



Dust sampling developments using sticky pads

G. Walton (1,2) and H. Datson (1)

(1) DustScan Ltd, Griffin House, Market Street, Charlbury, Oxon, OX7 3PJ, UK , (2) School of Process, Environmental & Materials Engineering, University of Leeds

The monitoring of dust movements and dust settlement is often necessary where quarrying and mineral processing raise environmental or nuisance concerns for nearby receptors, especially when multiple dust sources are present within and beyond the limits of mineral working. Health and safety issues may also arise; monitoring, therefore, needs to address both concerns. This paper explores recent developments of the passive dust monitoring system that uses sticky pads to sample deposited dust and dust in flux. Early methods to provide directional data on moving dust included cylindrical pads that collected dust on an acrylic adhesive. Whilst excellent data were obtained on dust source directions in terms of coverage and colour, dust could not be readily removed from the sticky pads for geochemical or other analyses. A system for 'acid digestion' of segments of sticky pads with dust and equivalent blank pads allowed the development of a method by which distinctive elemental ratios and proportions could be determined. By this means the proportion of key indicator elements consistent with dust from a specific quarry or other source could be studied and this distribution further refined by the use of geostatistics. Recent developments have concentrated on the use of hot-melt adhesives that allow for the removal of dust following the standard scanning for dust coverage and colour. A dust disc sampler, using the same adhesive, was developed to collect settled dust. Field trials have indicated a good correlation between the dust disc and the Frisbee-type dust deposition sampler, but avoiding the collection of rain water. A mass detection limit of 0.5 g m^{-2} has been established and the technique also applied to directional dust samples from sticky pads. Examples will be shown of these methods in use in quarries and open-pit mines in the UK and elsewhere. The ability to separate dust from the sampling media allows the preparation of samples for grading analyses, and chemical and mineralogical testing using ICP-MS and SEM-EDX (including QEMSCAN) as well as gravimetry. Health risk dust is generally taken to be <10 microns in size and may be measured by a variety of techniques, however directional PM_{10} can now be sampled using sticky pads. Interesting variations have been identified in PM_{10} levels prior to initial excavations at a site where conditions are geochemically and geomorphologically consistent, but where the variations in PM_{10} levels are not necessarily consistent with variations in weather. The ability to characterise and quantify dust using simple sticky pad equipment may help in apportioning responsibility for nuisance and health risk concerns associated with mineral workings.