

Title \*

Testing the effectiveness of respiratory protection used to prevent inhalation of volcanic ash: filtration efficiency experiments

Abstract \*

During airborne particulate events, whether from urban pollution, volcanic ash, biomass burning, fires or desert dust, civil/health protection agencies may recommend or distribute disposable masks and citizens may choose to procure them. However, there is a lack of evidence on mask types which are effective at preventing inhalation of fine particles in non-occupational settings.

The Health Interventions in Volcanic Eruptions project (<http://community.dur.ac.uk/hive.consortium/>) is building the first evidence base on the effectiveness of the range of types of respiratory protection worn by communities exposed to volcanic ash, including cloth, bandanas, surgical and N95-style masks. Mostly, agencies distribute surgical masks, or basic, single-layer, non-woven masks.

Filtration efficiency tests were performed (3 repeats) on 18 materials with three dusts (2 ash types and Aloxite, chosen as a low-toxicity, surrogate dust for the subsequent volunteer study) at two concentrations (1 and 2.5 mg.m<sup>-3</sup>) and 2 flow rates (equivalent to 40 and 80 l.min<sup>-1</sup>). Each material was held in a sample holder, within a chamber, and PM<sub>2.5</sub> concentrations measured by TSI Sidepak, outside the material (challenge conc., mg.m<sup>-3</sup>) and inside the holder (penetration conc., mg.m<sup>-3</sup>), to determine penetration %.

Overall, 4 masks performed very well with mean penetration of < 2% (FFP2, FFP3, Japanese PM<sub>2.5</sub> mask, Indonesian mask provided by the Red Cross). Surgical masks had ~12% penetration and all other materials had 25-83% penetration, including wetted materials. Four masks have now been tested for effectiveness on volunteers, with one mask also being tested for improved fit through adaptation with an elasticated outer layer.

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