tection and flow rate combined ($P<0.001$). The level of protection of algae had no significant effect on DMD, CH_4 or NH_4–N ($P>0.374$), but lower CH_4 emissions were generally observed with increasing protection level. Slower turnover rate and lower protection level may serve to promote toxic effects of the algae on rumen microbes, as indicated by the observed onset of floating digesta mat instability, which may reflect reduced production of fermentation gases (CH_4 and CO_2).

Key Words: methane, microalgae, rumen

807 Comparing real-time PCR to purine analysis in regard to estimation of bacterial crude protein. E. Castillo-Lopez*, J. Miner, and P. Kononoff, *University of Nebraska*, *Lincoln*.

The objectives were to evaluate the estimation of rumen bacterial crude protein (BCP) based on two methods, real-time PCR (RTPCR) and purine analysis, and, secondly, to determine the impact of yeast on estimation of BCP. In the first trial, an *in vitro* fermentation was carried out. Treatments were I) Control: grass hay and corn, II) Added distillers dried grains (DDG) and III) Added DDG with added solubles (DDG+S). After 48 h of fermentation, the amount of BCP was estimated based on purine analysis and RTPCR. The RTPCR probe targeted DNA encoding the bacterial 16S rRNA to establish the ratio of bacterial DNA:BCP. Data were analyzed as a completely randomized design arranged in a 2X3 factorial. Estimates of BCP production were 0.383 and 0.285 ±0.013 g BCP/L of fermentation fluid based on purine analysis and RTPCR, respectively, and were different ($P < 0.01$). There was ($P < 0.01$) an effect of treatment on BCP production estimates, 0.39, 0.35 and 0.26 ±0.016 g BCP/L for the control, DDG, and DDG+S respectively. The method by treatment interaction tended to be different ($P = 0.06$). Specifically, BCP of the control was 0.41 and 0.38 ±0.023 g BCP/L for purine analysis and RTPCR respectively, and were not different ($P = 0.34$). The BCP estimated for DDG were 0.43 and 0.26 ±0.023 g BCP/L for purine analysis and RTPCR respectively, and were different ($P < 0.01$). The BCP estimated for DDG+S were 0.30 and 0.22 ±0.023 g BCP/L for purine analysis and RTPCR and were different ($P = 0.04$). In the second trial, bacteria were isolated from ruminal fluid from one steer and split into six samples. Yeast was added to three samples at one third of total DM, DNA was extracted from all samples, and BCP was estimated using RTPCR. Data were analyzed as a completely randomized design. Estimates for BCP were 0.29 and 0.27 ±0.013 g/L digesta for samples with and without yeast, respectively, and were not different ($P = 0.38$). Results suggest purine analysis may overestimate BCP due to the presence of yeast cells, while RTPCR is unaffected by the presence of yeast. Thus, RTPCR may be a more accurate method to measure BCP.

Key Words: bacterial crude protein, distillers grains, purine analysis

808 Evaluation of supplementation or controlled-release capsule (CRC) to supply *n*-alkane as an intake marker in steers fed switchgrass or alfalfa hay. S. Chavez*, C. Lane, M. Braxton, A. Bruner, E. Leonard, J. Burns, and G. Huntington, *North Carolina State University*, *Raleigh*.

The objective was to evaluate *n*-alkanes as intake markers provided either in supplement or CRC. Seven ruminally fistulated beef steers (BW = 422 ± 36 kg) were fed 1 kg of soyhulls supplement once daily and alfalfa (n =3) or switchgrass (n=4) twice daily (18 g/kg BW). Each steer received dotriacontane (C32) in supplement or intraruminal CRC in a balanced changeover of 16-d periods. Delivery from the CRC was periodically measured with calipers. Fecal grab samples and total feces were collected during the last 5 d of each period. Fecal grab samples were divided into aliquots that were freeze-dried (FD) or oven-dried (OD) to a constant weight at 60°C. Forage and fecal alkanes were saponified, extracted with heptane, and analyzed by gas chromatography. The two forages were used to evaluate different levels of forage hentriacontane (C31) to predict intake. Overall, predicted intake (6.21 ± 1.26 kg DM/d) did not differ ($P = 0.12$) from measured intake (5.88 ± 1.27 kg DM/d). Fecal C31 (1,037 ± 55 mg/kg DM) and C32 (141 ± 13 mg/kg DM) did not differ ($P < 0.26$) between OD and FD in alfalfa. Fecal C31 (124 ± 18 mg/kg DM) and C32 (112 ± 10 mg/kg DM) did not differ ($P < 0.75$) between OD and FD in switchgrass. Intake predicted by fecal grab samples (6.21 ± 0.34 kg DM/d) did not differ ($P < 0.89$) from intake predicted by 5-d total fecal collection (6.28 ± 0.34 kg DM/d). Intake predicted by supplementation (6.29 ± 0.34 kg DM/d) did not differ ($P < 0.82$) from intake predicted by measured release of C32 from the CRC (6.13 ± 0.34 kg DM/d). Measured CRC delivery was appreciably less than manufacturer's specifications. Use of manufacturer's specifications would increase predicted intake from 1.18 to 1.35 times among the steers. In conclusion, alkanes can be used as markers to predict intake by using fecal grab samples rather than collecting total feces. Hay intake can be predicted accurately with once daily alkane supplementation, and samples can be OD or FD with no difference in alkane concentrations.

Key Words: alkanes, intake, steer

Swine Species: Symposium: Environmental Concerns Based on Swine Production

809 Research and extension needs in air and water quality. D. J. Meisinger*, *US Pork Center of Excellence*, *Ames, IA*.

The US Pork Center of Excellence in cooperation with the National Pork Board′s Environmental Committee hosted two invitational workshops to develop research and extension needs, one for air quality and one for water quality. These workshops had perfect attendance of the invitation list with the result being an exhaustive set of research and outreach needs. The air quality group organized themselves into breakout groups by gases, odors, and particulate matter. The water quality group did the same with the topics of nutrients and sediments, pharmaceuticals and hormones, and pathogens. Each breakout group answered the following questions:

- Identify research that is underway or has already been completed.
- Identify what is known and can be developed into extension materials and programs.
- Identify what still needs to be answered by further research efforts.
- Work to form a consensus targeting future research investments and efforts.
- Work to identify opportunities for soliciting research funding from external sources.

The deliverables from these two meetings were as follows:

- Identification of producer materials that should be developed based on available research.
- A recommended priority list for development of producer educational and informational materials based on available research.

- Identification of research efforts needed to fill gaps in information.
- A recommended priority list for identified research needs.

A document comprised of all these results is available as an environmental quality research and extension needs publication. Another module on nutrient management is being developed.

Key Words: air quality, water quality, research & extension needs

810 Occupational and environmental concerns in swine production. K. Donham*, *University of Iowa, Iowa City*.

The term: Confined Animal Feeding Operation (CAFO) is used to describe animal feeding operations (AFOs) over a specified size that are a risk as a point source for water pollution, and therefore require regulation (US Environmental Protection Agency). In regard to water, air, and solid waste pollution, CAFOs have many of the same concerns as described for other agricultural operations. However, there are special concerns in regards to CAFOs because of the sheer size, the concentration of animals, feed, manure (usually handled in liquid form), dead animals, flies, and associated gases, particulates, odors and odorants, and infectious diseases all concentrated on a small land area. There are concerns that the manure cannot be recycled without pollution on such a small area, and that local and regional air and water quality suffers. Public concerns relative to adverse consequences of livestock production have been increasingly voiced since the late 1960s (Thu, 1998). Numerous regional, national and international conferences have been held on the subject since 1994 (Merchant, 2002, 2008; Thu, 1995). An in-depth review of the literature on the subject (Donham, 2000) will be updated. One reason large scale livestock production has raised concern is that it has separated from family farming and has developed like other industries in management, structure, and concentration. The magnitude of the problem cited by environmental groups has often been criticized by lack of science based evidence. Additional to general environmental concerns, occupational health of workers has become more relevant as many operations now are employing more than 10 employees, which brings many operations under the scrutiny of the Occupational Safety and Health Administration. In this presentation the scientific literature is reviewed relative to the science basis of occupational and environmental impacts on community and individual health. Further, recommendations are made to help promote sustainability of our livestock industry within the context of maintaining good stewardship of our environmental and human capital.

Key Words: swine, health, environment

811 The potential ability of swine nutrition to influence environmental factors positively. S. T. Petersen*, *Land O'Lakes Purina Feed LLC, Shoreview, MN*.

Environmental issues are a growing concern. Several of them can be categorized under the following headings; manure storage and handling, air quality, manure nutrient concentration and soil nutrient levels. Recently introduced, EcoCare feed is a dedicated and affordable feed program addressing manure management, ammonia emissions and nutrient excretion, while optimizing pig performance. Components in EcoCare feed reduce manure solids and viscosity resulting in improved physical uniformity of the manure that is easier to agitate and handle through equipment. Internal research trials have indicated a reduction of 14% in solids and 22% in viscosity over a 45 collection day period; these physical changes may have positive implications on manure pit pump-out and facility sanitation. EcoCare feed also has the potential to reduce ammonia emissions. This is achieved primarily by using crystalline amino acid inclusion, specific Bacillus bacteria and saponin-derived compounds. Emissions measured in a manure pit simulation trial, performed at LongView Animal Nutrition Center, demonstrated that pigs consuming EcoCare feed excreted manure with reduced ammonia volatilization by 18% over a 45 day period when compared to the control pigs. Over time, EcoCare feed may result in reduced production of ammonia by up to 40% in commercial situations. Nutrient manipulation of feeds can greatly reduce nutrient waste. For example, reduced nitrogen excretion can be achieved by incorporating crystalline amino acids, using specific feed additives can lower the volatilization of nitrogen-containing ammonia from manure pits and by using phytase, we can reduce inorganic phosphorus in the diet thus improving phosphorus digestibility. These types of formulation can be achieved without limiting swine growth performance. In fact, EcoCare feed has been shown to improve feed conversion rate by up to 4% over other standard feeds in field conditions. EcoCare is a registered trademark of Land O'Lakes Purina Feed LLC.

Key Words: swine, environment, nutrition

812 Potential of anaerobic digestion to address current environmental concerns on swine operations. D. I. Massé*, *Agriculture and Agri-Food Canada, Sherbrooke, Québec, Canada*.

Recently, there have been concerns raised about the potential impact of livestock production on natural resources. According to the FAO report, Livestock's Long Shadow, the rapidly growing and intensifying livestock sector contributes negatively to climate change and air pollution, soil and water degradation, and biodiversity depletion. The FAO report also indicates that the demand for animal food products is expected to double by 2050. This will further increase pressure on natural resources. These concerns are leading to a renewed interest in environmental biotechnologies that can minimize environmental impact and valorize livestock operations' by-products. An anaerobic digestion process called Psychrophilic Anaerobic Digestion (PAD) in Sequencing Batch Reactor (SBR) has been developed at Agriculture Canada. This very stable biotechnology recovers usable energy, stabilizes, deodorizes, and increases the availability of plant nutrients. Experimental results indicated that PAD of swine manure slurry at 15 – 25°C in an intermittently-fed SBR reduced the pollution potential of swine manure slurry by removing 84 to 93% of the soluble chemical oxygen demand (COD). The process performs well under intermittent feeding, once to three times a week, and without external mixing. Therefore, feeding activities could be integrated with the routine operation of manure removal from the barn, thereby minimizing interferences with other farm operations and allowing the use of existing manure handling equipment for feeding the bioreactors. The process stability was not affected by the antibiotics commonly used in livestock production. The anaerobic digestion process was also effective in eliminating populations of zoonotic pathogens and parasites present in raw livestock manure slurries. The biotechnology produces biogas at rates exceeding 0.20 L of CH4 per gram of soluble COD fed and the biogas produced is of high quality with a methane concentration ranging between 70 and 80%. The recovery of green energy and the production of a value added odorless fertilizer will substantially reduce the carbon footprint on products of animal origin.

Key Words: anaerobic digestion, swine manure

813 Fate and transport of zoonotic bacterial, viral, and parasitic pathogens during swine manure treatment, storage, and land application. C. Ziemer*[1], J. Bonner[2], Task Force Members for CAST Special Publication No. 29[2], D. Cole (Cochair)[3], and J. Vinjé (Cochair)[4], [1]*National Soil Tilth Lab ARS-USDA, Ames, IA*, [2]*Council for Agricultural Science and Technology, Ames, IA*, [3]*Georgia Division of Public Health, Atlanta, GA*, [4]*Centers for Disease Control and Prevention, Atlanta, GA*.

The public is always somewhat aware of foodborne and other zoonotic pathogens; however, recent illnesses traced to produce and the emergence of another avian influenza virus have increased the scrutiny on all areas of food production. The Council for Agricultural Science and Technology has recently published a comprehensive review of the fate and transport of zoonogic pathogens that can be associated with swine manure. The majority of microbes in swine manure are not zoonotic but a number of bacterial, viral and parasitic pathogens have been detected. Awareness of the potential zoonotic pathogens in swine manure and how treatment, storage and handling affect their survival and potential to persist in the environment is critical to ensure that producers and consumers are not at risk. This review will cover the primary zoonotic pathogens associated with swine manure; including bacteria, viruses and parasites; as well as their fate and transport. Because the ecology of microbes in swine waste is still poorly described, a number of recommendations for future research are made to better understand and reduce human health risks. These recommendations include examination of environmental and ecological conditions that contribute to off-farm transport and quantitative risk assessments.

Key Words: swine manure, zoonotic pathogens, manure handling