelter.

12.18.3 Emissions And Controls[2-4,8]

Lead emissions are largely fugitive and are caused by drilling, loading, conveying, screening, unloading, crushing, and grinding. The primary means of control are good mining techniques and equipment maintenance. These practices include enclosing the truck loading operation, wetting or covering truck loads and stored concentrates, paving the road from mine to concentrator, sprinkling the unloading area, and preventing leaks in the crushing and grinding enclosures. Cyclones and fabric filters can be used in the milling operations.

Particulate and lead emission factors for lead ore crushing and materials handling operations are given in Tables 12.18-1 and 12.18-2.

12.18.4 Updates since the Fifth Edition

Update 2007

- The PM factor was updated to be consistent with the factor for fine crushing in AP42 section 11.19.2, Crushed Stone Processing.

Table 12.18-1 (Metric Units). EMISSION FACTORS FOR ORE CRUSHING AND GRINDING

Type Of Ore And Lead Content (wt %)		Particulate Emission Factor[a]	EMISSION FACTOR RATING	Lead Emission Factor[b]	EMISSION FACTOR RATING
Lead[c] (SCC 3-03-031-01)	5.1	0.0195	E	0.001	E
Zinc[d] (SCC 3-03-031-02)	0.2	0.0195	E	0.00004	E
Copper[e] (SCC 3-03-031-03)	0.2	0.0195	E	0.00004	E
Lead-Zinc[f] (SCC 3-03-031-04)	2.0	0.0195	E	0.0004	E
Copper-Lead[g] (SCC 3-03-031-05)	2.0	0.0195	E	0.0004	E
Copper-Zinc[h] (SCC 3-03-031-06)	0.2	0.0195	E	0.00004	E
Copper-Lead-Zinc[i] (SCC 3-03-031-07)	2.0	0.0195	E	0.0004	E

[a] Reference 2. Units are expressed as kg of pollutant/Mg ore processed. SCC = Source Classification Code. PM Emissions Factors are from uncontrolled fines crushing in AP-42 Section 11.19.2. Lead Emissions Factors are the product of the PM Emissions Factors and the wt% lead content of the ore.
[b] Reference 2,3,5,7.
[c] Refer to Section 12.6.
[d] Characteristic of some mines in Colorado.
[e] Characteristic of some mines in Alaska, Idaho, and New York.
[f] Characteristic of Arizona mines.
[g] Characteristic of some mines in Missouri, Idaho, Colorado, and Montana.
[h] Characteristic of some mines in Missouri.
[i] Does not appear in ore characterization of the top 25 domestic lead producing mines.

Table 12.18-2 (English Units). EMISSION FACTORS FOR ORE CRUSHING AND GRINDING

Type Of Ore And Lead Content (wt %)		Particulate Emission Factor[a]	EMISSION FACTOR RATING	Lead Emission Factor[b]	EMISSION FACTOR RATING
Lead[c] (SCC 3-03-031-01)	5.1	0.039	E	0.002	E
Zinc[d] (SCC 3-03-031-02)	0.2	0.039	E	0.00008	E
Copper[e] (SCC 3-03-031-03)	0.2	0.039	E	0.00008	E
Lead-Zinc[f] (SCC 3-03-031-04)	2.0	0.039	E	0.0008	E
Copper-Lead[g] (SCC 3-03-031-05)	2.0	0.039	E	0.0008	E
Copper-Zinc[h] (SCC 3-03-031-06)	0.2	0.039	E	0.00008	E
Copper-Lead-Zinc[i] (SCC 3-03-031-07)	2.0	0.039	E	0.0008	E

[a] Reference 2. Units are expressed as kg of pollutant/Mg ore processed. SCC = Source Classification Code. PM Emissions Factors are from uncontrolled fines crushing in AP-42 Section 11.19.2. Lead Emissions Factors are the product of the PM Emissions Factors and the wt% lead content of the ore.
[b] Reference 2,3,5,7.
[c] Refer to Section 12.6.
[d] Characteristic of some mines in Colorado.
[e] Characteristic of some mines in Alaska, Idaho, and New York.
[f] Characteristic of Arizona mines.
[g] Characteristic of some mines in Missouri, Idaho, Colorado, and Montana.
[h] Characteristic of some mines in Missouri.
[i] Does not appear in ore characterization of the top 25 domestic lead producing mines.

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