primary and secondary sources in dairy production were integrated in a software tool called the Dairy Greenhouse Gas Model or DairyGHG. This tool calculates the carbon footprint of a production system as the net exchange of all GHGs in carbon dioxide equivalent (CO2e) units per unit of milk produced. Primary emission sources include enteric fermentation, manure handling facilities, cropland used in feed production, and the combustion of fuel in the machinery used to produce feed and handle manure. Secondary emissions are those occurring during the production of resources used on the farm, which can include fuel, electricity, machinery, fertilizer, pesticides, plastic, and purchased replacement animals. A long-term C balance is assumed, which does not account for potential depletion or sequestration of soil carbon. Depending upon farm size, milk production level, and the feeding and manure handling strategies used, the carbon footprint of production systems was found to range from 0.4 to 0.8 kg CO2e per kg of milk produced. This footprint was most sensitive to the amount of methane produced through enteric fermentation, moderately sensitive to the GHG emissions during long-term manure storage, and mildly sensitive to the amount of fuel, electricity and inorganic fertilizer used on the farm. DairyGHG provides a relatively simple tool for evaluating management effects on net GHG emissions and the overall carbon footprint of dairy production systems. This tool is available at http://www.ars.usda.gov/Main/docs.htm?docid=17355 for download and installation on computers using Windows® operating systems.

Key Words: greenhouse gas, carbon footprint, dairy farm

113 Greenhouse gas emission rates from Holstein and Black Angus-Cross feedlot steers and calves. K. R. Stackhouse*, Y. Pan, Y. J. Zhao, M. J. Tobias, and F. M. Mitloehner, *University of California*, *Davis*.

According to United Nations estimates, livestock contributes 18% of the global anthropogenic greenhouse gasses (GHG); however, actual emission data that help verify emission models remain sparse. The present study quantified GHG emissions from a total of 56 steers and calves. Animal types were assigned to three replicate groups (n = 3) of three animals per group and included: 1) 544 kg Holstein steers (1200H), 2) 544 kg Black Angus-Cross steers (1200BA), 3) 340 kg Holstein steers (750H), 4) 340 kg Black Angus-Cross steers (750BA), 5) 159 kg Holstein steers (350BA), and 6) 54 kg Holstein calves (120H). Cattle were housed in an environmental chamber for 24 h, after which waste remained for an additional 24 h. Steers were fed a 90% concentrate diet and calves were milk bottle and grain fed. Greenhouse gasses carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) were measured in 20 min intervals, using a photoacoustic gas analyzer. Emission rates ($g^{-1}cow^{-1}h$) were analyzed over time using PROC MIXED in SAS. Compared to the background, GHG emissions increased when steers entered the chamber; e.g., 1200BA emissions of (CO_2) increased by 366.67 ($g^{-1}cow^{-1}h$), (CH_4) by 3.78 ($g^{-1}cow^{-1}h$)and (N_2O) by 0.05 ($g^{-1}cow^{-1}h$) ($P < 0.001$). Associations of GHG to body weight and cattle breed were identified ($P < 0.05$). In summary, GHG are mainly produced by enteric fermentation and respiration, rather than by the animals' fresh waste, and differ greatly across life stages of cattle. The present data will be useful to verify models and to enhance emission inventories for enteric fermentation, respiration, and fresh waste for numerous cattle life stages across the U.S. beef industries.

Key Words: beef cattle, greenhouse gas, environmental chamber

114 Effects of urine application on chemistry of feedlot pen surfaces. N. A. Cole*[1], A. M. Mason[1], R. W. Todd[1], and D. B. Parker[2], [1]*USDA-ARS-CPRL*, *Bushland, TX*, [2]*West Texas A&M University*, *Canyon*.

Beef cattle feedlots can emit significant quantities of ammonia that may adversely affect air quality and decrease the fertilizer value of manure. The major source of ammonia loss may be urinary urea. We conducted three studies to evaluate the effects of urine on the chemistry of feedlot pen surfaces. In Exp.1, samples were collected from the loose surface manure and the underlying layers (dry hard pack, wet hard pack, soil) of nine pens at each of three commercial feedyards. Samples were collected from an area that had recent (< 10 minutes) urine deposition, and a pen area devoid of urine. The samples were analyzed for DM, ash, pH, electrical conductivity (EC), nitrate-N, ammonium-N, and total N, C, and P. The loose surface manure from urine spots had lower ($P < 0.05$) DM content (59.7 vs. 88.2%), and greater ($P < 0.05$) pH (8.08 vs. 7.80), EC (1.45 vs. 1.22 S/m), ammonium-N (6,755 vs. 2,381 ppm), total N (3.00 vs. 2.73%), and ammonium-N:total N (21.8 vs. 8.5%) than urine-free areas. In Exp. 2 (Summer) and 3 (Spring), 4 L of deionized water or artificial urine (21.4 g of urea/L) were applied to 1 m square plots (6/treatment) on a feedlot surface. The loose manure on the pen surface was sampled for 7 d and chemically analyzed. Compared to untreated plots, ammonium-N concentrations of plots treated with artificial urine increased ($P < 0.001$) from 391 to 6,343 ppm and pH of plots increased from 8.1 to 8.5 in less than 5 min following application and remained elevated ($P < 0.05$) for 79 to 96 h. Water applications caused a short term (2 to 4 h) increase in ammonium-N concentrations. These results support the hypothesis that ammonia losses from feedlot pens occur rapidly from urine spots. Therefore, we conclude that 1) methods which do not take this spatial variability into account will greatly underestimate ammonia emissions, and 2) pen surface amendments used to control ammonia losses must be on the pen surface continuously for optimal efficacy.

Key Words: cattle, urine, ammonia

115 Modifying available grazing time to increase dairy cow urine capture. C. E. F. Clark*[1], K. L. M. McLeod[1], C. B. Glassey[1], P. Gregorini[1], K. Betteridge[2], and J. G. Jago[1], [1]*DairyNZ*, *Hamilton, Waikato, New Zealand*, [2]*AgResearch*, *Palmerston North, Manawatu, New Zealand*.

A major source of nitrogen in New Zealand's ground and river water is dairy cow urinary nitrogen excreted as a result of excess dietary protein in grazed pasture. Nitrogen loss to the environment may be reduced by modifying available grazing time to capture urinary nitrogen. Forty-eight Holstein Friesian cows milked twice a day in early lactation (Days in milk = 35±9 days) were allocated to three treatments replicated twice. Cows were offered perennial ryegrass pasture for four hours after each milking (2x4), eight hours between milkings (1x8) or for the 24 hour period excluding milking times (control). The 2x4 and 1x8 treatments were on a bark pad when not grazing or being milked to capture urination. During the experimental period, each treatment group was allocated the same daily herbage allowance of 33 kg DM per cow (pre-grazing cover 3,200 kg DM/ha, P=0.38). No supplements were fed. The frequency and location of cow urination events were determined for 6 cows within each treatment using urination sensors (AgResearch, Palmerston North, New Zealand) on day 1, 2, 7 and 8 after a 10 day adaptation period. There was no difference (P=0.10) between treatments in the number of urinations per cow per day nor the milk urea concentration (P=0.44). However, the 2x4 and 1x8 treatments captured approximately 25% more urinations ($P<0.05$) on the bark pad than the control. These findings highlight an opportunity to reduce nitrogen loss to the environment.