particulate emissions; detergents may do the same, though this is disputed. Some investigators believe that anything that decreases engine deposits (more scavenger, presence of detergent additive) will increase particulate emissions; this seems possibly true since some 15% of the Pb consumed in running on leaded fuel is retained as deposits in the engine, exhaust system, etc. Another 10% of the Pb consumed seems to be retained in the lubricating oil. Replacement of tetra-ethyl lead with tetramethyl lead has no discernible effect on particulate emissions. High fuel aromaticity gives higher particulate emissions.

The rate of Pb emissions depends strongly on the immediate history of the engine and on engine speed. At low speed with a clean engine, the Pb emitted is only a small fraction (say, 20%) of the amount consumed, and deposits build up. With sustained light-duty service, Pb emissions eventually approach 60% of the Pb consumed. If, after a period of such low-speed driving, the car is suddenly accelerated, the Pb emissions can be as high as 2000% of the amount consumed, owing to the ejection of deposit material, much of it in large (up to 5000 μ diameter) flakes. With protracted running at high speeds the loosening of deposited material will finally subside and the rate of Pb emissions will be just a little less than the rate of Pb consumption in the fuel. If now low-speed driving is resumed, Pb emissions will be very low (say, 10% of that consumed) and will climb slowly to the low-speed value. The emission rate is very erratic, however, since large-particle emissions can be affected by thermal or mechanical shock, changes in gas velocity, etc. There may be another maximum associated with deceleration.

In general, severe engine operating conditions mean that a higher percentage of the Pb consumed is emitted and the particles are bigger. Over the life of