BIOGRAPHICAL SKETCH

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NAME: Kevin D. Perry

eRA COMMONS USER NAME (credential, e.g., agency login): KEVINPERRY

POSITION TITLE: Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Iowa State University, Ames, IA USA	BS	05/1990	Meteorology
University of Washington, Seattle, WA USA	PhD	06/1995	Atmospheric Sciences
University of California, Davis, CA USA	postdoc	12/1998	Air Quality

A. Personal Statement

Dr. Kevin Perry has more than 23 years of management and research experience in the areas of ambient air quality monitoring, instrumentation/analytical technique development, source apportionment, atmospheric dry deposition, and the climatic and health effects of particulate matter. His experience includes management and participation in ~20 ambient air monitoring projects ranging from local-scale pollution events (e.g. plumes from the World Trade Center collapse, smoke from pyrotechnic displays) to the intercontinental transport of pollutants (e.g., Aerosol Characterization Experiment – ACE-Asia, International Transport and Chemical Transformation Experiment – ITCT2K2). Dr. Perry has deployed ambient air monitoring equipment at ground-based, ship-based, airborne, and high-altitude mountain observatories around the globe. He also developed a technique using the Advanced Light Source (ALS) Synchrotron at Lawrence Berkeley National Laboratory (LBNL) to use Synchrotron-Xray Fluorescence (S-XRF) to characterize the size- and time-resolved elemental composition of atmospheric particulate matter.

Dr. Perry's current research is focused on the emission of dust from the exposed portion of the Great Salt Lake. He has spent more than 200 days conducting field work at the GSL and has completed a comprehensive soil survey of the entire 800 square miles of exposed lakebed. Previous research focused on quantifying the effects of particulate matter on birth outcomes and gastrointestinal health using a retrospective analysis of existing air quality data with patient medical and birth records from the Utah Population Database (UPDB). Dr. Perry has also completed research projects related to the transport and deposition of atmospheric mercury.

Dr. Perry served as chair of the Department of Atmospheric Sciences from 2011 through 2018 and teaches a wide variety of atmospheric sciences courses including an Honors think tank course on Air Quality, Health, and Society. He is one of three members in the College of Mines and Earth Sciences to receive the University of Utah Early Career Teaching Award. He is a member of the American Meteorological Society, the American Geophysical Union, and has published 38 peer-reviewed journal articles and two book chapters.

B. Positions, Scientific Appointments, and Honors

Positions and Scientific Appointments

2022-Present	Professor, Atmospheric Sciences, University of Utah
2021-Present	Member, Great Salt Lake Strike Team
2021-Present	Steering Committee Member, Dust Alliance for North America
2011-2018	Department Chair, Atmospheric Sciences, University of Utah

2008-2022	Associate Professor, Atmospheric Sciences, University of Utah
2002-2007	Assistant Professor, Meteorology, University of Utah
1999-2001	Assistant Professor, Meteorology, San Jose State University
1997-2008	Co-Director, Determination of Extinction and Long-range Transport of Aerosols (DELTA) Research Group, Department of Chemical Engineering, University of California, Davis
1995-1998	Postdoctoral Researcher, Air Quality, Crocker Nuclear Laboratory, Univ. of California - Davis
1990 – 1994	Research/Teaching Assistant, Department of Atmospheric Sciences, University of Washington
1989 – 1990	Student President, College of Sciences and Humanities, Iowa State University of Science and Technology
1988 – 1989	Undergraduate Research Assistant, Department of Geologic and Atmospheric Sciences, Iowa State University of Science and Technology

Honors

2018	Career & Professional Development Center Faculty Recognition Award, University of Utah
2015	Utah Medical Association Environmental Award
2006	University Early Career Teaching Award, University of Utah
1994	Outstanding Student Paper Award, American Geophysical Union Spring Conference
1990	Outstanding Leadership Award, College of Sciences and Humanities, Iowa State University

C. Contributions to Science

1. Determined Why Smoke from the World Trade Center Collapse and Fires was Hazardous to Human Health.

The rubble pile from the collapse of the World Trade Center towers smoldered for more than a month after the initial collapse and produced a smoke plume that contained a wide variety of unusual, and potentially harmful, types of particulate matter. First responders who failed to utilize appropriate respirators suffered permanently-debilitating lung damage. Despite the obvious risk, the US Environmental Protection Agency repeatedly proclaimed that the smoke plume did not pose a danger to human health because it did not contain asbestos or particulate matter concentrations in excess of the National Ambient Air Quality Standards. I helped plan and implement an independent assessment of the particle size and chemical composition of particles within the smoke plume. We discovered that the smoke contained 1) unprecedented concentrations of ultrafine silica, 2) fine and very fine transition metals, 3) sulfuric acid, and 4) carcinogenic organic molecules. Exposure to these unusual aerosols posed significant acute and chronic health risks that were overlooked by the USEPA.

Cahill, T. A., S. S. Cliff, K. D. Perry, M. Jimenez-Cruz, G. Bench, P. Grant, D. Ueda, J. F. Shackelford, M. Dunlap, M. Meier, P. B. Kelly, S. Riddle, J. Selco, and R. Leifer, Analysis of aerosols from the World Trade Center collapse site, New York, October 2 to October 30, 2001. *Aerosol Sci & Technol*., 38, 165-183, 2004.

Cahill, T. A., S. S. Cliff, J. Shackelford, M. Meier, M. Dunlap, K. D. Perry, G. Bench, and R. Leifer, Very fine aerosols from the World Trade Center collapse piles: Anaerobic Incineration?, Book Chapter In ACS Symposium Series 919, Urban Aerosols and their Impacts: Lessons Learned from the World Trade Center Tragedy, J. S. Gaffney and N. A. Marley, Eds., American Chemical Society, Washington D.C., pp 152-163, ISBN 0-84-123916-9, 2005.

2. Discovered that Mineral Dust can Undergo Long-range (Intercontinental) Transport.

The long-range transport of North African dust to the Middle East, Europe, South America, and the Caribbean has been well documented during the past 25 years. With the advent of routine collection and analysis of fine aerosols at national parks, monuments, and wilderness areas in the continental United States, these North African dust incursions can now be tracked, characterized, and quantified across much of the eastern half of the United States. Identification of the North African source of these dust episodes is confirmed by mass distribution measurements, a characteristic Al/Ca ratio, is entropic backward air mass trajectories, and sequential plots of the spatial distribution of the dust plumes. North African dust incursions into the continental United States persist for10 days and occurred, on average, 3 times per year from 1992 to 1995. Fine soil mass usually exceeds 10 $\mu g/m^3$ during these dust episodes and dominates local fine soil dust by an order of magnitude or more, even in the so-called "dust bowl" states of the central United States. Size-resolved measurements of elemental composition taken during July 1995 indicate that the mass mean diameter of the transported North African dust is < 1 μm. The high mass scattering efficiency and abundant particle surface area associated with these submicron soil aerosols could have important consequences for both the radiative balance of the region and the chemistry of the local aerosols during summer when the long-range transport of North African dust to the United States is most common. Subsequent studies demonstrated that transpacific transport of dust from the Gobi and Taklamakan Deserts in Asia is also common.

Perry, K. D., T. A. Cahill, R. A. Eldred, D. D Dutcher, and T. E. Gill, Long-range transport of North African dust to the eastern United States, *J. Geophys. Res.*, 102, 11225-11238, 1997.

Guelle, W., Y. J. Balkanski, M. Schulz, B. Marticorena, G. Bergameti, C. Moulin, R. Arimoto, and K. D. Perry, Modeling the atmospheric distribution of mineral aerosol: Comparison with ground measurements and satellite observations for yearly and synoptic timescales over the North Atlantic, *J. Geophys. Res*., 105, 1997-2012, 2000.

VanCuren, R. A., S. S. Cliff, K. D. Perry, and M. P. Jimenez-Cruz, Continental aerosol dominance above the marine boundary layer in the eastern North Pacific: Continuous aerosol measurements from the 2002 Intercontinental and Chemical Transformation Experiment (ITCT2K2), *J. Geophys. Res*., 110, D09S90, doi:10.1029/2004JD004973, 2005.

3. Confirmed that bacteria are routinely transported intercontinental distances by adhering to mineral dust particles.

Microorganisms are abundant in the upper atmosphere, particularly downwind of arid regions, where winds can mobilize large amounts of topsoil and dust. However, the challenge of collecting samples from the upper atmosphere and reliance upon culture-based characterization methods have prevented a comprehensive understanding of globally dispersed airborne microbes. In spring 2011 at the Mt. Bachelor Observatory in North America (2.8 km above sea level), we captured enough microbial biomass in two transpacific air plumes to permit a microarray analysis using 16S rRNA genes. Thousands of distinct bacterial taxa spanning a wide range of phyla and surface environments were detected before, during, and after each Asian long-range transport event. Interestingly, the transpacific plumes delivered higher concentrations of taxa already in the background air (particularly *Proteobacteria*, *Actinobacteria*, and *Firmicutes*). While some bacterial families and a few marine archaea appeared for the first and only time during the plumes, the microbial community compositions were similar, despite the unique transport histories of the air masses. It seems plausible, when coupled with atmospheric modeling and chemical analysis, that microbial biogeography can be used to pinpoint the source of intercontinental dust plumes. Given the degree of richness measured in our study, the overall contribution of Asian aerosols to microbial species in North American air warrants additional investigation.

Smith, D. J., H. J. Timonen, D. A. Jaffe, D. W. Griffin, M. N. Birmele, K. D. Perry, P. D. Ward, and M. S. Roberts, Intercontinental dispersal of bacteria and archaea by transpacific winds, *Applied and Environ. Microbiology*, doi:10.1128/AEM.03029-12, 2013.

4. Established a Link Between Exposure to Particulate Matter and Eosinophilic Esophagitis.

Eosinophilic esophagitis (EoE) is emerging as the most common cause of esophageal food impactions in emergency visits. Seasonal aeroallergens (ie, pollen) have been postulated to influence the presentation of EoE. Pollution influences expression of TSLP (thymic stromal lymphopoietin), a pivotal EoE-related cytokine. We hypothesized that airborne particulate matter may result in excitation of inflammation and, thus, increase the risk for esophageal dysfunction in EoE. We conducted a case-crossover analysis of Emergency Department (ED) visits among EoE patients in Utah to test the hypothesis that exposure to particulate matter with aerodynamic diameter ≤ 2.5 microns ($PM_{2.5}$) associates with exacerbations of EoE. In summary, we found a significant association for ED visits for chest pain, dysphagia, and food impaction and exposure to $PM_{2.5}$ concentrations exceeding the NAAQS standard. The findings of this study suggest that high levels of $PM_{2.5}$ might trigger EoE exacerbations via effects on TH2-mediated responses. Thymic stromal lymphopoietin (TSLP) expression, a pivotal EoE-related cytokine linking innate and Th2 adaptive immune disorders, is affected by ambient particulate matter and diesel exhaust particles. Additionally, high levels of $PM_{2.5}$ exacerbate Th2-mediated responses. Thus, exacerbations of EoE from exposures to ambient pollution are physiologically plausible.

Maestas M. M., K. D. Perry, K. Smith, R. Firszt, K. Allen-Brady, J. Robson, E. Joy, and K. Peterson, Food impactions in eosinophilic esophagitis and acute exposures to fine particulate pollution, *Allergy*, doi: 10.1111/all.13932, 2019.

5. Determined that Mineral Dust from the Exposed Lakebed of Great Salt Lake Contains High Concentrations of Potentially Harmful Metals.

The elevation of the Great Salt Lake (GSL) has recently reached historically low levels due to a combination of water diversion and drought. Due to the shallow nature of the GSL, more than 750 square miles of lakebed are now exposed. As a result, dust plumes originating from the exposed lakebed have become common. These dust plumes have a significant impact on local air quality and have been shown to reduce the snowpack in the adjacent mountains due to enhanced melt rates. With more than 2 million residents living in close proximity to the GSL, there is also a concern that the dust plumes might pose a health hazard. To determine if the PM_{10} dust from the GSL contains heavy metals which might pose a threat to human health, a systematic survey of all 757 square miles of the exposed GSL lakebed was undertaken between June 2016 and August 2018 using Incremental Sampling Methodology (ISM). All soil samples were dried, sieved, resuspended, and analyzed to determine the elemental mass fractions of the respirable particles (i.e., particles with diameters $< 10\ \mu m$ – PM_{10}) using a combination of Inductively-Coupled Plasma Mass Spectrometry (ICPMS) and Synchrotron X-ray Fluorescence (SXRF). The PM_{10} soil from the GSL lakebed is highly enriched in elements associated with evaporite minerals (e.g., boron, calcium, chlorine, lithium, magnesium, sulfur, and strontium). Of the 53 elements measured using ICPMS and SXRF, only nine had some values which exceeded the Residential Regional Screening Levels (RSLs) established by the U.S. Environmental Protection Agency (EPA). These nine elements included antimony, arsenic, cobalt, copper, lanthanum, lithium, manganese, vanadium, and zirconium. Four of these elements (arsenic, lanthanum, lithium, and zirconium) also had some values which exceeded the Industrial RSLs established by the EPA. Every measurement of arsenic exceeded both the residential and industrial exposure RSLs by more than an order of magnitude. Thus, arsenic is the contaminant of greatest potential concern to human health for those living downwind of the expose playa.

Perry, K. D., E. T. Crosman, and S. W. Hoch, Results of the Great Salt Lake Dust Plume Study, https://d1bbnjcim4wtri.cloudfront.net/wp-content/uploads/2019/12/10101816/GSL_Dust_Plumes_Final_Report_Complete_Document.pdf, 2019.