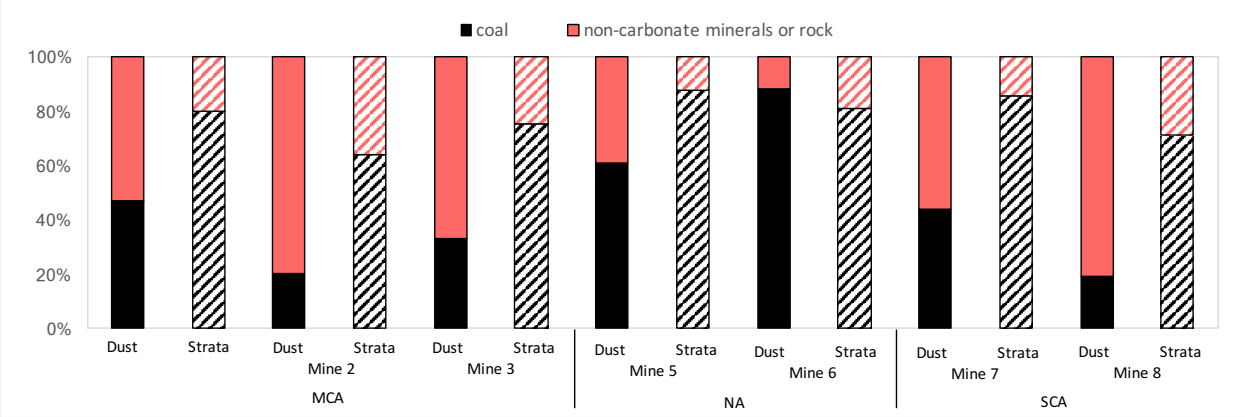
***Spotlight Topic*:** Virginia Tech researchers find high fractions of non-coal particles in respirable dust samples.

Alpha Foundation Grant AFC113-11: Connecting Dust Characteristics and Worker Health in Underground Mining

Contact Information: Virginia Tech; Dr. Emily Sarver, co-PI; esarver@vt.edu

Virginia Tech researchers working in conjunction with a grant to the University of Pittsburgh to investigate the influence of specific dust *characteristics* and associated exposure patterns on lung disease in underground coal miners made an interesting discovery, finding that the major constituents in the respirable dust samples were often not coal. Rather, carbonate and non-carbonate minerals tended to dominate many samples.

As part of the study, respirable dust samples were collected in various areas of 8 underground coal mines, including 4 mines in Mid-Central Appalachia (MCA, MSHA district 4), 2 mines in South-Central Appalachia (SCA, district 12) and 2 mines in Northern Appalachia (NA, districts 2 and 3). Personal samples were also collected in some mines by volunteers. Analysis was done using electron microscopy and thermogravimetric methods and showed that, on the basis of both particle number and dust mass fractions, carbonates were very prevalent in the respirable dust in most mines. This was largely attributed to rock dusting products being used in the mines to mitigate explosibility hazards. However, even when results were normalized to exclude carbonates and thus primarily consider the dust constituents generated in the mine, the prevalence of coal was less than expected. The figure below shows the normalized results of dust samples collected near the mining face compared to the relative heights of coal and rock strata being mined. In 6 of the 7 mines where these samples were collected, there was significantly less coal dust than expected based on the mining heights. The non-carbonate minerals in these samples was largely attributed to cutting of roof and/or floor rock, and in all cases this fraction of the dust was dominated by alumino-silicate minerals with varying amounts of quartz and other minor constituents.



This study demonstrated that at least three primary sources of respirable dust can exist in coal mines: the coal and rock strata being cut or drilled, and rock dusting products being applied. Considering the possible disparate health effects associated with different types of particles, measurement of respirable dust mass alone is likely inadequate to assess risks. Beyond discoveries of dust constituent materials and likely sources, the study also revealed interesting correlations between the particle size and shape with differences observed among the three coal regions. In conclusion, the study reveals that there may be differences in dust generating mechanisms associated with particular mining environments that need to be more thoroughly examined to gain a better understanding of respirable health risks.