

**APPENDIX D**  
**SAES-422**  
**Format for Multistate Research Activity**  
**Accomplishments Report**

***Note:** This report is submitted each year of an activity's duration and is due 60 calendar days following the annual meeting. The SAES-422 is submitted electronically by AAs into NIMSS. Annual Reports for MRF projects are available to CRIS and CSREES through NIMSS.*

**Project/Activity Number:** NC1029

**Project/Activity Title:** Applied Animal Behavior and Welfare (NCR131)

**Period Covered:** Jan 2014 to Dec 2014

**Date of This Report:** Sept 8, 2015

**Annual Meeting Date(s):** Dec 17, 2014

**Participants:**

Siegford, Janice ([siegford@msu.edu](mailto:siegford@msu.edu)) – Michigan State;

Johnson, Anna ([johnsona@iastate.edu](mailto:johnsona@iastate.edu)) – Iowa State;

Calvo-Lorenzo, Michelle ([michelle.calvo\\_lorenzo@okstate.edu](mailto:michelle.calvo_lorenzo@okstate.edu)) – Oklahoma State;

Wickens, Carissa ([cwickens@ufl.edu](mailto:cwickens@ufl.edu)) – University of Florida;

Croney, Candace ([ccroney@purdue.edu](mailto:ccroney@purdue.edu)) – Purdue University;

Minton, Ernie ([eminton@ksu.edu](mailto:eminton@ksu.edu)) – Kansas State;

Johnson, Peter ([pjohnson@nifa.usda.gov](mailto:pjohnson@nifa.usda.gov)) – USDA;

Mench, Joy ([jamench@ucdavis.edu](mailto:jamench@ucdavis.edu)) – University of California, Davis;

Green, Angela ([angelag@illinois.edu](mailto:angelag@illinois.edu)) – University of Illinois;

Endres, Marcia ([miendres@umn.edu](mailto:miendres@umn.edu)) – University of Minnesota;

**Brief summary of minutes of annual meeting:**

1pm: Opening & Welcome by Janice Siegford

1:10-2:30pm: Station reports

1:10pm: Anna Johnson, Iowa State (done)

1:30pm: Michelle Calvo-Lorenzo, Oklahoma State University (done)

1:50pm: Carissa Wickens, University of Florida (done)

2:10pm: Candace Croney & Maja Makagon, Purdue University (done)

2:30-2:55 pm: Q&A & Ernie Minton

Peter Johnson

NIFA RFA call is likely to come out at end of December or beginning of January (has been for release for a while but waiting for farm bill update)

No letters of intent for foundational RFA. Means less time between RFA and due

date of full proposal. Deadline could be as early as sometime in March.

Two new areas for RFA foundational in past year

CARE = critical ag research and extension for projects nearing implementation and need funds to bring to producers, up to \$150K to take new or revised information to producers. Must involve stakeholders and have short- to mid-term outcomes.

Exploratory (high risk, high impact up to \$100K to help with preliminary data.) Open deadline throughout year after RFA. Has a letter of intent and then a short proposal.

31 AW proposals submitted and 3 awards made (10% success rate, which is a smidge higher than animal health), with a maximum of \$500K.

1-2 proposals funded in that area

BBSRC + USDA partnership for upcoming funding cycle for animal welfare

BBSRC does respond to their community—so if their researchers ask for it, it may be more likely to happen

Could we start an informal UK connection via some sharing at NC1029 meeting?

Janice mentioned ISAE in 2016 in Edinburgh

Ernie Minton

Discuss the upcoming year, which will involve a rewrite of the NC1029 in the fall. Cass has volunteered to coordinate the rewrite effort. Please think about possible objectives for NC1029 that would better encompass your work if the current objectives don't suit your line of research.

September 15: Deadline to submit a request to write a proposal in NIMSS and upload the Issues and Justifications section.

Each project MUST select an Administrative Advisor prior to submitting a proposal request. Without an AA, the request will not be approved. The NCRA office can no longer assign AAs to projects.

Effective 2014, all NC projects will retain the same number designation, unless otherwise requested. Please let the NCRA office know by September 15 if you would like a new number.

October 15: Deadline to upload the Objectives section in NIMSS. Please contact the NCRA office when this is complete and we will send out the national request for participation.

November 15: All participants and their AES offices should have submitted completed Appendix E forms into NIMSS.

December 1: Completed proposal is due in NIMSS in its entirety. Failure to meet this deadline may result in the project not being reviewed and renewed this round.

December 15: AA review forms due in NIMSS.

Mid-late December: All proposals are sent to NC regional review committees (NCACs) and multistate research committee (MRC)

Late March/Early April: Final project reviews and decisions made at the NCRA Spring meeting. The NCRA office will notify project AAs of results and send any requested revisions to project AAs by mid-April.

Cass has volunteered to lead the rewrite effort

Next year's meeting: could we make it face to face at a meeting many of us may already be going to.

Candace & Cass will co-host next year as chairs

2:55pm-4:00pm: Station reports

2:55pm: Joy Mench, UC Davis (done)

3:10pm: Angela Green, University of Illinois (done)

3:20pm: Janice Siegford, Michigan State University (done)

3:30pm: Marcia Endres, University of Minnesota (done)

3:50-4:00pm

Reminder to send station reports using template provided by Chris Hamilton.

**Election of NC1029 officers for 2015 to be conducted via email**

Chair (typically the secretary moves to this position):

Candace & Cass could be jointly nominated for this position

Secretary:

Please let Ernie, Candace, Cass or I know if you are interested in being secretary next year.

Additional business: None

Close of meeting

**Accomplishments:**

At Michigan State University J. Siegford and J. Swanson are analyzing data from commercial scale project involving housing of laying hens (together with colleagues from UC Davis) and have published results from a 2009 USDA AFRI grant related to using a wireless body-mounted sensor to monitor behavior and resource use in laying hens. Both projects will help understand the impact of housing systems on laying hen welfare to the benefit of laying hens and producers.

C. Heleski's work on assessing the welfare of horses and donkeys and developing codes of practice will lead to improved methods of assessing welfare of these animals, particularly in areas where they are used as working animals.

The University of Florida in collaboration with University of Delaware conducted a pilot study to test horses' aversion to different  $\text{NH}_3$  concentrations (0 vs. 25 ppm ammonia). Adult horses were used in 10-minute feeding trials utilizing the newly developed head box system in which an equal amount of concentrate feed was offered in both head boxes. During each trial, initial head box selection, feed consumption, time spent feeding, and heart rate (HR) were recorded. Trials were video recorded to note responses and derive behavioral measures that may serve as indicators of aversion. Horses appeared to avoid feeding from the head box containing 25 ppm ammonia compared to 0 ppm ammonia. Specifically, horses spent a greater amount of time feeding from and consumed more feed from the box containing ammonia free air.

University of Florida has been contributing to the development of an online equine behavior and welfare learning lesson that will be made available through eXtension Horses. The lesson is projected to be available spring of 2015. The University of Florida has also been building course content in the area of animal welfare and animal behavior for both the graduate and undergraduate program.

The majority of Dr. Makagon's (Purdue University) contributions relate to NC1029 Objective 1 (Development *and evaluation*) of novel animal behavior measurement techniques to assess where on-farm welfare challenges may exist and to develop alternative management strategies to solve these challenges). Research was completed pertaining to the on-farm assessment of turkey welfare, and evaluation of a 3-point gait scoring system for assessing the walking abilities of Pekin ducks.

Texas A&M quantified the impact of LED lighting during incubation of layers and broilers. Data was collected looking at many factors including: timing of lighting, type of white light, and red light. LED lighting in broiler eggs has consistently shown an increase of 2-4% in hatch and a substantial improvement in chick quality. Furthermore, lighted incubation has shown improvement in lowering stress and fear in birds post-hatch.

Texas A&M has also worked to investigate the impacts of different types of lighting on broilers and layers. Data looking at comparing types of lighting as well as different types of bulbs with a lighting type have been conducted. LED lighting has been shown to improve production in both layers and broilers while also lowering stress and fear when compared to CFL and incandescent lighting.

Oklahoma State University evaluated the effects of growth-promoting technologies (i.e. antimicrobials, antibiotics, growth-promoting implants, beta-adrenergic agonists) typically used in conventionally raised beef cattle to determine how modern technologies affect cattle behavior and health when compared to cattle raised in an all-natural system (i.e. no growth-promoting technologies administered to cattle). Cattle were evaluated individually and as groups for a wide variety of behaviors. Cattle health records and blood samples were collected to monitor the overall health status of cattle. There were no negative impacts of technologies on cattle disposition, activity, condition of mobility, or health.

Oklahoma State University is also completing the evaluation of behavioral and physiological indicators of pain and distress in young male pigs when ethyl alcohol was tested as a new form of pain relief for castration. Prior to castration, ethyl alcohol was injected directly into each testicle of male pigs to compare its possible pain-alleviating effects to known anesthetics like Lidocaine. Preliminary data demonstrates that the potential of using ethyl alcohol as a form of pain alleviation may extend beyond its possible analgesic properties. Pilot study findings suggest that ethyl alcohol may disrupt testicular development, indicating that injecting ethyl alcohol may chemically sterilize young male pigs. However, further analyses are needed to confirm these results and determine ethyl alcohol's role in alleviating pain as an analgesic and/or possibly sterilizing pigs via injection.

Understanding how cattle respond to man-made flooring surfaces is an important component of their welfare, as they spend more than half of their time standing. University of California tested surface electromyography (EMG) as an indicator of cow comfort in response to flooring. EMGs provide unique information about cattle muscle contractions and these increase the longer dairy cattle stand. However, EMGs do not differ during short-term standing bouts (e.g. length of a

feeding bout) on a range of flooring types and conditions.

As welfare assessments and audits become more common, it is important to understand the sample size and approach required to accurately describe conditions on commercial farms. University of California Davis conducted 2 experiments to assess either the number of cows required or the frequency of sampling needed to accurately describe the overall welfare of the animals and their heat stress status, respectively. They found that common recommendations (e.g. Welfare Quality and the Farmer's Assuring Responsible Management) about sample size are likely insufficient to describe accurately all welfare parameters, including hind leg injuries and lameness. In contrast, they found that relatively infrequent (every 1 h or less often) measures are needed to measure dairy cattle responses to hot weather. In addition, University of California Davis used the Welfare Quality Protocol to assess the welfare of laying hens at different ages: 1) in three different housing systems (conventional cages, enriched colony system, aviary) on a commercial farm and 2) in multiple cage-free organic and non-organic commercial flocks in California and Iowa (in conjunction with Iowa State University). These assessments suggested that changes in hen health and physical parameters could be reliably evaluated over the life of the flock, and pinpointed critical periods for particular flock issues. However, it was questionable whether some measures (e.g. comb abnormalities) really assessed significant welfare problems, and other measures (particularly fear testing) were found to be too influenced by factors that were not relevant to welfare (e.g. test conditions) to be considered valid tools for assessment.

### **Impacts:**

Hens housed in groups in single tier floor pens show individual patterns of space use that change over time. Michigan State University, domestic hens were tracked using a combination of body worn sensors and video recordings of their behavior and data analyzed with an approach common in studies of free-ranging wildlife by using Geographic Information Systems (GIS). Hens show individual ranges and preferences for location, and, as the hens age, these change. Hens housed in commercial multi-tiered aviaries display circadian patterns of movement between the open litter areas on the floor and the tiered enclosure where food and water are located. Hens move down to the floor in the morning when the doors to the litter open and are seen using the litter for dust bathing in the greatest numbers during the early afternoon. Hens move gradually back into the litter during the evening hours and can be found roosting in the largest numbers in the upper tier of the aviary following lights off. Hens do not use the lower perches for roosting at night to a great extent but instead crowd the upper perch, ledge and mesh floor area, suggesting that height from the ground is important.

With the human population growing globally, the number of horses housed in confinement continues to increase. As a result, concerns over air quality for horses and their caretakers are also on the rise. The research conducted at the University of Florida comprises a necessary first step in determining the impact of ammonia emissions on the behavior and well

-being of horse

The findings should build a foundation for future investigation of management solutions that can mitigate the negative impacts of ammonia and other greenhouse gas emissions on the health of humans, animals, and the environment.

Program evaluations received from the 2014 University of Florida/Institute of Food and Agricultural Sciences (UF/IFAS) Florida Equine Institute and the UF/IFAS Lake County Equine Lecture Series indicated that attendees valued the information presented on the topics of equine

behavior, learning/training, and welfare. Florida Equine Institute attendees (50%) indicated they plan to implement what they learned about horse-handler interactions and horse behavior and training in order to improve the management of horses at their farms/facilities.

Concerns over the well-being of commercial poultry and its economic impacts have contributed to a rise in the development and implementation of well-being assessment programs. For such programs to be effective it is important that they are science-based, reliable and efficient, so that results can be compared across time and between farms. Purdue University evaluated welfare assessment tools with impacts for the turkey and duck industries.

Despite the large size of the U.S. turkey industry, research pertaining to turkey well-being assessment has been sparse. In collaboration with researchers from Spain (Dr. Inma Estevez and Joanna Marchewka) and Italy (Dr. Valentina Ferrante), Purdue University compared two on-farm welfare assessment methods. Results were additionally compared to output measures obtained at the slaughter facility. The results indicate that the transect walk-through method, developed by Dr. Inma Estevez' and colleagues, shows promise as a reliable, non-invasive and practical tool for the on-farm assessment of turkey welfare.

Walking problems pose an important welfare concern in meat poultry production, including commercial duck production, and may pose a significant economic cost. Although mobility issues have been investigated broadly in turkeys and broiler chickens, for example, within the framework of environmental effects, behavioral time budgets, the presence or absence of pain, and physiological and pathological correlates, the information gained does not account for physiological differences between these poultry species and ducks. The results of this previous work, therefore, cannot be simply extrapolated to ducks. Along with researchers from Michigan State University (Dr. Darrin Karcher, Dr. "Mick" Fulton) and Purdue University (Dr. Russell Main), we are conducting a series of studies to evaluate how gait score categories relate to quantitative measures of walking abilities of ducks.

Studies at Texas A&M looking into incubation lighting conditions have demonstrated an increase in hatch of 2-4%. The use of this technology can result in improvements of revenue in the millions for the poultry industry. Furthermore, the improved chick quality and stress responsiveness observed will improve the welfare of the birds.

The lighting studies conducted at Texas A&M will allow the industry to make improvements to production and welfare of the birds. Increases in feed conversion with new technology will lead to more efficient egg and meat production. While at the same time the birds will be less stressed and less fearful during production.

Cattle health and behavior studies at Oklahoma State University have evaluated the welfare impacts of growth-promoting technologies in the beef industry. A novel scoring system of cattle mobility was tested and new information about cattle well-being and modern technologies in beef production have been determined. Research indicates there were no negative impacts of technologies on cattle disposition, activity, condition of mobility, or health. Adopting the new mobility scoring system may help determine if other factors (i.e. varying transportation duration, weather conditions, cattle genetics, handling conditions, etc.) in combination with the use of modern technologies may alter the health, behavior and well-being of cattle.

The practice of castration without pain relief is known to cause pain and distress, and new tools are needed to improve pain management programs for common husbandry practices in animal agriculture. Neonatal pig behavior and well-being research at Oklahoma State University is

focused on developing novel strategies for improving the pain and distress of young pigs during castration. Once completed, the results of this work will contribute to the scientific literature and educational materials used by the swine industry to provide potential solutions that optimize pig welfare and practical pain management protocols.

## **Publications:**

### *Book Chapters*

Houpt, K.A. and C.L. Wickens. 2014. Handling and transport of horses. In: *Livestock handling and transport*. Fourth Edition. T. Grandin (ed.) CABI, UK. pp. 315-341.

### *Refereed Journal Articles*

Archer, G.S. and J.A. Mench. 2013. The Effects of Light Stimulation During Incubation on Indicators of Stress Susceptibility in Broilers. *Poultry Science*. 92:3103–3108.

Archer, G.S. and J.A. Mench. 2014. Natural incubation patterns and the effects of exposing eggs to light at various times during incubation on post-hatch fear and stress responses in chickens. *Applied Animal Behavior Science*. 152:44-51.

Archer, G.S. and J.A. Mench. 2014. The Impact of Light During Incubation on the Productivity, Plasma Melatonin Concentrations, and Behavior of Broiler Chickens: Duration and Onset. *J. Animal Science*. 92(2): 1753-1758.

Banerjee, D., C.L. Daigle, B. Dong, K. Wurtz, R.C. Newberry, J. Siegford, and S. Biswas S. 2014. Detection of jumping and landing force in laying hens using wireless wearable sensors. *Poult. Sci*. 93:1-10.

Daigle, C.L., D. Banerjee, R.A. Montgomery, S.K. Biswas, and J.M. Siegford. 2014. Moving GIS indoors: spatiotemporal analysis of agricultural animals. *PLOS One* 9(e104002):1-11.

Daigle, C.L., and J. M. Siegford. 2014. When continuous observations just won't do: developing accurate and efficient sampling strategies for the laying hen. *Behav. Proc*. 103:58-66.

Endres, M.I., K.M. Lobeck-Luchterhand, L.A. Espejo, and C.B. Tucker. 2014. Evaluation of the sample needed to accurately estimate outcome-based measurements of dairy welfare on farm. *J. Dairy Sci*. 97:3523-3530.

Erasmus, M. A. and J. C. Swanson. 2014. Temperamental turkeys: reliability of behavioural responses to four tests of fear. *Appl. Anim. Behav. Sci*. 157:100-108.

Heleski, C., C. Wickens, M. Minero, E. DallaCosta, C. Wu, E. Czeszak, and U. Koenig von Borstel. 2014. Do soothing vocal cues enhance horses' ability to learn a frightening task? *Journal of Veterinary Behavior: Clinical Applications and Research*. In Press (doi: 10.1016/j.jveb.2014.08.009).

Holcomb, K.E., C.B. Tucker, and C.L. Stull. 2014. Preference of domestic horses for shade in a hot, sunny environment. *J. Anim. Sci*. 92:1708-1717.

Lyles, J.L. and M.S. Calvo-Lorenzo. 2014. Practical developments in managing animal welfare in beef cattle. What does the future hold? *J. Anim. Sci*. 92(12): 5334-5344.

- Marchewka, J., I. Estevez, V. Ferrante, G. Vezzoli, and M.M. Makagon. In press. The transect method: a novel approach to on-farm welfare assessment of commercial turkeys. *Poult. Sci.*
- Mintline, E.M., A. Varga, J. Banuelos, K.A. Walker, B. Hoar, D. Drake, D.M. Weary, J.F. Coetzee, M.L. Stock, and C.B. Tucker. 2014. Healing of surgical castration wounds: a description and an evaluation of flunixin. *J. Anim. Sci.* 92:5659-5665.
- Newby, N.C., C.B. Tucker, D.L. Pearl, S.J. LeBlanc, K.E. Leslie, M.A.G. von Keyserlingk, and T.F. Duffield. 2014. An investigation of ketoprofen following rumen fistulation surgery in lactating dairy cows. *Can. Vet. J.* 55:442-448.
- Rajapaksha, E. and C.B. Tucker. 2014. How do cattle respond to sloped floors? An investigation using behavior and electromyograms. *J. Dairy Sci.* 97:2808-2815.
- Rajapaksha, E. and C.B. Tucker. In press. Restless behavior and muscle activity of dairy cows on rough standing surfaces presented under 1 or 4 legs. *J. Dairy Sci.*
- Rajapaksha, E., C. Winckler, and C.B. Tucker. In press. Effect of rubber flooring on dairy cattle stepping behavior and muscle activity *J. Dairy Sci.*
- Schütz, K.E., N.R. Cox, and C.B. Tucker. 2014. A field study of the behavioral and physiological effects of varying amounts of shade for lactating cows at pasture. *J. Dairy Sci.* 97:3599-3605.
- Stackhouse-Lawson, K.R., C.B. Tucker, M.S. Calvo-Lorenzo, and F.M. Mitloehner. In press. Effects of growth-promoting technology on feedlot cattle behavior in the 21 days before slaughter. *Appl. Anim. Behav. Sci.*
- Tucker, C.B., E.M. Mintline, J. Banuelos, K.A. Walker, B. Hoar, D. Drake, and D.M. Weary. 2014. Effect of a cooling gel on pain sensitivity and healing of hot-iron cattle brands. *J. Anim. Sci.* 92:5666-5673.
- Tucker, C.B., E.M. Mintline, J. Banuelos, K.A. Walker, B. Hoar, A. Varga, D. Drake, and D.M. Weary. 2014. Pain sensitivity and healing of hot-iron cattle brands. *J. Anim. Sci.* 92:5674-5682.

#### *Poster Presentations*

- Archer, G.S. (2014). Comparing the effect of different types of lighting on broiler production, fear, and stress. 2014 Poultry Science Association Annual Meeting, Corpus Christi, Tx.
- Badr A.A., M.Y. Matoock, and C.R. Heleski. 2014. Are mules or donkeys better adapted for Egyptian brick kiln work? (Until we can change the kilns). Proceedings of the 12th ISAE North American Regional Meeting, East Lansing, MI. May 30-31. pp. 60.
- Byrd, C. J. and M.M. Makagon. 2014. We're all in this together: A multi-species look at lameness assessment. Proceedings of the 12<sup>th</sup> North American Regional meeting of the International Society for Applied Ethology (NA-ISAE), pg. 43. (Poster presentation)
- Chen, J.M., K.E. Schütz, and C.B. Tucker. 2014. Sprinkler flow rate affects dairy cattle physiological and behavioral responses. 7th American Dairy Science Association Discover Conference, Itasca, IL.
- Domingue, A.G. and G.S. Archer. (2014). The effect of exposing chicken embryos to warm- or cool-spectrum light-emitting diode (LED) light during incubation on hatchability, embryo mortality, 14-d growth and FCR, fear and physical asymmetry. 2014 Poultry Science Association Annual Meeting, Corpus



Christi, Tx.

- Dorey, S.L., D.L.M. Campbell, and J.M. Siegford. 2014. Which is the best chicken shampoo? Preferred dust bathing substrates for aviary-housed laying hens. Proceedings of the 12th ISAE North American Regional Meeting, East Lansing, MI. May 30-31. pp. 56.
- Gallegos, K. and G.S. Archer. (2014). Comparison of the effect of light-emitting diode (LED) versus compact fluorescent lamp (CFL) lighting on hen production, egg quality, fear, and stress. 2014 Poultry Science Association Annual Meeting, Corpus Christi, Tx.
- Greene, B., C. Wickens, C. Heleski, and C. Brady. 2014. Assessing the Impact and Viewpoints of Attendees of the 2013 International Society for Equitation Science Conference. Proceedings of the 10<sup>th</sup> International Society for Equitation Science Conference, August 6-9, Vejle, Denmark, P. 84.
- Huth, J.H. and G.S. Archer. (2014). The effect of exposing chicken embryos to light-emitting diode (LED) light during incubation: Layer and broiler eggs. 2014 Poultry Science Association Annual Meeting, Corpus Christi, Tx.
- Mintline, E.M., A. Varga, J. Banuelos, K.A. Walker, B. Hoar, D. Drake, D.M. Weary, J.F. Coetzee, M.L. Stock, and C.B. Tucker. 2014. Healing of surgical castration wounds: a description and an evaluation of flunixin. 4th International Symposium on Beef Cattle Welfare, Ames, IA.
- Rocha, B. and G.S. Archer. (2014). Comparing the use of bird-level versus room illumination on broiler production, fear, and stress. 2014 Poultry Science Association Annual Meeting, Corpus Christi, Tx.
- Simon, G., B. Hoar, and C.B. Tucker. 2014. Assessing cow-calf or suckler cow herd welfare: a pilot study on 10 California ranches. 6th Welfare Assessment at the Farm and Group Level, Clermont-Ferrand, France.
- Stackhouse-Lawson, K. C.B. Tucker, M. Calvo-Lorenzo, and F.M. Mitloehner. 2014. Effects of growth-promoting technology on feedlot cattle behavior in the 21 days before slaughter. 4th International Symposium on Beef Cattle Welfare, Ames, IA.
- Toaff-Rosenstein, R.L., L.J. Gershwin, A.J. Zanella, and C.B. Tucker. 2014. The sickness response in Bovine Respiratory Disease at peak clinical illness. 48<sup>th</sup> International Society for Applied Ethology, Vitoria-Gasteiz, Spain.
- Tresoldi, G., K.E. Schütz, and C.B. Tucker. 2014. Heat abatement on commercial dry lots: managing resources to improve cattle welfare. 27th American Dairy Science Association Discover Conference, Itasca, IL.
- Tresoldi, G., K.E. Schütz, and C.B. Tucker. 2014. Heat abatement on commercial dry lots: managing resources to improve cattle welfare. 12th North American Regional Meeting of the International Society for Applied Ethology, East Lansing, MI.
- Tucker, C.B., E.M. Mintline, J. Banuelos, K.A. Walker, B. Hoar, A. Varga, D. Drake, and D.M. Weary, DM. 2014. Pain sensitivity and healing of hot-iron cattle brands. 4<sup>th</sup> International Symposium on Beef Cattle Welfare, Ames, IA.
- Weir, J., H. Li, C. Zhang, and C. Wickens. 2014. A Preliminary Investigation of Horses' Preference for Different Ammonia Concentrations. Proceedings of the 10th International Society for Equitation Science Conference, August 6-9, Vejle, Denmark, P. 52.
- Weir, J., C. Zhang, H. Li, and C. Wickens. 2014. Development of an Ammonia Preference Head Box System for Horses. Proceedings of the American Society of Agricultural

and Biological Engineers Annual International Meeting, July 13-16, Montreal, Quebec, Canada.

Wurtz, K.E., J.P. Steibel, R.O. Bates, C.W. Ernst, and J.M. Siegford. 2014. Using behavioral and genomic tools to identify pigs suited for group living. Proceedings of the 12th ISAE North American Regional Meeting, East Lansing, MI. May 30-31. pp. 62.

*Popular Articles*

Chen, J and C. Tucker. 2014. Soaker nozzle type affects water use, but not cow cooling. California Dairy Newsletter, 6(3).

Chen, J.M., G. Tresoldi, and C.B. Tucker. 2014. Are your cows hot? Hoard's Dairymen, July: 447.

**Authorization:** Submission by an AES or CES director or administrative advisor through NIMSS constitutes signature authority for this information.

\*Limited to three pages or less exclusive of publications, details may be appended.

