Environmental effects of mercury pollution by artisanal and small-scale gold mining in Bombana area, Southeast Sulawesi Province, Indonesia

Basri

Abstract: Indonesia has a large population of ASGM sectors so as the third largest mercury emitter in the world after China and India. Significant health risk associated with ASGM includes exposure of mercury due to the hazardous working condition. The study aims to evaluate the socio-economic and environment effects by ASGM in Bombana area, Southeast Sulawesi Province, Indonesia. Sampling was performed in three areas such as ASGM area, mining company area, and control area by stratified and purposive sampling methods. All 237 samples including human scalp hair, cattle hair, soil, and grass were analyzed by PIXE. A cattle horn is analyzed by a micro-PIXE. Paleontological Statistic (PAST) Ver. 3.17 and IBM SPSS Statistic 21 Ver. 21.0 were used for data analyses. The results of socioeconomic assessments indicate that the income of miners is lower (ranging from 200,000 IDR to 5,000,000 IDR) than that of the control group (ranging from 2,000,000 IDR to 6,000,000 IDR). Unsafe working practices of miners cause several occupational hazards such as the musculoskeletal disorder, neurological symptoms, respiratory disorder, and degenerative disease. The analytical results showed that the mean values of mercury concentration in human scalp hair from the ASGM area and company area are higher (13.0 and 14.0 μg/g, respectively) than that from control group (5.70 μg/g) and exceeds the Human Biomonitoring threshold limit (5 μg/g hair). Compared to the control area, mercury concentration of cattle in the ASGM area registered an extensive increase in cattle hair (7.80 μg/g) (control area mean: 2.50 μg/g). Grass mercury concentrations in the ASGM area (mean value: 9.90 μg/g) are higher than those of the control area (mean values: 2.70 μg/g). Furthermore, soil mercury concentrations in the ASGM area (mean values: 390 μg/g) are higher than those of the control area (7.40 μg/g). The quantitative 2D elemental images by the micro-PIXE analysis show that the maximum values for Hg in the cattle horn were 275 μg/g. Atmospheric contamination is the most important route on Hg emission transport, driving the primary exposure to human and nature. The continuous growth of the ASGM sector imposes the critical environmental impact on miners and inhabitants living around ASGM areas.