Design Guidelines for Health & Safety in Animal Agriculture Production Systems

FINAL REPORT JUNE, 2013

Prepared by the Center for Rural Design, University of Minnesota

Design Guidelines for Health and Safety in Animal Agriculture Production Systems

This report is prepared for

The Upper Midwest Agriculture Safety and Health Center (UMASH)

- University of Minnesota

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Introduction

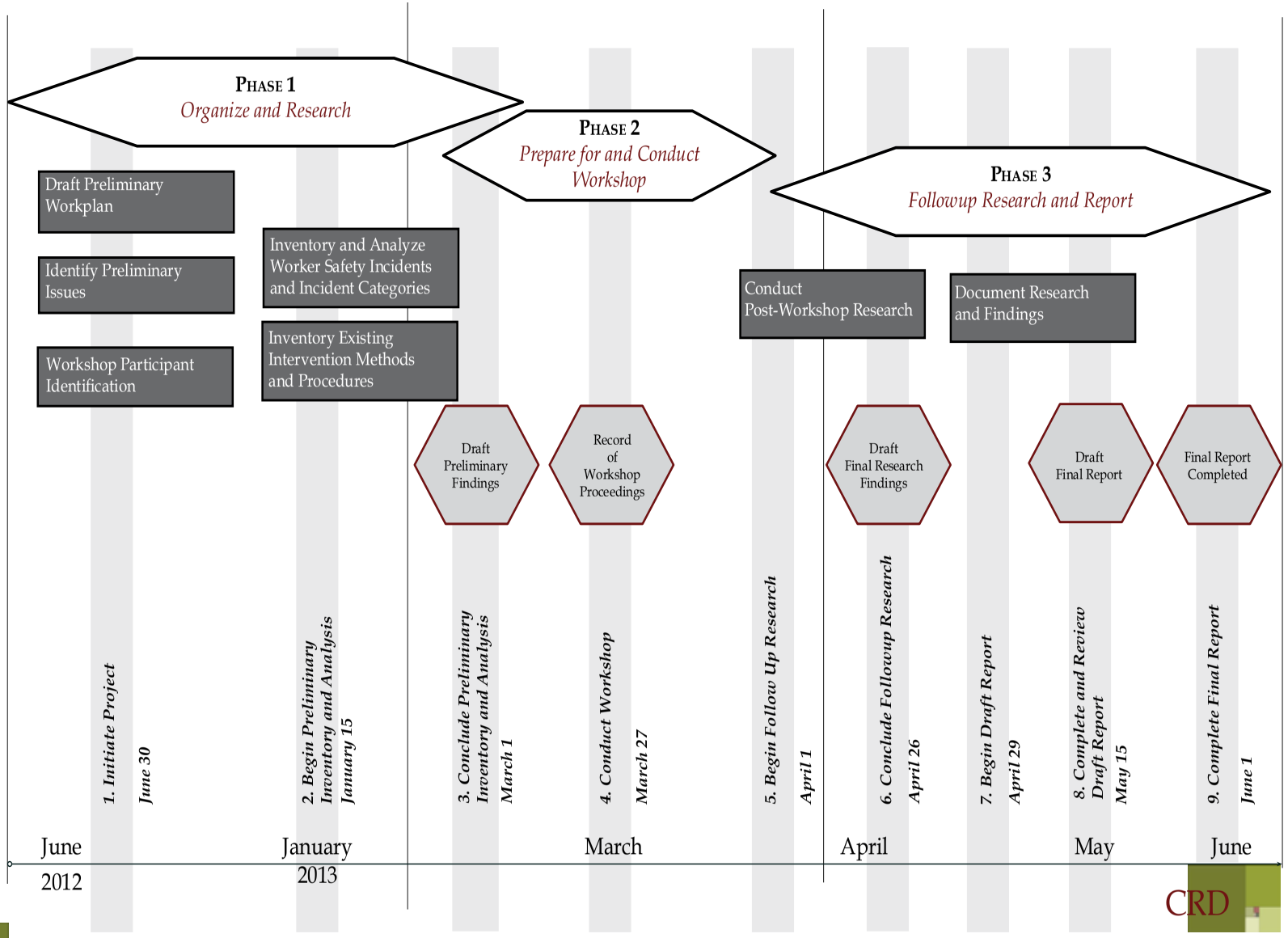
Agriculture is one of the most dangerous industries; it has the highest risk of work-related fatalities and non-fatal injuries in the United States.(1) Currently, it still lacks well-established standards, regulations and guidelines to protect agricultural workers. Part of the reason is the complexity of the working environment in agriculture - the work places and tasks in agriculture have a lot of variety and are hard to control individually. However, it is possible to improve occupational health and safety in agriculture by building up well-controlled and safe facilities, particularly in animal production.(2) Therefore, one of the preliminary purposes in this project is to identify the health and safety issues in animal agricultural operations and then explore the present practices to build a safe facility for improving occupational health and safety in animal production.

Other than size the basic design, construction, and management of animal production facilities have changed little in the past 50 years. Inexpensive fossil fuel and feed, plentiful water, and limited concern regarding air emissions has resulted in few incentives to critically evaluate, modify, or significantly change the design and construction of animal building systems—particularly dairy, swine and poultry production systems – and their impact on the safety and health of agricultural workers and their families.

By using science based production, energy, environmental, economic, and social criteria incorporated into the design guidelines, it can help bring animal facilities into the mainstream of commercial building design and construction protecting the health and safety of agricultural workers. Also, the use of the design guidelines will improve relationships with neighbors and the rural communities near these facilities. The design guidelines emerging from this small project are an innovative idea that has never been systemically analyzed, and could become a transformative idea.

Design is an effective link between science and society using design thinking and the problem solving process of design. This project can help define worker safety and health issues connected to animal agriculture, and open the door for on-going research to determine science-based integrated performance design guidelines for sustainable commercial animal buildings for swine, dairy, and poultry production systems in the United States.

Project Timeline



Problem Statement

There are many kinds of small and large farms with a variety of agricultural workers in the Upper Midwest; however, this project focused on those involved with buildings for commercial animal production systems. The project identified suggestions for categories of design interventions for animal housing that through their utilization in the design, construction, and management of these buildings will lead to a safer and healthier operation for workers. The categories of design interventions are intended to define the issues that are important for safety and health and prioritize their safety hierarchy to minimize the hazards that are inherently part of working with animals and the buildings that house them.

Other than size the basic design, construction, and management of animal production facilities have changed little in the past 50 years. Inexpensive fossil fuel and feed, plentiful water, and limited concern regarding air emissions has resulted in few incentives to critically evaluate, modify, or significantly change the design and construction of animal building systems—particularly dairy, swine and poultry production systems – and their impact on the safety and health of agricultural workers and their families.

Also, many of the agricultural workers in animal facilities in the Upper Midwest are immigrant families and without this labor force animal production would be severely limited. In large commercial animal facilities, workers are sometimes working with animals 24 hours a day, 7 days a week with little or no standards to guide the design, construction and operation of these buildings. Animal agriculture is, by the working relationships between humans and animals, inherently risky. Animal handling can be dangerous and many workers have been injured even those with experience and training.

Disease transmission between animals and between domestic animals and wildlife is an increasing issue for food safety in the location and site design of animal production facilities. Likewise, manure handling can create social conflicts, and almost every action in feeding and caring for animals requires the utilization of equipment. The location of power lines, driveways and movement patterns of machines, and any equipment utilized must be considered an integral aspect of design guidelines to enhance the safety and health of workers and emergency personnel - as typically required for mainstream commercial buildings.

To effectively deal with worker safety and health issues, animal agriculture in the United States must change the way it locates, houses and manages animal facilities by using

design guidelines based on production, energy, environmental, economic, and social criteria that bring animal facilities into the mainstream of commercial building design and construction. The overall aim of the project is to analyze worker health and safety issues related to commercial animal housing for swine, dairy and poultry production systems in the Upper Midwest.

The project goal is to open the door for ongoing funding and research to develop commercial animal production performance guidelines that increase animal productivity, reduce energy consumption, are cost competitive over building life, use more durable and environmentally friendly building components, improve rural landscape character, provide more neighborly and socially acceptable and understandable housing systems, improve worker and animal health, maintain animal biosecurity, and provide for food safety and security.

Methodology: Background Research

In general, three parts are included in this report:

1. Health and Safety Issues in Animal Production
2. Safety in Animal Agriculture and Facility Design
3. Agricultural Systems Health and Hygiene Development

Looking at the given statistical data and research cases from the Occupational Safety and Health Association (OSHA) and the National Institute for Occupational Safety and Health (NIOSH) has identified the present health and safety issues in animal production in the United States.

For procedures that minimize the potential hazards in the workplace, including facility design and relevant industrial hygiene interventions, research was conducted using journals of animal science along with studies from NIOSH and the University of Minnesota. According to the circumstances in the United States, propose proper recommendations from the present practices and research.

Both Philip Herold, Research & Learning Director for Agricultural, Biological and Environmental Sciences at the Magrath Library, and Bruce Alexander, Director of The Upper Midwest Agriculture Safety and Health Center (UMASH) at the University of Minnesota were consulted during the research process.

Findings: Background Research

Health and safety risks in the animal agriculture industry are influenced heavily by animal type. The background research findings have been categorized by animal and then by the major health and safety risks associated with each animal type.

Dairy and Beef

1. Animal Handling
2. Manure Storage
3. Electrical and Power Management
4. Machinery Operation

Swine

1. Animal Handling
2. Manure Handling
3. Mismanagement of Ventilation Systems

Poultry

1. Animal Handling
2. Ammonia
3. Dust
4. Acute and Chronic Illness

The Occupational Health and Safety Risks chart located at the end of the background research findings summarizes the common health and safety risks for workers between all animal types.

Dairy and Beef

Four main operations were identified involving dangerous hazards in dairy and beef industries.

1. Animal handling The most frequent hazards come from animal handling.(4) The animal itself is a hazard. Workers could get physically attacked when an animal is out of control, such as a kick, bite, being stepped on, and pushed during milking. In addition, the indirect hazards related to animal interaction may be stuck with needles during immunization and hearing loss due to animal noise. (4)

2. Manure storage Manure storage and management is another serious issue, especially in large-scale animal industry.(4) The most hazardous is toxic gas generated from manure, such as ammonia, hydrogen sulfide, methane, and carbon dioxide, because they are usually stored in confined systems without proper ventilation. High levels of toxic gases accumulate fast in enclosed and limited spaces and could be fatal; workers without proper personal protective equipment (PPE) can be killed in only a few minutes. Besides, inadequate ventilation leads to oxygen deficiency and may result in a deadly outcome to workers and animals.

3. Electrical and Power Management Careless and untrained electrical and power management puts workers in risky conditions. Not following a standard procedure of tag-offs energy supply, improper installation and maintenance of electrical system are the main reasons that workers get electrical shock.(4) Instead of complete training of agricultural operation, workers usually learn skills from personal or other worker's experiences, which are another reason of higher fatality and injuries when compared to similar operations in other industries.

4. Machinery Operation Without proper training on operating machinery systems hazards include, such as misusing the tractor and skid-steer loader operation and being stuck or caught in/between machine. Additionally, intentional bypassing of safety features increases the risk of injuries; for example, not using the seatbelt and control interlock system may result in injuries.(4)

Furthermore, there are potential physical hazards involved in all kinds of operation, such as fall and slips due to not well-managed work place, which is one of the major sources of occupational injuries for youth worker.(5)

Swine

Three operations involved with potential hazards in swine production were identified.

1. Animal Handling Multiple physical and biological environmental agents are involved during handling animal. The environmental agent could come straight from the animal or the surrounding environment. Hazards directly from animals include close contact with pig (injuries) and animal noise during gestation (hearing loss).(7) Indirect environmental hazards could be slip/fall hazard due to urine and manure, dust and particulate such as swine dander and hair, dry manure, feed containing antibiotic, and viral and bacterial agent (allergy, inflammation, and influenza infection).(7) Another potential hazard is hormone in medications which might lead to abortion on female worker.(7) Have well understanding on animal behaviors and good management and facility design can reduce the risk during handling animal.

2. Manure Handling Two major sources of potential hazards during handling manure are toxic gases generated from manure and physical hazards in the manure facility. Since the manure is stored in an enclosed system, it is easy to accumulate a high concentration of toxic gas, including hydrogen sulfide, methane, ammonia, and carbon dioxide. Workers without adequate personal protection might be killed by deadly gas in only a few minutes. In large scale animal production, if no safe protection is in the manure facility, workers might fall into the large open storage area and drown.(8)

3. Mismanagement of Ventilation Systems Mismanagement of facility ventilation systems can generate the serious respiratory health effects on human and animal.(8) Carbon monoxide (CO) is generated from incomplete combustion of fossil fuel when operating engines inside a closed garage. Winter is the most dangerous season because people lower the ventilation system and keep the building closed. Since CO is odorless and colorless it is easily not detectable by workers. It also hurts animal's health; for example, abortion or being less vigorous for piglets. Installing the CO meter and having good ventilation can avoid the damage from CO. Besides, as the ventilation breaks down, animals could be dead due to oxygen deficiency and heat exhaustion. An effective warning system helps to reduce this risk. (7,8)

Poultry

Four hazards for worker health and safety in poultry facilities were identified.

1. Animal Handling Workers come into contact with the animals when removing chicks from shipping cartons, cleaning and disinfecting cages, spreading bedding material, inspecting poultry for disease and removing dead poultry. Contact with the animals may result in wounds from poultry claws and beaks and increased contact with the animals heightens the chances of forming an acute or chronic illness.

2. Ammonia The pH, temperature, and moisture levels of the litter in broiler and turkey facilities have the greatest influence on ammonia concentrations. In facilities where birds are raised in cages, such as the layer industry, the ammonia concentrations are dependant on the manure storage and removal systems as well as the ventilation rate and airflow patterns in such facilities that store manure in pits below the cages.

3. Dust Poultry dust is composed of food, fecal material, broken feather barbules, skin debris, fungal fragments, spores, bacteria and bacterial fragments, viruses, and particles of litter. Various activities like brushing down surfaces, sweeping around machinery and shaking nesting box mats by poultry workers results in exposure to the highest dust concentrations. Poultry dust, especially when combined with ammonia, will act as a respiratory insult and can cause acute or chronic respiratory disease.

4. Acute and Chronic Illness Poultry workers are exposed to contaminants in feed additives, broken feather parts, dried ammonia, viable and nonviable bacteria, molds, and fungal spores. Inhalation of confinement dusts can result in adverse inflammatory, toxic, or allergic effects, including bronchitis, asthma, an inflammatory-based asthmatic condition, mucus membrane irritation, and allergic reactions. Acute work-related symptoms include coughing, phlegm, eye irritation, chest tightness, fatigue, nasal congestion, wheezing, sneezing, nasal discharge, headache, throat irritation, and fever.

Occupational Health and Safety Risks Chart

Chart A: Summary of the common health and safety risks across all animal agriculture production facilities.

hazard classification	source of environmental agent	health outcome	management
biological Hazard	medication/vaccine	allergy and inflammatory to skin	training about using medication
	dust (from manure, feed, grain)	allergy, infectious disease, productive health outcome b/c hormone	ventilation system & PPE
	Microorganism (virus, bacteria, fungal)	infectious disease	PPE
chemical hazard	sprays and mists from chemicals		PPE
	gas from confined space	chemical asphyxiation, oxygen (O2) deficiency, inhalation, engulfment, and/or caught-in hazards	ventilation system & PPE
physical	animal handling	injuries (cut, bite, step)	understand the animal behavior; avoid sudden change of environment to control animal
	noise from animal and machinery	hearing loss	PPE
	manure pit and tank	drowning	put the protective facility around pit and tank
	environment in the water and manure	fall, slip	improve the manure system to drain the manure and cho0se the proper material of ground
	electricity system (lock out/tag out operation)	Electrocution & electrical shock	training and follow the manual
	machinery operation	crushed-by, struck-by, caught in-between, entanglement, and/or amputation hazards	training and follow the manual
	lifting	ergonomic injuries	using the equipment to facilitate loading
	gravity	crush	follow the manual to lock the machinery

Bureau of Labor Statistics (2011)

The Injuries, Illnesses, and Fatalities (IIF) program provides annual information on the rate and number of work related injuries, illnesses, and fatal injuries, and how these statistics vary by incident, industry, geography, occupation, and other characteristics. The data does not include farmsteads with less than 11 workers. This data supports the combined background research findings about occupational health and safety risks in animal agriculture.

Table A: Fatal occupational injuries by occupation and event or exposure.

Occupation[1]	Total Fatal Injuries (number)	Event or Exposure[2]					
		Violence and other injuries by persons or animals[3]	Transportation Incidents[4]	Fires and explosions	Falls, Slips,Trips	Exposure to harmful sub-stances or environments	Contact with objects and equipment
Material Recording, Scheduling, Dispatching, and Distributing Workers	54	10	31	--	6	4	3
Couriers and Messengers	10	--	9	--	--	--	--
Couriers and Messengers	10	--	9	--	--	--	--
Postal Service Workers	16	--	13	--	--	--	--
Postal Service Mail Carriers	16	--	13	--	--	--	--
Shipping, Receiving, and Traffic Clerks	4	--	--	--	--	--	--
Shipping, Receiving, and Traffic Clerks	4	--	--	--	--	--	--
Stock Clerks and Order Fillers	15	7	3	--	4	--	--
Stock Clerks and Order Fillers	15	7	3	--	4	--	--
Secretaries and Administrative Assistants	4	--	--	--	--	--	--
Secretaries and Administrative Assistants	4	--	--	--	--	--	--
Executive Secretaries and Administrative Assistants	3	--	--	--	--	--	--
Other Office and Administrative Support Workers	15	4	4	--	5	--	--
Office Clerks, General	12	4	--	--	5	--	--
Office Clerks, General	12	4	--	--	5	--	--
Farming, Fishing, and Forestry Occupations	262	16	103	11	16	31	81
Supervisors of Farming, Fishing, and Forestry Workers	17	--	4	--	3	--	5
First-Line Supervisors of Farming, Fishing, and Forestry Workers	17	--	4	--	3	--	5
First-Line Supervisors of Farming, Fishing, and Forestry Workers	17	--	4	--	3	--	5
Agricultural Workers	138	13	56	8	9	24	26
Miscellaneous Agricultural Workers	135	13	55	6	9	24	26
Agricultural Equipment Operators	11	--	4	--	--	--	4
Farmworkers and Laborers, Crop, Nursery, and Greenhouse	79	4	33	5	8	17	11
Farmworkers, Farm, Ranch, and Aquacultural Animals	43	9	17	--	--	4	11

Table B: Fatal occupational injuries by industry and event or exposure..

INDUSTRY[1]	NAICS CODE[1]	Total Fatal Injuries (number)	Event or Exposure[2]					
			Violence and other injuries by persons or animals[3]	Transportation Incidents[4]	Fires and explosions	Falls, Slips,Trips	Exposure to harmful sub-stances or environments	Contact with objects and equipment
Greenhouse, Nursery, and Floriculture Production	1114	15	--	5	--	--	5	3
Nursery and Floriculture Production	11142	14	--	5	--	--	5	--
Nursery and Tree Production	111421	12	--	5	--	--	4	--
Other Crop Farming	1119	41	--	23	--	3	5	9
Tobacco Farming	11191	7	--	3	--	--	--	--
Cotton Farming	11192	3	--	--	--	--	--	--
Hay Farming	11194	3	--	--	--	--	--	--
All Other Crop Farming	11199	26	--	16	--	--	--	7
Animal Production	112	147	20	63	4	11	8	40
Cattle Ranching and Farming	1121	123	16	50	4	9	6	37
Beef Cattle Ranching and Farming, including Feedlots	11211	52	7	23	--	4	--	13
Beef Cattle Ranching and Farming	112111	45	7	21	--	4	--	8
Dairy Cattle and Milk Production	11212	38	3	13	--	5	3	13
Poultry and Egg Production	1123	5	--	--	--	--	--	--
Sheep and Goat Farming	1124	5	--	3	--	--	--	--
Sheep Farming	11241	3	--	--	--	--	--	--
Other Animal Production	1129	11	3	7	--	--	--	--
Horses and Other Equine Production	11292	5	--	--	--	--	--	--

Table C: Incidence rates of nonfatal occupational injuries and illnesses by case type and ownership.

Industry[2]	NAICS code[3]	2011 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
All industries including State and local government[6]		126,140.9	3.8	1.9	1.2	0.7	1.9
Private industry[6]		107,654.2	3.5	1.8	1.1	.7	1.7
Goods producing[6]		18,849.0	4.2	2.3	1.2	1.1	1.9
Natural resources and mining[6,7]		1,644.6	4.0	2.4	1.4	.9	1.6
Agriculture, forestry, fishing and hunting[6]	11	974.9	5.5	3.2	1.8	1.4	2.3
Crop production[6,8]	111	413.8	5.5	3.2	1.7	1.5	2.2
Animal production[6,8]	112	163.6	6.7	4.1	2.3	1.8	2.6
Forestry and logging	113	57.1	5.0	3.3	2.9	.3	1.8
Fishing, hunting and trapping	114	8.6	4.8	1.6	1.1	–	3.2
Support activities for agriculture and forestry	115	331.7	4.8	2.7	1.5	1.1	2.2

Table D: Numbers or nonfatal occupational injuries and illnesses by industry and case types.

Industry[1]	NAICS code[2]	2011 Annual average employment[3]	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[4]	Cases with job transfer or restriction	
All industries including State and local government[5]		126,140.9	3,807.4	1,903.8	1,181.3	722.5	1,903.6
Private industry[5]		107,654.2	2,986.5	1,538.7	908.3	630.4	1,447.8
Goods producing[5]		18,849.0	758.4	415.7	223.9	191.7	342.8
Natural resources and mining[5,6]		1,644.6	65.4	38.8	23.3	15.5	26.6
Agriculture, forestry, fishing and hunting[5]	11	974.9	48.3	28.3	16.2	12.0	20.0
Crop production[5,7]	111	413.8	19.7	11.6	6.3	5.3	8.1
Oilseed and grain farming[5]	1111	17.4	–	.2	.2	([8])	–
Vegetable and melon farming[5]	1112	84.9	3.9	2.3	1.5	.9	1.6
Fruit and tree nut farming[5]	1113	154.0	6.4	4.0	2.3	1.7	2.4
Greenhouse, nursery, and floriculture production[5]	1114	121.5	6.7	4.3	1.9	2.4	2.4
Other crop farming[5,7]	1119	36.0	1.5	.8	.5	.2	.8
Animal production[5,7]	112	163.6	12.4	7.6	4.2	3.3	4.8
Cattle ranching and farming[5]	1121	92.6	7.6	4.6	2.8	–	2.9
Beef cattle ranching and farming, including feedlots[5]	11211	24.0	2.3	1.7	.7	1.0	.6
Dairy cattle and milk production[5]	11212	68.7	5.3	2.9	2.1	.8	2.4
Hog and pig farming[5]	1122	20.9	1.7	1.0	.4	.5	.7
Poultry and egg production[5]	1123	35.3	2.0	1.4	.6	.8	.6
Other animal production[5]	1129	10.7	.8	.4	.3	.1	.4
Forestry and logging	113	57.1	2.5	1.6	1.5	.2	.9
Logging	1133	50.2	2.4	1.6	1.4	.1	.8
Fishing, hunting and trapping	114	8.6	.2	.1	([8])	–	.1
Fishing	1141	6.8	.2	.1	([8])	–	.1
Hunting and trapping	1142	1.8	.1	–	–	–	.1
Support activities for agriculture and forestry	115	331.7	13.5	7.4	4.2	3.2	6.1
Support activities for crop production	1151	290.4	11.7	6.5	3.5	3.0	5.2
Support activities for crop production	11511	290.4	11.7	6.5	3.5	3.0	5.2
Soil preparation, planting, and cultivating	115112	23.6	.4	.3	–	.2	–
Crop harvesting, primarily by machine	115113	9.4	.4	.3	.1	.2	.1
Postharvest crop activities (except cotton ginning)	115114	79.4	4.5	2.2	1.2	1.0	2.3
Farm labor contractors and crew leaders	115115	155.2	5.9	3.4	1.9	1.5	2.5
Support activities for animal production	1152	27.0	1.1	.6	.4	.2	.6
Support activities for forestry	1153	14.3	.6	.3	.3	–	.3
Mining[6]	21	669.7	17.2	10.6	7.1	3.5	6.6

Table E: Incidence rates of nonfatal occupational injuries and illness by industry and case types.

Industry[2]	NAICS code[3]	2011 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
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Mining[7]	21	669.7	2.2	1.4	.9	.5	.9
Oil and gas extraction	211	149.4	.9	.5	.4	.1	.4
Oil and gas extraction	2111	149.4	.9	.5	.4	.1	.4

Methodology: Stakeholder Workshop

In order to capture and integrate perspectives from within the industry a workshop with representatives from a broad cross section of commercial animal agriculture was identified as a very important first step in the process. We invited industry leadership from beef, poultry, dairy, and swine producers to insurance, building construction, public health, veterinary medicine, and worker groups to attend and participate in a one day workshop on the St. Paul campus of the University of Minnesota on Wednesday, March 27, 2013.

Within the letter of invitation the participants were introduced to the primary topic of the workshop by posing four questions for them to consider prior to the day long workshop.

1. How do you assess the health and safety aspect of commercial animal agriculture buildings?
2. What are the safety and health issues that you think the workshop should discuss from your perspective?
3. Would design guidelines that define worker safety and health issues to help farmers, producer groups, and insurance groups construct better and safer buildings without significantly increasing animal production costs be helpful to the industry?
4. What are the priorities for worker health and safety in commercial animal agriculture to be addressed in this project and how can it be accomplished?

These questions were meant to be more or less open ended so as to encourage broad thinking about conceptualizing the nature and range of issues facing the animal agriculture industry related to worker safety. Our deliberate hope was to avoid having the participants arrive at the workshop with preconceived notions about what the specific problems are and what the best solutions to those problems might be.

To stimulate workshop discussion a preliminary list of potential issues related to animal agriculture worker safety was developed. It was not considered to be complete, all encompassing, or prioritized. It was intended that the list will become more so during the workshop. The preliminary list was as follows:

- **Building Systems**
  - Structural Issues
  - Electrical Issues
  - Waste Water Issues
  - Fire Issues
  - Air Quality Issues
  - Heating and Ventilating Issues
  - Noise Issues
- **Operating Systems**
  - Stationary Equipment
  - Moveable Equipment
  - Transport and Truck Equipment
- **Handling Systems**
  - Animal Handling
  - Material Handling
  - Feed Handling
  - Other Product Handling
- **Chemical and By-product Systems**
  - Manure
  - Chemicals
  - Cleaners
  - Medicines
  - Energy Recovery

The workshop was broken into both small-group and full-group discussions with the morning focusing on assessing and expanding the preliminary list of issues facing worker safety in animal agriculture and then, in answering the four questions posed in the invitation as they relate to the expanded list of issues. The afternoon session was devoted to both risk assessment and rating as well as brainstorming and categorizing appropriate design responses that provide direction for future research in addressing the expanded list of issues identified in the morning session.

Findings: Stakeholder Workshop

Compilation of Workshop Discussions - Morning

Farmer/Worker Perspectives

- Farmers do care about worker safety
- Guidelines must be presented as 'suggestions'
- Bottom-up approach from within the industry
- Size of the farm influences whether the issue of worker safety is approached 'formally' or 'informally'
  - Formal training materials and training sessions
  - Informal 'word of mouth' training
- Cost of food to consumers is an issue
- Trouble finding qualified workers
- Trouble in understanding and responding to cultural differences – worker/employer – both ways
  - Learning style differences
  - Multi-lingual signage
- Engaging with workers on a social/cultural/family level
  - Alleviate worker concern about cultural fit
  - Alleviate worker concern over family welfare
  - Allows workers to be more engaged with the job and reduces distraction
- Worker interest/passion/satisfaction in the job will reduce safety risk and increase overall quality of an operation
- Disease transmission to animals from workers
- OSHA involvement and inspections rare 'pre-incident'
- Age/experience of workers
- High employee turn-over rate in many cases
- Job specialization vs cross job training
- Potential communications difficulties in multi-lingual work places
- Potential for behavior breeding in animals to reduce risk to human interaction

Insurance Perspectives

- Workers Comp – acute, disabling injuries the primary loss, often due to:
  - Material handling

    - Livestock handling
    - Slips, trips, falls
    - Machinery operation – stationary and movable
- Chronic health issues - respiratory
- Fatalities are limited and rare
    - Confinement pits and areas
    - Feed/grain bins
    - Manure pits
    - Limited number of staff on site – no safety backup
- Building losses
    - Structural issues (e.g., truss design)
    - Fire safety
    - Noxious/explosive gas control
- Employee training important to reduce human risk
- Building guidelines important to reduce risk to facility
- Guidelines will reduce risks and rates

Permitting perspectives

- Building design to suit climate and intended use
    - Lack of most code requirements (state or local)
    - Construction may not follow engineering (lack of inspections)
- Local zoning/permitting doesn't deal with facility design
- Disconnect between local, county and state permitting leads to confusion and frustration
- Road access and quality don't always support emergency equipment (fire, ambulance)
- Social perceptions guide political perceptions and perception is 'reality' (often based on emotional responses)

Pork Industry Perspectives

- Manure handling and maintenance issues lead to new risks – methane foaming
- Restricting/minimizing uses of existing technology can increase worker safety risk
    - Eliminating the use of gestation crates (increases risk to animals as well)

- Building design and animal handling methods can reduce the opportunity for escape
- Separation of phases of the industry increases animal welfare (disease) but reduces the number of workers per site

Dairy Industry Perspectives

- Easier to expand than build new – limits ability to fully upgrade an operation as a whole
- Material and livestock handling are primary issues
- Training exists in many cases but not always followed correctly by workers
- Important to track types and locations of incidents to identify high risk practices or locations
- Design and technology can reduce worker safety risks but currently expensive to implement (robotic milkers)

Poultry Industry Perspectives

- Manure handling – dust related hazards
- Air quality issues – ammonia
- Feed handling issues
- Animal handling not really a big issue

Building/Facility Perspectives

- Indoor air quality management – worker and animal health
- Construction may not follow engineering
- Wholistic design rather than 'add-on' design
- Risk of confined spaces – need for emergency exits from pens and buildings
    - Not always in keeping with disease control or animal handling practices
- Building and equipment maintenance
- Ability to access all parts of a facility and move emergency personnel and equipment where needed
- Buildings have gotten larger and facilities more complex
- Managing bio-security in light of other issues
- Difficulty in retrofitting older facilities

- Chemical, medicine, and hazardous material storage and handling
- Bulk material and feed storage and handling

Compilation of Workshop Discussions - Afternoon

Risk Assessment and Rating

- Animal handling and movement – high risk in some industries
- Walking surfaces (slips, trips, falls) – high risk
- Air quality and respiratory problems – high risk
- Bulk material handling – high risk (feed, manure, dead animals, etc.)
- Chemical handling and storage – moderate risk
- Energy risks – moderate
    - Electrical energy exposure and shock
    - Mechanical energy – stationary and movable equipment and vehicles
    - Chemical energy – explosion, chemical burns
- Manure storage (suffocation) – low risk (high fatality)
- Feed and grain storage (suffocation) – low risk (potentially fatal)
- Building or equipment fire – low risk (potentially fatal)
- Weather hazards (storm and snow load) – low risk (potentially fatal)

Future Strategies

Agricultural Systems Health and Hygiene Development

1. Training Eliminating the hazards from sources initially through strengthening workers identifying environmental agents and improving work practices to minimize the damage. For example, train workers on understanding animal behaviors to avoid injuries during handling animals; train workers how to medicate/inject an animal; train workers to follow the safe machinery and energy procedure and understand the related adverse health effects.(1,7-9)

2. Personal protective equipment As facility design and good work practice can't ensure the improvement of the quality of the working environment the least strategy is using personal protective equipment (PPE), such as respirator, glove, goggle and clothing to keep the hazard from human body. For example, if workers have to enter into manure system, the proper PPE is required.(1,8)

Facility Design

1. Ventilation System Incorporating a well-designed ventilation system will ensure better air quality for workers and animals especially in those facilities that are air-tight and reduce the risk of inhaling toxic gases. Better ventilation systems also ensure a comfortable environment for both the animal and worker resulting in better production from both parties. For example, adequate air exchange rate is required in the worker and animal areas. Also, make sure to maintain the ventilation system during the winter. (8)

2. Manure Storage Systems Not store manure in below ground pits under animal housing buildings that are only covered with slatted floors. Preferred self-contained manure storage is outside of the animal housing facility either below or above ground so animals and people are not exposed to gases and odors. The only time risks to people is once or twice during the year when the manure storage is pumped and manure is applied on cropland.

3. Consciously Designed Spaces Specific to Animal Agriculture Practices
Carefully considered design specific to the needs of animal agriculture production and practices will address current issues and potentially lower accidents and injuries of workers in these facilities. Design considerations may include larger spaces for animal handling, surfaces that do not accumulate animal debris and manure, better ventilation systems, etc.

Intentions for Future Research

The intent of the project outlined in this report was to discuss a variety of issues involving building and site systems, operating systems, animal handling systems, and chemical and by-product systems as they relate to worker safety. From this discussion, the goal was to identify areas of future research that would lead to the development of a comprehensive set of design guidelines for new or retrofit facilities that would enhance worker safety. The research team for this project has drafted a preliminary research proposal to address worker safety along with several other relevant issues facing the animal agriculture industry:

- safeguard worker and animal safety and health;
- enhance animal productivity;
- reduce energy consumption;
- be cost competitive over building life;
- use more durable and environmentally friendly building components;
- improve rural landscape character;
- provide more neighborly and socially acceptable and understandable housing systems that maintain biosecurity;
- provide for food safety and security; and
- integrate worker cultural, social, and housing issues.

The proposal builds on the outcomes of the current project to provide specific and implementable strategies to address the issues outlined above. The team intends to submit the research proposal to the National Institute for Occupational Safety and Health (NIOSH) under their NIOSH Exploratory and/or Developmental Grant Program (R21). We expect to build a broad team of collaborators and submit the proposal in October 2013.

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