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The effectiveness of respiratory protection worn by communities to protect from volcanic ash inhalation. Part I: Filtration efficiency tests

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ABSTRACT

During volcanic eruptions and their aftermath, communities may be concerned about the impacts of inhaling volcanic ash. Access to effective respiratory protection (RP) is therefore important for many people in volcanic areas all over the world. However, evidence to support the use of effective RP during such crises is currently lacking. The aim of this study was to build the first evidence base on the effectiveness of common materials used to protect communities from ash inhalation in volcanic crises.

Key Words: respirator, facemask, $PM_{2.5}$, ash, volcano, filtration efficiency

We obtained 17 forms of RP, covering various types of cloth through to disposable masks (typically used in occupational settings), which communities are known to wear during volcanic crises. The RP materials were characterised and subjected to filtration efficiency (FE) tests, which were performed with three challenge dusts: ashes from Sakurajima (Japan) and Soufrière Hills (Montserrat) volcanoes and aluminium oxide (Aloxite), chosen as a low-toxicity surrogate dust of similar particle size distribution. FE tests were conducted at two concentrations (1.5 mg/m^3