

## Department of Defense Enhanced Particulate Matter Surveillance Program (EPMSp)

The goal was to provide US Central Command (USCENTCOM) with scientifically founded information on the chemical and physical properties of dust collected at deployment locations within their Area of Responsibility (AOR). This project was developed to assist Department of Defense (DOD) occupational and health physicians and environmental health professionals in assessing possible human health risks from exposure to ambient particulate matter on Middle East military bases. Our results were reported in 2008. We demonstrated the benefits of integrating analytical results from complementary disciplines to better understand mineral dusts and other aerosols that are encountered at sites of military importance.

**Summary of Project Details:** We collected aerosol and bulk soil samples over one year at 15 military sites in the Middle East. We conducted chemical analyses to measure the levels of potentially harmful trace elements such as lead, arsenic and other metals. We conducted major element and ion chemistry, x-ray diffractometry, and scanning electron microscopy with an energy dispersive x-ray fluorescence detector. Our results from the EPMSp included 61,108 analyses on Teflon membrane, 21,888 on quartz fiber and more than one million single particle analyses on Nuclepore filters.

**Management Implications:** Our recommendations were twofold: remediation and future studies. We showed the three main air pollutant types where samples were taken to be: geological dust; smoke from burn pits; and heavy metal condensates (e.g., lead smelting, battery manufacturing). Little can be done about dust from regional storms, although dust at operating sites can be mitigated using best management practices. We recommended against open burning, to reduce a toxic cloud of smoke that persists over the bases. We recommended moving lead smelters and battery manufacturing facilities outside heavily populated areas to reduce exposure to lead, zinc, cadmium, arsenic and antimony. Iraq uses leaded gasoline, and subsequently there is lead from vehicle emissions in the atmosphere and re-suspended in dirt roads. Little can be done to alleviate that. Similarly, electronic circuit board recycling may be contributing to the release of metals into the atmosphere.

Our recommended future investigations included: identifying data gaps; specific additional statistical analyses; address the organic carbon artifact problem; source characterize burn pits and emissions from battery and smelting operations; conduct a detailed mineralogical investigation of dust coatings on mineral grains; assess study results in terms of health standards; conduct a toxicological study of the dust; evaluate chemical and mineralogical results in conjunction with meteorological data; and conduct regular one-in-six data monitoring of PM<sub>10</sub> and PM<sub>2.5</sub> at bases that are in operation for more than one year.



