



Mass Balance for Lead in the California South Coast Air Basin

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Introduction:

Over the past twenty years the concentration of lead in the atmosphere in the U.S. has been significantly reduced, notably through the gradual phasing out of leaded gasoline. The primary sources of lead input into the atmosphere merit reevaluation.

Problem Statement:

A mass balance for lead for 1972 was conducted for the South Coast Air Basin (SOCAB) by Huntzicker, Friedlander, and Davidson (1975). At that time the major contributor of atmospheric lead was the combustion of leaded gasoline, and Huntzicker et al. considered vehicle emissions to be responsible for essentially all of the atmospheric lead found in the Basin. By 1989, however, the use of leaded gasoline had been greatly reduced. This research reports on an updated mass balance for lead in the same region.

Approach:

A mass balance for lead for the year 1989 in the South Coast Air Basin has inputs to the atmosphere of 600 ± 190 kg/day and outputs of 580 ± 160 kg/day, showing rough agreement. Stationary sources are responsible for only about 5 percent of the total lead emissions. The bulk of the lead is emitted from vehicles using leaded gasoline (37 percent) and unleaded gasoline (15 percent), as well as from resuspension of previously deposited lead on roads (43 percent). Over half of the total emitted lead deposits on roads and nearby soil, while about one third is carried out of the Basin by wind. A small amount, less than 10 percent, is deposited on surfaces throughout the Basin. These percentages are approximately the same as those in a mass balance for the same region calculated for 1972, when lead emissions from leaded gasoline were about a factor of 70 greater than leaded gas emissions in 1989. When the lead emissions are used as inputs to a simple continuously stirred flow reactor model for the Basin, reasonable agreement is obtained between calculated and measured concentrations.

Inputs to SOCAB atmosphere (kg/day)		Outputs from SOCAB atmosphere (kg/day)	
Stationary sources	30	Near Deposition	330 ± 110
Combustion of leaded gasoline	220 ± 97	Far Deposition	50 ± 30
Combustion of unleaded gasoline	90 ± 96	Removal by Wind	200 ± 110
Road dust	260 ± 130		
Total inputs	600 ± 190	Total outputs	580 ± 160

Conclusions:

Automobile-emitted lead (including resuspension of previously deposited road dust lead) is responsible for approximately 95 percent of the total lead emitted into the SOCAB atmosphere in 1989. Presently regulatory agencies are comparing the importance of stationary and mobile sources of lead. Local high concentrations are caused by point sources, while regional concentrations depend on all sources. This work indicates the need to investigate both point and area sources.

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