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Assessment of spatial distribution of lead in soils around an active military shooting range

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Abstract. In this study, the extent of Pb contamination around an active military shooting range is re-assessed to ascertain current contamination status comparatively to data's reported 20 years ago. This is because lead bullet disintegration and mobility takes several years and extensively affects levels of soil-Pb contamination. A total of 120 topsoil samples were collected within the impact area (front) and non-impact area (back) for Pb determination. High concentrations of Pb were found at impact berm both front (28940±2996 µg/g) and back (775±128 µg/g). Spatial distribution of contamination reflects the distances from berm. Soil-Pb contamination around non-impact area was notable at back berm through to 100 m distance with significant difference in Pb, Cr, Ni and Zn levels. Concentration of Pb at berm was observed to have increase five-fold over a period of about twenty years from previous study with accumulation factor of about 1000. Principal component analysis PCA indicated 67 % of total metal load of range soil was majorly from impact areas of the berm. The correspondence analysis relay plot shows pollution order of Pb > Ni > Cd > Cr > Zn > Cu. This confirms soil contamination especially around the impact area, i.e. impact berm and firing lines and non-impact area at 0 m, 10 m, 50 m and 100 m. Environmental consequence of high soil-Pb levels within the range especially non-impact areas utilized for farming activities will leave much to desire. Hence, extensive and continuous monitoring is needed. However, remediation through appropriate soil washing technique could reduce Pb levels and improve soil condition regardless of age.

***Keywords*:** lead; soil contamination; bullet; shooting range; principal component analysis.

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