

MINERALIZED DUST EXPOSURE IN THE MIDDLE EAST: POTENTIAL HEALTH RISKS FROM METALS AND MICROBIAL PATHOGENS

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In the Middle East, dust and sand storms are a persistent problem delivering significant amounts of mineralized particulates via inhalation into the mouth, nasal pharynx, and lungs. The health risks of this dust inhalation are presently being studied but accurate characterization is lacking. Experiments were designed to study the chemical composition, mineral content, or microbial flora of Kuwaiti and Iraqi dust for its potential to cause adverse human health effects. Multiple site samples were collected and chemical and physical characterization including particle size distribution and inorganic analysis was conducted, followed by analysis and identification of biologic flora to include bacteria, fungi and viruses. Data indicates that the mineralized dust is composed of calcium carbonate over a matrix of metallic silicate nanocrystals containing a variety of trace and heavy metals constituting ~3 % of the PM10 particles by weight, of which ~1% is bioaccessible aluminum and reactive iron, each. Microbial analysis reveals a significant biodiversity of bacteria of which ~25 % are known pathogens. Of the microbes identified, several have hemolytical properties and most have significant antibiotic resistance. Viral analysis indicates a tremendous amount of virions with a large percent of RNA viruses. The level of total suspended particle mass at PM10 constitutes an excessive exposure micro-particulates including PM 2.5. Reported data on cell culture and animal studies have indicated a high level of toxicity to these dust particles. Taken together, these data suggest that at the level of dust exposure commonly found in the Middle East (i.e., Iraq, Kuwait, and Afghanistan), in addition to the microbial and metal content, mineralized dust constitutes a significant health risk, both acute and chronic, to deployed troops and native inhabitants.

Keywords: mineralized dust, metals and microbial pathogens