Title: Tracking Ammonia Emissions from Large Agricultural Sources

Faculty Mentor: Emily Fischer, (Associate Professor, Department of Atmospheric Science, evf@atmos.colostate.edu) Other Mentors: Ilana Pollack and Amy Sullivan (Department of Atmospheric Science Research Scientists, ipollack@rams.colostate.edu and apsull@engr.colostate.edu); Larry Hooker, Interim Director and Agent (4-H Youth Development / Livestock), lhooker@co.weld.co.us)

Location: Fort Collins (ATS Foothills Campus), with field work in Larimer and Weld County

Goals, scope, and objectives: The goal of the internship is for an undergraduate student to participate in a ground-based atmospheric chemistry field campaign in tandem with an airborne field campaign. The student will aid in measurements of ammonia and methane from a mobile laboratory. Ammonia contributes to fine particle formation and nitrogen deposition; however, less is known about the emissions, abundances, and loss processes for this species than other anthropogenic pollutants. Though there have been large research strides with respect to ammonia over the last several years, a recent analysis of global satellite observations implies that we should prioritize quantifying ammonia emissions from large point sources, including cattle and dairy feedlots. The student will gain experience with sophisticated atmospheric chemistry instrumentation and data interpretation in this context. The student will play active roles in the fieldwork, and they will perform preliminary data analysis. They will also work on a joint effort between the CSU Department of Atmospheric Sciences and CSU Extension to reach out to the agricultural community regarding the field campaign.

Specific objectives include: The student will deploy ammonia and methane measurements (Picarro model G2508 analyzer) in a mobile lab. We will use a mobile laboratory in several strategic ways to augment the aircraft sampling. We will attempt downwind transects of individual sources (i.e. cattle and dairy feedlots) further downwind than feasible with the aircraft. We will compare ratios of ammonia to methane sampled from the aircraft and the mobile lab. Using the change in this ratio as a function of the downwind distance, we should be able to confirm that net ammonia flux direction is downward in concentrated airmasses downwind of major sources. In addition, we will pick a site(s) where we anticipate relatively consistent winds, and then keep the mobile laboratory downwind of that(those) site(s) for 24-hours or revisit them over multiple days to collect diurnal data.

Outcomes: By the end of the internship the intern will develop important skills necessary to: (1) conduct mobile air pollution measurements, (2) coordinate research activities across multiple facilities, (3) interpret ammonia and methane measurements, (4) display and map mobile measurements, and (5) disseminate air quality information to a wide variety of agricultural stakeholders.

Mentorship style: The PI leads the NSF-supported PROGRESS (PROmoting Geoscience Research Education and SuccesS) mentoring program to improve the recruitment and retention of undergraduate women in the earth and environmental sciences. Our mentoring strategy will be based on findings from this project. We will also integrate the student into the larger cohort of students that complete summer research in the CSU Department of Atmospheric Science under the NSF Earth System Modeling and Education Institute (ESMEI) Research Experiences for Undergraduates (REU) program.

Travel Funds: All travel necessary for this project will be covered.