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Lead particle size and its association with firing conditions and range maintenance: implications for treatment

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Six firing range soils were analyzed, representing different environments, firing conditions and maintenance practices. The particle size distribution and lead (Pb) concentration in each soil fraction were determined for samples obtained from the backstop berms. The main factors that were found to influence Pb fragment size were the type of soil used to construct the berms and the type of weapon fired. The firing of high velocity weapons, i.e. rifles, onto highly angular soils induced significant fragmentation of the bullets and/or pulverization of the soil itself. This resulted in the accumulation of Pb in the finer soil fractions and the spread of Pb contamination beyond the vicinity of the backstop berm. Conversely, the use of clay as backstop and the use of low-velocity pistols proved to be favorable for soil clean-up and range maintenance, since Pb was mainly present as large metallic fragments that can be recovered by a simple screening process. Other factors that played an important role in Pb particle size distribution were soil chemistry, firing distance, and maintenance practices, such as the use of water spray for dust suppression and deflectors prior to impact. Overall, coarse Pb particles render much easier as well as cost-effective maintenance, soil clean-up and remediation via physical separation. Fine Pb particles release Pb easier, pose an airborne Pb hazard and require the application of stabilization/solidification treatment methods. Thus, to ensure sustainable firing range operations by means of cost-effective design, maintenance and clean-up, especially when high velocity weapons are used, the above mentioned factors should be carefully considered.