



# UMASH

Upper Midwest  
Agricultural Safety  
and Health Center

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*A collaboration of the University of Minnesota School of Public Health and College of Veterinary Medicine, the National Farm Medicine Center of the Marshfield Clinic with the Migrant's Clinicians Network, and the Minnesota Department of Health.*

Summary Annual Report

2015

NIOSH Center of Excellence in Agricultural  
Disease and Injury Research, Education, and Prevention  
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## SECTION I

### Center Summary:

The Upper Midwest Agricultural Safety and Health Center (UMASH) is a Center of Excellence in Agricultural Disease and Injury Research, Education, and Prevention funded by the National Institute for Occupational Safety and Health (NIOSH). The center is a collaboration of the **University of Minnesota School of Public Health** and **College of Veterinary Medicine**, the **National Farm Medicine Center of the Marshfield Clinic** with the **Migrant Clinicians Network**, and the **Minnesota Department of Health**. This collaboration brings together unique and complimentary expertise to address existing and emerging occupational health and safety issues in agriculture.

A central theme for UMASH is **the interrelationship between the production practices and the farm workplace health and safety conditions**. Production practices are primarily driven by social, economic and animal health considerations. In the agriculture, workplace health and safety conditions are strongly influenced by these production practices.



The UMASH emphasizes the concept of **One Health** which focuses on the interdependence between animal health, human health, and the health of the environment. The UMASH also emphasizes the importance of maintaining vigilance over how changes in agriculture production can influence the health and well-being of agricultural populations.

The UMASH center has seven currently **funded projects**: health and safety in the pork production industry, methicillin-resistant *Staphylococcus aureus* (MRSA) colonization and infection in swine veterinarians, surveillance of disease and injury in dairy farmers, surveillance of zoonotic diseases in agriculture workers, immigrant dairy worker health and safety, facilitating return to work of ill and injured workers, and establishing a multidisciplinary network to address agriculture worker health and safety issues. The center also has an **outreach** component to disseminate and collect information from stakeholders; a **pilot projects program** to foster new partnerships, explore new opportunities and address emerging issues in the field of agricultural safety and health; and an **evaluation** program to monitor and assess the performance and outcomes of the center.

### Relevance:

The agriculture industry is challenged with responding to an increasing global demand for a safe and plentiful food supply that is both affordable and produced in a sustainable manner. To meet this demand the industry will develop novel approaches to producing food. The changes accompanying food production will also impact the people who produce the food. The complex and varied nature of the agricultural workplace contributes to agriculture being one of the most hazardous occupations. As agriculture evolves to meet increasing global food demand, the occupational health risks encountered by the agricultural work



force will evolve with some hazards being eliminated and others emerging. The changing face of agriculture will also change who is producing food. Small farms may give way to larger enterprises that hire the majority of their labor force; including many who have no background in agriculture. Understanding and managing these changes is essential to protecting the health of agriculture workers and their families.

The Upper Midwest Agricultural Safety and Health Center (UMASH) conducts research, education and prevention activities aimed at improving the health and safety of workers and their families. The UMASH investigates how this evolving industry is changing the risks agricultural populations face. It develops improved methods to identify and reduce risks and it explores how best to interact with producers, agricultural workers and their families, and the broader agricultural community.

**Key Personnel:**

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**Ag Center web link:** [umash.umn.edu](http://umash.umn.edu)

## SECTION II

### Program highlights

### Research Projects:

#### Surveillance for Zoonotic Diseases in Agricultural Workers in Minnesota

Agriculture is a large part of Minnesota's economy, supporting more than 340,000 people through food animal production and processing support services. Zoonotic diseases (diseases that can be passed between animals and people) are a risk to agricultural workers, their families, and others exposed to food animals. However, little information is available describing specific risk factors on the farm for developing a zoonotic disease and how frequently agricultural workers and their families get sick from food animals. The UMASH project at the Minnesota Department of Health (MDH) focuses on describing the size of this problem in agricultural populations, which can be used to develop more effective prevention measures to minimize the occurrence of zoonotic diseases



Diarrheal illnesses such as *Cryptosporidium*, *E. coli* O157:H7, *Campylobacter*, *Salmonella* are reportable to MDH, and all ill people are interviewed with a routine questionnaire that includes questions about agricultural exposures (living, working, or visiting a farm, petting zoo, fair, or other venue with animals). Since January 2012, patients with agricultural exposure have been re-interviewed with a more detailed questionnaire about the types of activities they were doing with the animals. Based on these interviews, 51% of patients with a *Cryptosporidium parvum* infection, 25% of patients with an *E. coli* O157:H7 infection, 26% of patients with a *Campylobacter* infection, and 13% of patients with a *Salmonella* infection had a food animal exposure in the week before their illness. For all but *Salmonella*, the percentages of ill people with food animal contact are much higher than previously reported estimates; (*Cryptosporidium* 16%, *E. coli* O157:H7 6%, *Campylobacter* 17%, and *Salmonella* 11%). MDH offers educational materials to these patients, and 57% of them were interested in receiving the materials. In addition to collecting data on recent zoonotic infections, MDH has offered four, free full-day workshops to people associated with county fairs and two free evening workshops to people with agritourism operations (apple orchards, pumpkin patches, corn mazes, etc.) on how to have safe human-animal interactions. These workshops have been well-attended and well-received, and we plan on continuing them on a yearly basis.

This past summer we had two outbreaks of *E. coli* O157 associated with different county fairs. MDH has been working closely with the fair board presidents and will be providing onsite consultations for the fairs to discuss measures that can be implemented for next fair season in order to prevent future outbreaks from happening.



## **MRSA Colonization and Infection in Swine Veterinarians**

Public health concern about the emergence of methicillin resistant *Staphylococcal aureus* (MRSA) in livestock, particularly pigs, is increasing. However, there is limited scientific information on the importance of livestock associated MRSA in human populations. The overall objective of this study is to analyze long-term patterns of *S. aureus* colonization (both methicillin resistant (MRSA) and methicillin susceptible (MSSA) strains) and infection of swine veterinarians. Concurrently, a survey of occupational hazards for US swine veterinarians and current practices for risk reduction is being conducted to assess current practices in relation to existing recommendations and guide educational efforts to promote better practices for veterinarians and other groups who are occupationally exposed to animals. The project will terminate in September 2014, and is in the final stages of analysis and reporting.

A study cohort of 68 swine veterinarians across 15 states was recruited to participate in a longitudinal study to determine the incidence and prevalence of nasal colonization of MRSA and MSSA. Compliance with sampling was outstanding (over 98%) yielding 1768 *S. aureus* isolates (including 207 MRSA. Monthly prevalence of *S.aureus* (58.3% to 82.4%) and MRSA (5.9% to 15.2%) exceeded US population estimates, and the predominant variants (MLST sequence type/spa type) detected were ST398/t034, ST5/t002 and ST9/t337 which similarly predominate among US pigs, suggesting that they are commonly contaminated with *S. aureus* from the swine population. The prevalence of MRSA was much lower than an estimate of 44% reported in a similar Dutch study, and remained relatively stable throughout the study. Most veterinarians are intermittently and transiently colonized, but a substantial minority (about 20%) appear to be persistently colonized. Furthermore, the data indicate that the nasal staphylococcal flora of swine veterinarians are predominantly of animal origin. A broader online survey of occupational health in swine veterinarians to determine the occurrence of occupationally related health events yielded 180 responses which are currently being analyzed to assess the personal protection practices of US swine veterinarians. This will include analysis of associations between risks of colonization/infection of swine veterinarians with MRSA/MSSA, exposure to pigs and the use of personal protective equipment.

## **Occupational Hazards in Pork Production Associated with Production Practices**

The methods for raising pigs continue to evolve with a greater proportion being raised in high-density confinement facilities. Working in these facilities is not without hazards and exposure to airborne contaminants, including hydrogen sulfide, ammonia, endotoxin, and particulate matter, is common. At sufficient concentrations these contaminants can affect the respiratory system. As pork production practices change to meet the animal health, economic, and societal concerns it is likely the potential exposures to workers will also change. One of the aims of this project is to compare air contaminants in facilities that use different rearing methods and characterize the seasonal influence on exposures. We studied a facility over the course of a year that has parallel systems that keep gestation crates or gestation pens and finishing barns with feed delivery systems for both wet and dry feed. We were able to characterize the potential



air contaminant exposure risks to ammonia, hydrogen sulfide, carbon dioxide, heat, endotoxin and respirable dust. Subsequent to the year-long study, we have focused on characterizing exposures to ammonia, hydrogen sulfide, endotoxin and respirable dust during power washing of farrowing and gestation rooms.

The greatest influences on worker exposure are season and location within the facility. The ventilation requirements needed to keep sows and finishing pigs cool in the summer also act to reduce air contaminant exposures to very low levels. In the cooler months concentrations of all contaminants rise and may be ten-fold higher than in the summer months. In this facility, concentrations of measured air contaminants are greater in the gestation room with pens than in the room with gestation crates, with varying levels of statistical significance. In addition, contaminant levels in areas of the facility where pigs are not present are considerably lower than those where they are. While contaminant concentrations are below regulatory limits throughout the facility, the potential health effects of being exposed simultaneously to three respiratory irritants, ammonia, hydrogen sulfide, and endotoxin, are not well known. In the process of conducting the systematic measurements throughout the facility, a substantial spike in hydrogen sulfide and endotoxin levels was noted during power washing in the room with gestation crates. The spike may have been the result of the power-washing displacing hydrogen sulfide from the manure collection pit. Subsequent tests during regular power washing of farrowing stalls between litters indicate that hydrogen sulfide and endotoxin concentrations are always elevated while ammonia and respirable dust are not. The endotoxin levels are of particular concern relative to proposed guidelines. In the finishing barns where feed was delivered in a wet slurry, the level of endotoxin was substantially lower, although the concentration of respirable dust was similar. Heat is another factor with a potential impact on the workers. On hot and humid summer days the temperature in the facility can be stressful to the workers and animals alike. Being aware of the risk of heat related illness, i.e. heat exhaustion and heat stroke, and methods to control that risk is important. The results of this study to date are now being communicated to producers to create more dialogue about understanding and controlling exposures in these facilities.

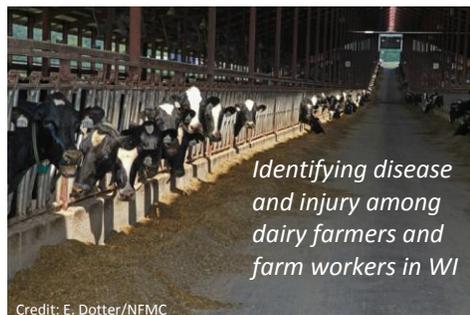


This project is also exploring injury risk associated with pork production. A challenge for reducing the burden of injury in the industry is the lack of comprehensive data for guiding prevention efforts. Data with sufficient detail to identify prevention measures are not routinely or uniformly collected. To better characterize injury burden in the industry and to make recommendations for injury data collection we have partnered with the National Pork Board to engage companies that collect injury data in various forms. These varying data resources are being used to describe injury and illness occurrence in the industry in more detail and to also explore mechanisms to improve injury surveillance in the future.

## Surveillance of Disease and Injury in Wisconsin Dairy Farmers and Workers

The main objective of this project is to establish and maintain a working disease and injury surveillance system among farmers and farm workers in Wisconsin. The initial data collection was completed in Fall 2014. Data analysis showed an excess of system wide trauma (i.e., extreme, involving multiple body systems) in women. The survey tool is being prepared for a second round of data collection to identify trends in disease and injury exposure on farms. An effective surveillance program is essential to providing data on the effects of safety programs and policies, among other changes over time.

The project is also evaluating the use of **Natural Language Processing (NLP)**, a tool designed to mine the electronic medical records of patients in the Marshfield Clinic service area to identify farmers and contribute to ongoing surveillance. The tool would allow disease and injury data to be automatically collected reducing the time and material costs of the surveillance project. After initially defining the search parameters, the research team is continuing to explore more fully the use and efficacy of the NLP tool. Specifically, they have compared the rate of disease and injury in two parts of the Marshfield Clinic service area. One area includes many dairy farms and the comparison area is known to contain very few dairy farms. These may be useful to further refine the NLP tool to identify dairy farm workers in the electronic medical records and track rates of injury and disease.



## Education and Translation Projects:

### Facilitating Return to Work for Injured and Ill Animal Agriculture Workers

The Return to Work project was designed to develop a computer application that would assist treating physicians in safely returning injured agricultural workers to their place of employment when they are not yet fully recovered but still capable of doing some productive tasks. The project team continues make great strides in the development of this application.

Farm task data collection is continuing through the end of Year 4. We have now visited 32 farms across Wisconsin and Minnesota. We have moved all data from the physical and occupational therapists' notes to Microsoft word format, then into a RedCap system. This system will house all farm task data that has been collected by therapists. We have loaded approximately 90% of the task data into a structured format, via RedCap. Select pieces of that data, critical to the Return-to-Work algorithm, are currently being loaded into the application database.



Thousands of farm task photos have also been captured over the past grant year. These photos will be loaded into a SharePoint photo library and indexed for optimal search. The photos are

also linked to specific tasks. Within the software application, they are used as educational tools to facilitate communication between the clinician and the patient.

Primary application development is still underway. The mobile-friendly, web application is functional and will be undergoing usability testing with clinicians, residents, and other users throughout the first quarter of year 5.

### **Seguridad en las Lecherías: Immigrant Dairy Worker Health and Safety**

The steady increase in consumer demand for dairy products has led to the increase in size and concentration of dairy operations. These large farms bring new occupational risk factors and changes in the diversity of the workforce. It is now estimated that 60% of the milk supply in the US is produced with assistance from immigrant labor, most of which are Hispanic and makes up half of the dairy workforce. These immigrant workers tend to have limited formal education, no training in handling large animals and speak only Spanish.

The *Seguridad en las Lecherías* (Safety in Dairies) project addresses the needs of this vulnerable workforce by designing and implementing a bilingual health and safety training curriculum that is culturally appropriate for Hispanic workers. The training consists of five 1-hour lessons in Spanish with a ‘train-the-trainer’ approach that prepares selected Hispanic workers to become *promotores de salud* (community health workers) to allow for ongoing support and reinforcement of safety messages after the training is completed. The Occupational Safety and Health Administration (OSHA) has approved the curriculum. This year, the project team along with colleagues from four other organizations was given the Stakeholder Collaboration in Occupational Injury Research Award by the National Safety Council for their work. The training curriculum materials have also been provided by request to over 30 other organizations across the US to train workers outside of this project.

As of September 2015, the *Seguridad* project has trained almost 800 workers on 67 farms providing over 2,300 worker training hours. Trainings will be completed this year. Workers who have been trained show a clear increase in health and safety knowledge. Farmers also benefitted in their relationships with their workforce through this training. As one producer wrote in a thank you note, “The information provided during these lessons have been very beneficial to our Spanish-speaking employees because the language barrier often prevents us from the getting the information to our employees accurately or in a timely manner. This has been a very positive experience for all of us.”



## Multidisciplinary Network to Address Agriculture Worker Health and Safety Issues

UMASH Network Project continues to successfully engage our varied stakeholders interested in agricultural safety and health and to provide educational materials to support this objective. From Fall of 2014 until Summer 2015, our group has continued to work in the areas livestock worker health, immigrant worker health, agriculture safety and health education, and agricultural worker compensation data.

Our Project staff has been actively involved in livestock worker health programs. Some highlights include:

- Production and placement of 4 bi-lingual videos (English and Spanish) on needlestick safety on the NIOSH YouTube Channel. These videos have been shared with educators, veterinarians, industry representatives, livestock owners and workers. Videos have been incorporated into some company training programs as well as training for veterinarians.



- Manuscript “Needlestick Injuries in Agriculture Workers and Prevention Programs” accepted for publication in the Journal of Agromedicine.
- In 2015-2016, the team will continue to work on the development of swine and dairy biologics database as a mobile, user friendly tool for rural healthcare providers and poison control staff as a resource for handling potential exposures to various livestock biologics and veterinary drugs. An expert panel will guide content and usability features.

The Network project developed educational posters and a fact sheet on dairy stockmanship or low stress animal handling techniques during the fall of 2014 and winter 2015. The team worked in conjunction with dairy specialists and industry representatives. Activities related to stockmanship include:

- Dissemination of posters and fact sheets at Farmfest, National Association of County Agricultural Agents, ISASH, dairy farms, UMASH Annual forum, and on the UMASH website.
- Development of 5 short videos related to dairy stockmanship, to be completed fall 2015. Intended audience is farm workers and students.
- In 2015-16, there are plans to include a dairy stockmanship marketing campaign and program evaluation.



- In 2015 and 2016, the team will continue to work with the National Pork Board to review the impact and use of stockmanship training program developed and distributed by the National Pork Board.

To better understand the medical and economic impact of livestock associated injuries, the Network team continues to engage the regional insurance industry, the Minnesota Department of Labor and Statistics to characterize the past 10 years of worker’s compensation claims.

- Preliminary findings were shared as a poster at the 2015 National Occupational Research Agenda (NORA) Symposium.
- In 2015-2016, manuscripts are being completed for swine related injuries.

In addition, the UMASH Network team collaborated with AgriSafe Network, the University of Wisconsin-Eau Claire's College of Nursing and Health Sciences, and the Southern Minnesota Center of Agriculture to host a forum of incorporating health and safety into agricultural curriculum.

- A review of educational programs in the five-state region of Minnesota (MN), Wisconsin (WI), Iowa (IA), North Dakota (ND), and South Dakota (SD) was conducted. Preliminary data from the internet search was shared with participants.
- A summary commentary has been jointly written and submitted for publication.

## Outreach and Engagement

UMASH has supported a strong personal commitment on the part of Center personnel to connect with our stakeholders. This has resulted in a deeper and broader reach to producers, processors, agri-businesses, public health and health care practitioners and researchers, veterinarians, farm family members, agricultural media outlets, and many others. Each project team has developed relationships with individuals and organizations that join our growing community of stakeholders that receive and disseminate UMASH information and products via our email messaging, facebook, twitter channels and through face to face networking at conferences, presentations and task force meetings.

UMASH publishes a quarterly electronic newsletter “**The UMASH Connection: Farms and People**” that is sent to over 900 individuals. Newsletters are archived on the UMASH website. Also on the website are project updates, educational Fact Sheets and information about meetings, presentations, and upcoming events. Throughout the year, UMASH investigators present UMASH and other related research at scientific and industry conferences and meetings.



The **UMASH website** ([umash.umn.edu](http://umash.umn.edu)) provides easy access to information about the center’s research, education and prevention projects, as well as, training and educational resources, event announcements and summaries,

contact info for researchers and staff, and other information. The website is currently undergoing review and will be migrated to a new platform in late 2015 to update the site and improve the user experience and functionality.

During 2015 our Center has been engaging stakeholders to better understand how safety and health information can become more integrated into existing agricultural educational programs and activities. On May 28 UMASH co-sponsored a forum “**Growing Agricultural Education: Embracing Health and Safety**” with the University of Wisconsin-Eau Claire's School of Nursing, the AgriSafe Network, and the Southern Minnesota Center of Agriculture to discuss agriculture health and safety education. Specifically, the assembled group was interested in how can we improve agricultural health and safety and reduce injuries through agricultural education. The forum participants were charged with identifying better ways to incorporate safety and health as part of our educational curricula, targeting educational strategies for the next generation of farmers and workers, and strategizing on ways to improve health and safety in the changing agricultural industries. This forum was an example of the working purpose of UMASH: *to connect people and organizations to “identify needs, challenges, and opportunities in agricultural health and safety”*.



Outreach staff shared research information and resources in April at the **National Extension Risk Management Education** conference and in July at the **National Association of County Agricultural Agents** conference reaching many extension educators and risk management professionals.

In August, UMASH participated in the **Minnesota Farm Fest** event, collaborating with the Great Plains Center for Agricultural Health outreach team. We initiated a Pledge campaign to ‘make safety a lifestyle, not just a slogan’ after the theme of the 2015 National Farm Safety and Health Week. Organizations as well as individual stakeholders engaged with team members to take the Pledge as an actionable intention to incorporate safety behaviors into daily life. The outreach team is continuing to garner support from the media as well to reach farm families and industry leaders with this campaign.



## Evaluation:

Understanding the impact of the UMASH center continues to be important to ensuring effective and impactful use of the Center’s resources. The UMASH partners with the Minnesota Evaluation Studies Institute at the University of Minnesota to implement the evaluation program for the UMASH center. During the past year, evaluation efforts were focused in three areas:

- Strategic planning - The evaluation team worked closely with the center directors to facilitate strategic planning for the center. The process is multi-faceted and includes input across the Center gathered via brainstorming and facilitated discussions. This process resulted in identifying two key priority goals for the center:
  - To be a resource leader in raising awareness of agriculture safety and health
  - To be a responsive network of experts who identify and react quickly to emerging issues related to agriculture worker safety and health
- Retrospective Inventory of Outreach – As part of UMASH’s commitment to assessing its impact through outreach efforts, the evaluation team has developed a database to inventory all outreach activities performed by the UMASH center. The evaluators met with the project and center staff to solicit input about their outreach activities and to review a reporting tool developed for future monitoring. Once outreach activities are entered in the database, the evaluators review and further code them for reporting and analysis. This information will be useful for strategic planning, to measure impact, and to inform future outreach priorities.
- Pilot Project Program - The pilot project reporting tool previously developed is being used by the evaluation team to follow-up with grantees for up to three years post project to capture information about project outcomes, such as, publications, presentations, application of results, new partnerships, and/or new funding, that resulted after the project ended. This information will be used to better understand the impact of the pilot project program.

## Other Center Activities

### UMASH Annual Forum: “Growing Agricultural Education: Embracing Health and Safety”

The 2015 UMASH Annual Forum entitled "Growing Agricultural Education: Embracing Health and Safety" was held at the Davies Center on the University of Wisconsin - Eau Claire campus on May 28, 2015. The forum was co-sponsored by the Upper Midwest Agricultural Safety and Health Center (UMASH), the College of Nursing and Health Sciences at the University of Wisconsin - Eau Claire, the Southern Minnesota Center of Agriculture and South Central College and MN West Community and Technical College, the National Farm Medicine Center in Marshfield WI, and the Migrant Clinician's Network.



Fifty-five attendees from diverse backgrounds including healthcare, occupational health and safety, education, research, government, media, communications, immigrant services and human resources participated in the forum. The interactive format provided attendees many opportunities to network and take part in discussions with different attendees throughout the day.

2015 National Occupational Research Agenda (NORA) Symposium: Total Worker Health™, Why you should build a program in Total Worker Health and How to do it.

The 2015 National Occupational Research Agenda (NORA) Symposium was held Wednesday, May 6 at Mayo Memorial Auditorium at the University of Minnesota School of Public Health. The symposium was co-sponsored by the Upper Midwest Agricultural Safety and Health Center (UMASH) and Midwest Center for Occupational Health and Safety (MCOHS).

Attendees from diverse backgrounds including healthcare, occupational health and safety, education, research, government, communications, labor relations, and human resources gathered to discuss "Total Worker Health". Students and researchers from MCOHS and UMASH Pilot Projects took part in a poster presentation session. Over thirty poster/abstracts were presented, including twelve UMASH posters.



Cross-center collaboration on Awareness Campaigns

To better serve the Upper Midwest region, UMASH collaborates with the other NIOSH-funded Ag Centers to share resources and conduct outreach **safety awareness campaigns**.

The UMASH outreach team led the Ag Centers Awareness work group over the past year to develop and launch two agricultural safety awareness campaigns in conjunction with two nationally recognized events: National Agriculture Day (March 2015) and National Farm Safety and Health Week (September 2015). Primary goals of the awareness campaigns are to raise awareness about agricultural safety and health and increase the awareness of, and access to, the Ag Centers' expertise and resources, including the joint YouTube Channel, a peer-reviewed video channel for AFF produced educational videos.



**Pilot Projects Program**

The UMASH pilot project program provides grant funding to explore new areas and build new partnerships in agricultural safety and health. The pilot project program emphasizes projects that address National Occupational Research Agenda (NORA) objectives for agriculture and approach One Health problems in agriculture. It is anticipated that the pilot projects will foster additional work in these areas.

The 2015 UMASH pilot project program engaged four new projects:

- **Robotic Milker Systems: A Cross-sectional Study Evaluating Farmer Perceptions of Quality of Life on Robotics and Non-Robotics Dairies.**

National Farm Medicine Center, Marshfield WI

This pilot project will create an instrument that will quantitatively and qualitatively assess the variations in injuries on farms with robotic milking system (RMS) installations. This project will also evaluate the perceived quality of life among the farmers and families of milking robot owners and non-robot owners in the upper Midwest.

- **Worker Health and Safety of an Integrated Poultry and Cropping System**

Sustainable Agriculture and Food Systems, UMN Regional Sustainable Development Partnerships, University of Minnesota

The Main Street Project in Northfield, Minnesota has developed an integrated poultry-cropping system where free range meat chickens live among perennial plantings of woody crops. This system is intended to provide a bridge to entrepreneurship for Latino agriculture workers, but could also interest other small to medium-scale producers. Air quality analysis is needed to determine the concentrations of toxic gases, respirable dust, and endotoxin present in the poultry house and paddock. Further, health and safety audits of the poultry-cropping system will aid in improvements to facility design and work practices. Results will provide an indication of the required safety measures needed to operate the system safely.

- **Pilot Project to demystify the sudden release of hydrogen sulfide during manure agitation**

Bioproducts & Biosystems Engineering Dept, University of Minnesota

This study will evaluate hydrogen sulfide (H<sub>2</sub>S) generation and transfer process during manure agitations in swine barns. Swine barns with and without foaming will be chosen for this study. Manure will be sampled from different depth of the pit before and during manure agitation and pumping. Gas will be sampled also at different sites of the barns. These samples will be analyzed for the spatial and temporal distributions of sulfide/H<sub>2</sub>S species. With this approach, the sulfide generation and transfer process due to agitation can be determined, and the potential of H<sub>2</sub>S toxicity can be assessed.

- **Communication Strategies to Support Agricultural Innovations and Engagement**

Applied Economics, University of Minnesota

The goal of this project is to identify the best communication strategies, channels, and content to reach dairy farmers and agricultural media organizations to share training and educational materials. The project will identify how agricultural media organizations have covered stockmanship information in the past. The project will also investigate the understanding of stockmanship practices among dairy farmers, attitudes towards practices, barriers to implementing practices and communication preferences for receiving

information about stockmanship. This research will provide a foundation for building communications campaign recommendations designed specifically for rural communities and farmers and will evaluate the effectiveness and potential to leverage communication to increase dialogue about these issues.