6.12 Lead Alkyl

6.12.1 Process Description[1]

Two alkyl lead compounds, tetraethyl lead (TEL) and tetramethyl lead (TML), are used as antiknock gasoline additives. Over 75 percent of the 1973 additive production was TEL, more than 90 percent of which was made by alkylation of sodium/lead alloy.

Lead alkyl is produced in autoclaves by the reaction of sodium/lead alloy with an excess of either ethyl (for TEL) or methyl (for TML) chloride in the presence of an acetone catalyst. The reaction mass is distilled to separate the product, which is then purified, filtered, and mixed with chloride/bromide additives. Residue is sluiced to a sludge pit, from which the bottoms are sent to an indirect steam dryer, and the dried sludge is fed to a reverberatory furnace to recover lead.

Gasoline additives are also manufactured by the electrolytic process, in which a solution of ethyl (or methyl) magnesium chloride and ethyl (or methyl) chloride is electrolyzed, with lead metal as the anode.

6.12.2 Emissions And Controls[1]

Lead emissions from the sodium/lead alloy process consist of particulate lead oxide from the recovery furnace (and, to a lesser extent, from the melting furnace and alloy reactor), alkyl lead vapor from process vents, and fugitive emissions from the sludge pit. Lead emission factors for the manufacture of lead alkyl appear in Table 6.12-1. Factors are expressed in units of kilograms per megagram (kg/Mg) and pounds per ton (lb/ton).

Emissions from the lead recovery furnace are controlled by fabric filters or wet scrubbers. Vapor streams rich in lead alkyl can either be incinerated and passed through a fabric filter or be scrubbed with water prior to incinerating. Control efficiencies are presented in Table 6.12-2.

Emissions from electrolytic process vents are controlled by using an elevated flare and a liquid incinerator, while a scrubber with toluene as the scrubbing medium controls emissions from the blending and tank car loading/unloading systems.

Table 6.12-1 (Metric And English Units). LEAD ALKYL MANUFACTURE LEAD EMISSION FACTORS[a]

EMISSION FACTOR RATING: B

Process	Lead	
	kg/Mg	lb/ton
Electrolytic[b]	0.5	1.0
Sodium/lead alloy		
Recovery furnace[c]	28	55
Process vents, TEL[d]	2	4
Process vents, TML[d]	75	150
Sludge pits[d]	0.6	1.2

[a] No information on other emissions from lead alkyl manufacturing is available. Emission factors are expressed as weight per unit weight of product.
[b] References 1-3.
[c] References 1-2,4.
[d] Reference 1.

Table 6.12-2. LEAD ALKYL MANUFACTURE CONTROL EFFICIENCIES[a]

Process	Control	Percent Reduction
Sodium/lead alloy	Fabric filter	99+
	Low energy wet scrubber	80 - 85
	High energy wet scrubber	95 - 99

[a] Reference 1.

References For Section 6.12

1. *Background Information In Support Of The Development Of Performance Standards For The Lead Additive Industry*, EPA Contract No. 68-02-2085, PEDCo-Environmental Specialists, Inc., Cincinnati, OH, January 1976.

2. *Control Techniques For Lead Air Emissions*, EPA-450/2-77-012, U. S. Environmental Protection Agency, Research Triangle Park, NC, December 1977.

3. W. E. Davis, *Emissions Study Of Industrial Sources Of Lead Air Pollutants, 1970*, EPA Contract No. 68-02-0271, U. E. Davis and Associates, Leawood, KS, April 1973.

4. R. P. Betz, *et al.*, *Economics Of Lead Removal In Selected Industries*, EPA Contract No. 68-02-0611, Batelle Columbus Laboratories, Columbus, OH, August 1973.