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**Abstract
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Environmental exposure to scandium and yttrium in Leicestershire (UK)

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BACKGROUND AND AIM:The aim was to determine the presence/distribution/risks to yttrium (Y) and scandium (Sc), usually included as rare earth elements (REEs), present in topsoils from Leicestershire (UK).

METHOD:850 topsoil samples were collected (2017-18); elements were measured by ICP-MS. Areas were further subdivided into the four ordinal directions to study distribution. Noncarcinogenic risks were characterised for Y.

RESULTS:Sc [7.762 (4.067-12.217) vs. 5.942 (3.315-9.830)] and Y [11.586 (5.795-16.041) vs. 10.620 (7.532-16.338)] showed higher median concentrations in the topsoils collected in the rural areas (median and ranges, all in mg/kg), although only Sc showed significance (p-value=0.0148). The application of fungicides and fertilisers might explain partially our results, as Sc and Y tend to occur in the same ore deposits as REEs which are associated with manufacture/use of fertilisers. Moreover, natural factors, might explain the distribution found. Thus, clay content, which can retain/absorb REEs, was significantly higher in rural topsoils (28 vs. 22.23 %). Similar distributions were found in urban subareas; significant higher medians (p-values=0.017) of both elements in the NE (6.516, 11.748 mg/kg) and lower in the NW (5.125, 8.855 mg/kg). However, only Y showed statistical significance for the rural subareas (p-value=0.006), being much lower in topsoils sampled in the NW (6.309 mg/kg). Clay content was also significantly lower/lower in topsoils sampled in the NE, for urban and rural subareas, respectively.

CONCLUSIONS:The mean concentrations of Sc (6.089 vs. 8.3 mg/kg) and Y (10.931 vs. 21.1 mg/kg) in Leicestershire's topsoils were lower than those reported in urban soils in London, and lower than those described as background for Sc in the UK (9.4 mg/kg), suggesting a lower contamination in Leicestershire. The risks to Y would be minimal as noncarcinogenic risks quotients for ingestion (4.98E-03, 5.43E-03) and dermal contact (1.77E-04, 1.93E-04) in urban/rural areas, were lower than the threshold, respectively.

Keywords: Scandium, yttrium, Leicester, topsoils, distribution