**Annual distribution and deposition of atmospheric 210Pb in Busan, the largest port city in Korea**

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This study investigated the annual and seasonal variations of 210Pb in aerosols in Busan, a major harbor city with extensive port infrastructure and dense industrial activities. Aerosol samples were collected using a high-volume air sampler from April 2019 to February 2021, and classified into total suspended particles (TSP, 2019 - 2020), particulate matter with an aerodynamic diameter ≤10 µm (PM10), and ≤2.5 µm (PM2.5, 2020–2021). The 210Pb concentrations ranged from 0.10 to 1.98 mBq m-3 (n = 92) for TSP, 0.09 to 1.97 mBq m-3 (n = 99) for PM10, and 0.02 to 2.07 mBq m-3 (n = 89) for PM2.5. Across all particle sizes, 210Pb concentrations exhibited clear seasonal patterns, with maxima in autumn and winter (October - February) and minima in summer (July - September), with differences reaching up to a factor of two between seasonal extremes. These seasonal increases in 210Pb concentrations are attributed to the combined effects of anthropogenic emissions from the vast port and industrial facilities in the vicinity of Busan Port, seasonal changes in prevailing winds, decreased precipitation, and enhanced atmospheric stability. The dry deposition fluxes of 210Pb in Busan were found to be comparable to or slightly higher than those observed in other major port and coastal cities worldwide. Particle-size and multi-tracer analyses revealed that fine particles (PM2.5, PM10) are more strongly influenced by mixed natural and anthropogenic sources compared to TSP, as also indicated by seasonal and particle-size-dependent variations in the 210Pb/Pb ratio. Overall, this study demonstrates that 210Pb in aerosols serves as an effective environmental tracer for assessing the combined impact of emission sources and meteorological factors in port areas. The findings underscore the importance of considering particle size and source characteristics when evaluating the environmental and health implications of airborne radioactivity in harbor cities