



Comparison of the TCLP, sequential extraction test and SPLP for evaluating lead leachability in firing range soils

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The accumulation of lead (Pb) in shooting range soils resulting from the use of Pb bullets is drawing increasing scrutiny. The TCLP, sequential extraction test (SET) and SPLP tests were examined to determine if they could accurately determine the leachability of Pb from six firing range soils exposed to vastly different environmental conditions (temperature, moisture, mineralogy, gradation and Pb speciation). Firing range soil samples had total Pb concentrations ranging from 1.0 g/kg to 49 g/kg. TCLP-Pb leachable concentrations ranged from 10 to 594 mg/L at the standard time (18h). However, the TCLP procedure did not necessarily produce stabilized results by the standard time (18h), making it prone to over-, accurate-, and under-estimations of Pb leachability, the results being primarily linked to the initial soil pH and Pb speciation and the continued dissolution of metallic Pb and/or its re-precipitation as cerussite. SET results suggested that majority (up to 88%) of the Pb occurred as carbonates even though the some soils were carbon deficient. Worse, that the dissolution of metallic Pb during the SET produced Pb carbonates in the absence of soil carbon suggests that the SET incorrectly predicts Pb speciation and leachability. Overall, both the TCLP and SET were inaccurate in estimating lead leachability, with SET suffering further as a key decision making tool because it is not linked to regulatory criteria. SPLP-Pb concentrations for the six firing range soils ranged from 0.01 to 2.6 mg/L. However, in contrast to TCLP, SPLP leaching solutions reached equilibrium within 18h regardless of soil type and initial Pb speciation, making it a more appropriate alternative for assessing lead leachability in range soils.