PURDUE
UNIVERSITY

COLLEGE OF AGRICULTURE

AGRICULTURAL RESEARCH AND GRADUATE EDUCATION

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Dear Jeff:

I am writing this letter in support of forming a North Central Development Committee to write a proposed multistate project entitled “emission and deposition issues surrounding agriculturally-sourced NH3”. The Purdue University representative would be Dr. Richard Grant in the Department of Agronomy. I understand that Dr. Doug Buhler at Michigan State University is also willing to write a letter of support.

Here is some background on the need and justification for such a North Central Development Committee.

Background: Ammonia (NH_3) is a gas readily released into the air from a variety of biological sources, as well as from industrial and combustion processes. It is the principle basic gas in the atmosphere and can be found at varying levels across the US. Data from the National Atmospheric Deposition Program/National Trends Network (NADP/NTN), a 30+ year wet deposition network with over 250 sites across the United States, has shown an increasing trend in ammonium (NH_4^+) concentration within precipitation in the central United States. About 85% of NH_3 emissions in the United States is from agriculture, largely animal waste and commercial fertilizer application. Areas with the highest atmospheric concentrations and the highest wet deposition fluxes are both found in the Midwest and Plains states. However, the estimation of NH_3 emissions from individual farms requires knowledge of the background levels to which the farm is adding. This was identified as a significant gap in knowledge in a recent USDA effort at defining methodologies for NH_3 and N_2O emissions estimation (page 5-129; Powers et al, 2014). Consequently, the national emissions inventory of N_2O emissions is in part limited by our inability to define the NH_3 emissions.

In many areas, NH_3 contributes significantly to atmospheric N deposition (Swede and Lear, 2014). This has been shown by a number of authors for U.S. national parks and wilderness areas (e.g., Ellis et al., 2013). Understanding the contribution of reduced nitrogen, versus oxidized forms that are subject to regulatory control, to total deposition is important for developing effective ecosystem protection from excess nitrogen, such as the Secondary National Ambient Air Quality Standard for NOx and Sox and critical load frameworks. Ammonia is also a detriment to animal and human health. Pulmonary edema and pulmonary inflammation results from inhalation of NH_3 at varying concentrations and durations, dependent upon species (see Carson et al., 1981 for a review). Additionally, the ready formation of ammonium particulate matter from NH_3 gas also has a health impact. In many areas, aerosol formation is limited by low NH_3 concentrations. With local NH_3 emissions present, aerosol formation can occur quickly. This small-sized aerosol has been associated with premature mortality, chronic bronchitis, and asthma complications (e.g., McCubbin et al., 2002). These aerosols can lead back to agricultural operations, and therefore particulate formation can have a wider health impact beyond the agricultural area and beyond health impacts from NH_3 gas alone. There are also important secondary effects of NH_3 emissions on air quality. NH_3 reacting with water vapor forms NH_4^+ is a precursor to particulate matter (PM) formation (USEPA, 2011, noted above). Significant attention is presently associated with PM formation and EPA regulates PM, although most states do not require agriculture to reduce emissions. Consequently, the increased understanding of sources and sinks of NH_3 in the atmosphere and across the

landscape will greatly enhance our ability to address a number of environmental and health issues associated with farming in the 21st century.

Basis for forming a Multistate Research Project: The difficulty of estimating ambient NH_3 concentration and regional deposition requires the development of generalized emissions model verification, spatial extrapolation methodologies, and dry deposition methodologies. While NH_3 has many beneficial uses, it can detrimentally affect the quality of the environment, including the acidification and eutrophication of natural ecosystems, the associated loss of biodiversity, and the formation of secondary particles in the atmosphere. Consequently, the interest in NH_3 extends across many disciplines.

Potential duplication of efforts in existing committees: The NIMSS data base of existing active projects was queried for multistate projects with goals that overlap foreseen objectives relating to the proposed project (Table 1). The only project with potentially overlapping objectives with the proposed committee was NC1187. The project's overlapping objectives were: 1) Determine the physical, chemical, and biological nature of particulate matter, including nanoparticles, derived from agricultural practices, processes, and operations and from the production, use, and disposal of consumer products, as they impact air, water, and soil quality and associated health, economic, and environmental impacts, including ecological sustainability and agricultural production; 2) Determine those particulate matter properties that control the cycling, biological availability, and uptake of nanoparticles, nutrients, carbon, and toxic substances in air, water, and soil systems. The only project with clear objectives involving ammonia was NRSP003. The project's overlapping objectives were: 1) Characterize geographic patterns and temporal trends in chemical or biological atmospheric (wet and dry) deposition; and 2) Support research activities related to: (a) the productivity of managed and natural ecosystems; (b) the chemistry of surface and ground waters, including estuaries; (c) critical loads in terrestrial and aquatic ecosystems; (d) the health and safety of the nation's food supply; and (e) source-receptor relationships. Within the NADP, there is a background ammonia monitoring effort (AMoN; http://nadp.slh.wisc.edu/AMoN/ that would be supporting a future project and a Total Deposition Science committee that addresses the deposition of ammonia. Both of these groups are dominated by federal and state regulatory scientists.

It appears there is documented justification to appoint an NCDC to analyze and model the emission and deposition issues surrounding agriculturally-sourced NH3.

Sincerely

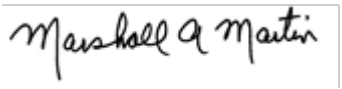

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Table 1: Related Projects extracted from the NIMSS

Project	Title	Period of operation
NC1195	Enhancing nitrogen utilization in corn based cropping systems to increase yield, improve profitability and minimize environmental impacts	10/01/2016 - 09/30/2021
WERA103	Nutrient Management and Water Quality	10/01/2015 - 09/30/2020
NE1544	Dairy Production systems: C,N, and P management for production, profitability and the environment.	10/01/2015 - 09/30/2020
NC1182	Management and Environmental Factors Affecting Nitrogen	10/01/2014 -

	Cycling and Use Efficiency in Forage-Based Livestock Production Systems	09/30/2019
NCCC308	Nutrition and Management of Feedlot Cattle to Optimize Performance, Carcass Value and Environmental Compatibility (NCT192)	10/01/2013 - 09/30/2018
NC1187	The Chemical and Physical Nature of Particulate Matter Affecting Air, Water and Soil Quality	10/01/2015 - 09/30/2020
NRSP003	The National Atmospheric Deposition Program (NADP)	10/01/2014 - 09/30/2019

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Cc:

Richard Grant
Chris Hamilton