**Potential use of milk urea N as a management tool to abate atmospheric nitrogen emissions from Wisconsin dairy farms**

J. M. Powell\*, C. A. Rotz† and M. A. Wattiaux‡

\*USDA-Agricultural Research Service, U.S. Dairy Forage Research Center, Madison, WI, 53706

†USDA-Agricultural Research Service, Pasture Systems and Watershed Management Research Unit, University Park, PA, 16802

‡Department of Dairy Science, University of Wisconsin-Madison, Madison, WI 53706

**Corresponding author**: [mark.powell@ars.usda.gov](mailto:mark.powell@ars.usda.gov)

**Abstract**

Urinary urea N (UUN) is the principal nitrogen (N) source controlling emissions of ammonia (NH3) and nitrous oxide (N2O) from dairy manure. Objectives of this study were to (1) study the integrative nature of dietary crude protein (CP) management, secretion of urea in milk (MUN), excretion of UUN, and N emissions from dairy production systems, (2) evaluate how associative changes in dietary CP, MUN and UUN affect atmospheric N emissions from dairy farms, and (3) discuss some of the challenges and opportunities to an expanded use of MUN to enhance dietary CP use, and decrease UUN excretion and N emissions from dairy farms. MUN records of 37,889 cows in 197 herds in Wisconsin revealed that approximately one-half of tested cows were consuming dietary CP in excess of requirement. Farm simulations were used to quantify the effect of dietary CP on whole-farm N emissions. At a state-wide average MUN of 12.5 mg/dL, from 48% to 87% of UUN was emitted as NH3, with the lowest loss from pasture-based farms and the greatest loss from tie-stall farms. Each 1 mg/dL decrease of MUN (in the range of 16 to 10 mg/dL) provided an associated daily decrease in UUN of 16.6 g/cow which decreased NH3 and N2O emissions from manure by 7 to 12%. Although more site-specific information is required on herd MUN-UUN relationships, and more reliable MUN assays are needed, monitoring of MUN may be used to enhance dietary CP use and reduce UUN excretion and N emissions from dairy farms.

**Key Words**: dietary crude protein (CP), milk urea nitrogen (MUN), urinary urea nitrogen (UUN), ammonia emission, nitrous oxide emission