

Lead astray

How much lead was used in the manufacture of leaded petrol before it was banned, and where is that lead now?

■ Leaded petrol was phased out in most industrial nations in the late 1990s, with the last significant quantities being made in 1997. In that year, 22,250,000 tonnes (about 30 billion litres) of petrol were manufactured for use in the UK, of which 6,140,000 tonnes (8 billion litres) were leaded using the “anti-knock” engine-protection compound tetraethyl lead (TEL).

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At that time, the maximum permitted amount of lead was 0.15 grams per litre, equivalent to 0.23 grams of TEL. So, 1228 tonnes of lead entered the environment via exhaust pipes – the lowest amount for many years. Prior to 1984, the maximum lead level was 0.4 grams per litre, so emissions would have been roughly 9000 tonnes a year, even taking into account the fact that not all grades of fuel contained the maximum permitted amount of TEL.

But the pollutant was neither the metal nor the oxide, it was lead bromide. In the 1920s, various organometallics were tested in petrol, including the very effective ferrocene. The advantage of TEL

was that deposits of the metal or its oxide could be swept out of combustion chambers by adding a halide compound to the petrol, which converted them to low-melting lead bromide. (Older drivers may remember the pale grey look of exhaust pipes. That was caused by this compound.)

Being water soluble, it results in lead ions getting into the food chain very easily, and they build up in top predators, such as humans. But in countries with regular rainfall, lead bromide is fairly rapidly washed out of soil, lakes and inland waterways. So the answer to the question is: it is in the sea. The decline of lead in the UK population is supported by a 1998 report that stated lead levels in blood had fallen to one-third of typical results from 1987.

TEL is still used today in small and diminishing quantities to make standard 100-octane aviation gasoline for older aircraft, but the vast majority of light-plane engines use normal 95-octane, which is lead free.

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Human attraction

How small would something need to be for the gravitational field of a human to significantly affect it? At what point would something be attracted to someone or able to establish an orbit? (Continued)

■ The time it would take a hydrogen atom to orbit a human