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SHORT CONTRIBUTION

# Reduced risk of acute poisoning in Australian cattle from used motor oils after introduction of lead-free petrol

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Lead (Pb) poisoning of cattle has been relatively common in Australia and sump oil has been identified as an important cause of Pb toxicity for cattle because they seem to have a tendency to drink it. Lead-free petrol has been available in Australia since 1975, so the aim of this study was to assess the current risk to cattle from drinking used automotive oils. Sump or gear box oil was collected from 56 vehicles being serviced. The low levels of Pb found suggest that the removal of leaded petrol from the Australian market as a public health measure has benefited cattle by eliminating the risk of acute poisoning from used engine oil.

**Keywords** cattle; lead; poisoning; sump oil
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Lead (Pb) poisoning of cattle has been relatively common in Australia. Approximately 10 to 20 bovine cases of Pb poisoning, mainly in calves, were diagnosed for every 1000 accessions of bovine specimens to the Tasmanian Department of Agriculture's Mount Pleasant Laboratories in Launceston over the 10 years to October 1972.[1] A mean of 1.58 Pb poisoning cases per 1000 diagnostic accessions from cattle, representing a yearly average of 12 poisoning incidents (range 5–23), was seen by the Queensland Department of Primary Industries' Veterinary Laboratories during the 20 years 1987 to 2006 (RA McKenzie, unpublished data). Sump oil has been identified as an important cause of Pb toxicity for cattle as they seem to have a tendency to drink it[2] (Figure 1). Furthermore, it has been used on cattle skin as an insect repellent, causing Pb poisoning on at least one occasion,[3] but as an acaricide no poisonings have been reported from its use.[4] Greater than 5000 mg Pb/L was reported in a sample of sump oil associated with poisoning of a calf in Queensland in 1971.[5] Lead-free petrol has been available in Australia since 1975 and all new cars have been required by law to use only lead-free fuel since 1987. Since 1 January 2002 only unleaded petrol has been available for on-road use, suggesting environmental contamination from this source will decrease with time.[6,7]

Sources of Pb in sump oil are, historically, soluble Pb from the combustion of fuel containing tetra-ethyl Pb and colloidal Pb from wear of engine bearings, whereas conventional commercial greases and gearbox oils often contain Pb naphthenates, producing Pb concentrations in greases and oils ranging from 1% to 7%.[8,9] In the USA, before the advent of unleaded petrol, used crankcase oil from a car and a truck were reported to contain 7,500 mg Pb/kg and 75 mg Pb/kg, respectively.[10] As part of an investigation in Denmark of the health risks from metal pollution, including that from leaded fuels, Pb levels in oils were measured and 9280 mg Pb/kg in gearbox oil (Mobil 46-SAE-90 gear oil), 2.1 to 24.5 mg Pb/kg in various other unused oils (including Mobil motor oils), and 697 to 3438 mg Pb/kg in used motor oils (Gulf, Chevron, Mobil, Esso and Shell) were reported.[11]

To assess the current risk to cattle from drinking used automotive oils containing Pb, including those originating from lead-free fuels, we collected approximately 20 to 25 mL of used sump or gearbox oil from each of 56 vehicles being serviced at a Brisbane service centre or at garages in Gatton, Boonah and Kingaroy during 2006 and 2008. The sump oils came from 27 petrol-engine passenger or commercial vehicles, 6 diesel-engine passenger or commercial vehicles, 2 bulldozers and 14 farm tractors. The seven gearbox oil samples came from other farm tractors. Oil preparation and Pb assay techniques were based on published methods.[12–14] From each sample, 5 mL of oil was transferred to a Pyrex conical flask and ashed at 390°C for 24 h. After cooling, the residue was dissolved in 8 mL of 69% nitric acid AR grade (Merck) and 2 mL of 96% sulfuric acid AR grade (Scharlau Chemie S.A.). The flask and contents were heated to 120°C on a hot plate for 6 h. After cooling, the solution was transferred to a graduated 50-mL capacity capped tube with several washings of reverse osmosis water (quality > 18.2 MΩ/cm). The final volume of each sample was 30 mL. Samples were assayed for Pb on an atomic absorption spectrometer (Varian Specta AA 220FS) using an air/acetylene flame with background correction. Calibration standards for the spectrometer were made from 1000 mg/L elemental Pb standard (Australian Chemical Reagents) and were prepared with the same acid composition as the test samples.

Pb was detected and its concentration measured in all 56 samples (Figure 2). The 49 samples with less than 10 mg Pb/L had a mean Pb content of 3.0 mg/L (range 0.2–8.8 mg/L). These samples originated from vehicles with odometer readings ranging from 3000 to 80,0000 km or running times from 100 to 15,000 hours. The seven individual samples with greater than 10 mg Pb/L contained 12.3 mg Pb/L (sump oil from a Toyota Camry with an odometer record of 19,6000 km), 16.4 mg Pb/L (Ford Falcon, 77,000 km), 36.7 mg Pb/L (Holden Commodore VT, 204,000 km), 37.1 mg Pb/L (Mitsubishi Magna, 44,000 km), 74.9 mg Pb/L (Ford Falcon, 233,000 km), 123 (Ford F350, 221,000 km) and 194 mg Pb/L (gearbox oil; Case NX80C tractor with 5000 operational hours). The low levels of Pb found in sump oil from petrol-engine vehicles suggested that the introduction of unleaded petrol has removed this as a source of Pb poisoning in farm animals. There was also minimal risk associated with the gearbox oils tested and the sump oil tested from diesel-engine vehicles and farm machinery, in which any Pb was limited to wear of engine bearings, as diesel fuel is free of Pb additives. There was clearly no relationship between odometer readings and the level of Pb measured. These findings were as anticipated, because of the changes made by industry to eliminate Pb from automotive applications, including oil, grease and bearings, to meet public health concerns.

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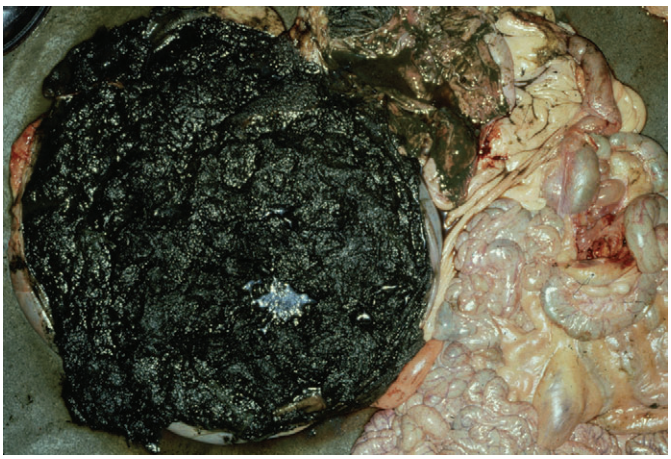

**Figure 1.** Sump oil contaminating the rumen contents of a calf with fatal lead poisoning in south-eastern Queensland in 1979. Fresh-weight lead concentrations were 80 mg/kg in liver and 35 mg/kg in kidney (RJ Rogers, unpublished data).

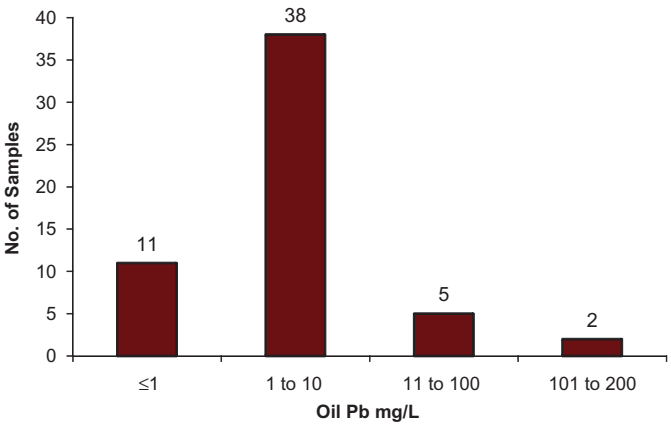


**Figure 2.** Distribution of lead (Pb) concentrations (mg/L) in used sump and gearbox oil samples from 56 petrol- and diesel-engine vehicles and farm machinery from south-eastern Queensland collected in 2006 and 2008.

The single oral lethal Pb dose is estimated to be 200 to 400 mg/kg body weight for calves and 600 to 800 mg/kg for adult cattle.[15] To be fatally poisoned by a single dose of the most Pb-contaminated oil sample from our survey (194 mg Pb/L), a 100-kg calf would have to drink at least 100 L and a 500-kg adult would have to drink 1500 L or more. Neither is plausible, as the maximum capacity of the four compartments of the adult bovine stomach is approximately 230 L.[16] In contrast, fatal poisoning of a 100-kg calf by sump oil containing 2000 to 5000 mg Pb/L[5,11] would need only 4 to 10 L. Thus the removal of leaded petrol from the Australian market as a public health measure, primarily for children, appears to have benefited cattle by eliminating the risk of acute Pb poisoning from used engine oil.

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## References

1. Munday BL, Mason RW, Cumming R. Observations on diseases of the central nervous system of cattle in Tasmania. *Aust Vet J* 1973;49:451–455.
2. Osweiler GD, Buck B, Lloyd WE. Epidemiology of lead poisoning in cattle: a five-year study in Iowa. *Clin Toxicol* 1973;6:367–376.
3. Rumbeiha WK, Braselton WE, Donch D. A retrospective study on the disappearance of blood lead in cattle with accidental lead toxicosis. *J Vet Diagn Invest* 2001;13:373–378.
4. Masika PJ, Sonandi A, Averbeke W. Tick control by small-scale cattle farmers in the Central Eastern Cape Province, South Africa. *J S Afr Vet Assoc* 1997;68:45–48.
5. Slatter DH. Sump oil: a potent source of lead. *Aust Vet J* 1971;47:461.
6. Halliwell D, Turoczy N, Stagnitti F. Lead concentrations in *Eucalyptus* sp. in a small coastal town. *Bull Environ Contam Toxicol* 2000;65:583–590.
7. O'Brien E. *Annual Report of The LEAD Group Inc. 2002: Ten Year Review of Objectives* (October 2002). http://www.lead.org.au/tlgar2002.pdf. Accessed 5 November 2008.
8. Monlux AW, Schoeppel RJ, Pearson CC, Waller GR. The effects of oil field pollutants on vegetation and farm animals. *J Am Vet Med Assoc* 1971;158:1379–1390.
9. van Peteghem T, de Vos H. Toxicity study of lead naphthenate. *Br J Indust Med* 1974;31:233–238.
10. Raymond RL, Hudson JO, Jamison VW. Oil degradation in soil. *Appl Environ Microbiol* 1976;31:522–535.
11. Clausen J, Rastogi S. Heavy metal pollution among autoworkers. I: Lead. *Br J Indust Med* 1977;34:208–215.
12. Whiteside PJ. Petrochemical fuel and lubricating oils. In: *An introduction to atomic absorption spectrophotometry*. Pye Unicam Ltd, Cambridge, 1979:59.
13. Hseu ZY. Evaluating heavy metal contents in nine composts using four digestion methods. *Bioresource Technol* 2004;95:53–59.
14. McKenzie TN. *Atomic absorption spectrophotometry for the analysis of wear metals in oil samples*. Varian Atomic Absorption Technical Paper AA-10. Varian Techtron Pty Ltd, Mulgrave, Victoria, 1981:1–9.
15. US National Research Council Committee on Minerals and Toxic Substances in Diets and Water of Animals. *Mineral tolerance of animals*. 2nd revised edn. The National Academies Press, Washington DC, 2005:210–223.
16. Habel RE. Ruminant digestive system. In Getty R, editor. *Sisson and Grossman's The anatomy of the domestic animals*. 5th edn. WB Saunders, Philadelphia, 1975;1:885.

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