Optical Remote Sensing of Particulate Matter to Quantify Plume Opacity and Mass Emission Factors

ABSTRACT

It is important to develop and evaluate optical remote sensing (ORS) techniques to quantify: 1) atmospheric plume opacity generated by point and fugitive sources and 2) particulate matter (PM) mass emission factors (EFs). Quantification of PM emissions to the atmosphere is important because PM adversely affects human health and contributes to climate forcing.

Digital Optical Method (DOM) will be discussed that uses digital still cameras and software as an alternative to human observations to quantify plume opacity. DOM was developed to reduce cost, provide archival records, and provide more objective measurements. DOM will be described in terms of its first principles, field evaluations, and use in practice.

Light Detection And Ranging (LIDAR) and ancillary measurements will also be discussed to quantify PM EFs for complex fugitive sources. Range resolved extinction coefficients and concurrent point measurements provided fugitive PM EFs for vehicles travelling on unpaved roads, helicopters, open burning, and open detonation. Field evaluation of this method demonstrates that it is well suited to improve quantification of PM EFs from fugitive sources when compared to similar emissions that were measured in controlled laboratory enclosures.

Mark J. Rood, AEES Kappe Lecturer

Ivan Racheff Professor of Environmental Engineering
Department of Civil and Environmental Engineering
University of Illinois at Urbana-Champaign

BIO: Mark J. Rood is the Ivan Racheff Professor of Environmental Engineering, at University of Illinois at Urbana-Champaign (UIUC), Illinois. Mark has more than 36 yr of research experience pertaining to gas separation and aerosol characterization. He studied at Illinois Institute of Technology, Chicago, University of Washington, Seattle, and Stockholm University, Sweden prior to becoming a professor at UIUC. Mark has published more than 130 peer-reviewed journal papers, co-authored one ASTM method, and six patents pertaining to gas separation techniques and ambient plume characterization. Mark is co-chief editor for "Environmental Technology & Innovation", member of the Advisory Board for "Particuology", was chief editor for ASCE’s "Journal of Environmental Engineering", and was an associate editor for "Journal of the Air and Waste Management Association." He is a Board Certified Environmental Engineer Member with the American Academy of Environmental Engineers and Scientists. He is a Fellow and was a director for the Association of Environ-