Standard Operating Procedures

Animal Sciences Research Center

Large Animal Housing Facilities

July, 2013

Written by: Mike Linville
Reviewed and approved by: Lon Dixon

Table of Contents

General Information - Livestock Housing 3

Cleaning and Sanitation 9

Daily Documentation and Environmental Monitoring 10

Responsibilities of the Principal Investigator 13

Animal Care Personnel Training 14

Security 16

Occupational Health and Safety Program 17

Animal Procurement 19

Oversight of Veterinary Care for Agricultural Animals 20

Health Requirements for Animal Housing 23

Documentation of Abnormal Health 26

Aseptic Surgical Preps 28

Experimental Surgery and Documentation of Post-Surgical Care 29

Postoperative Care of Animals 32

Anesthetics, Analgesics and Tranquilizers (AATs) 34

Environmental Enrichment 39

Controlled Drugs 41

Animal Euthanasia 42

Restraint, Confinement and Tethering 43

Transportation of Agricultural Animals 46

Vermin Control 48

Baby Pig Processing 49

Treatment of Dystocia in Swine 51

Guide for the Care and Use of Laboratory Animals, 8th edition is referred to as the *Guide* in this document

Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching, 3rd edtion is referred to as the *Ag Guide* in this document

General Information - Livestock Housing

1. The Animal Sciences Research Center (ASRC) large animal facilities provide indoor housing and intensive laboratory settings for agricultural animals. The large animal housing areas are referred to as Unit C (rooms E 117, E 118, E 119, and E120), Unit D1 (room E 121), Unit D2 (room E122), Unit D3 (room E 123), Unit D4 (rooms E 148, E 149, and E 142), and Unit F (rooms M 119 and M 124).

    a) Unit C is the environmental laboratory and provides special areas permitting computerized environmental control – temperature, humidity, radiation and light. This unit accommodates studies performed with large domestic animals on basic and applied aspects of animal science relating to environmental physiology, nutrition, endocrinology, genetics, biometeorology, domestic animal management, reproduction, lactation, growth, pathology and toxicology. It includes four environmentally controlled chambers and an observation room with support areas for sample and animal preparation, feed storage and milk handling.

    b) Units D1, D2 and D3 provide facilities to accommodate large animals involved in research projects where intensive sampling and immediate analysis or preparation of samples is required. Capability for studies in animal nutrition, genetics, reproductive biology, physiology, endocrinology and toxicology is provided. Animal areas include automatic waterers, regulated air flow and a flush system for waste removal to a treatment plant. Unit D1 provides space for 20, 12 ft. X 4 ft. swine pens and a feed room. Removable gates can be used to divide the pens into 6 ft. X 4 ft. areas. Some pens may be removed and replaced with farrowing crates when the need arises. Unit D2 provides 11, 12 ft. X 4 ft. pens, a work area and shares a feed room with Unit D3. These pens are similar Unit D1 and can be divided into 6 ft. X 4 ft. areas. Unit D2 is suitable for housing swine and smaller hooved stock. Unit D3 can be configured to house cattle, swine or sheep for various types of studies. It contains a work area and shares a feed room with Unit D2. Swine are most commonly housed in Unit D3.

    c) Unit D4 provides facilities to meet specialized needs of large animal research involving surgical modification and physiological monitoring. Facilities include 2 surgery rooms, a surgery prep room, an animal recovery room and 2 observation rooms. Service areas for instrument preparation and specimen processing are included.

    d) Unit F provides facilities to accommodate large animals involved in research projects where intensive sampling and immediate analysis or preparation of samples is required. Capability for studies in animal nutrition, genetics, reproductive biology, physiology, endocrinology and toxicology is provided. Animal areas utilize automatic waters, have regulated air flow and contain a flush system for waste removal to a treatment plant. This area is comprised of two separate rooms that share a common feed and prep room. Room AM124 can be configured with 12 stanchions for cattle, farrowing crates or metabolism cages for swine or sheep. Room AM119/120 has pens and crates for swine of varying ages and stages.

2. Operation of the ASRC Large Animal Research Facility is the responsibility of all investigators and employees. All individuals using the facility must maintain cleanliness and treat animals humanely. Complete records must be maintained and an atmosphere of respect for the rights of all personnel will be provided. Investigators are required to provide the animals with proper housing, handling, feed and water while in the facility. Animal health monitoring must be performed at least once daily, including weekends and holidays.

3. This SOP serves as a guideline for the housing and care of livestock housed in the Large Animal Facility

and serves the following functions:

a) Assurance that all personnel follow the same procedures.

b) Training document for new personnel and reinforcement of procedures for established personnel

c) Reference source for information regarding standard procedures.

4. It is the responsibility of the Facility Manager, Research Maintenance Technician and the Unit Supervisors to oversee the daily operations of the animal facility and assure compliance with the standard operating procedures.

5. Investigators must have a current, Animal Use Protocol on file in the ACQA office before conducting any animal research in the facility.

6. Security: Access to the ASRC Large Animal Facility will be limited to authorized personnel. Authorized personnel must accompany all visitors to the large animal housing areas.

7. Housing: Space requirements for agricultural animals are dependent upon species and size. The recommendations set forth in the *Guide for the Care and Use of Laboratory Animals* will be followed regarding housing for animals used in biomedical research (Table 1). Space requirements for animals used for agricultural research and teaching will be determined using the *Guide For the Care and Use of Agricultural Animals in Agricultural Research and Teaching* (Table 2). Deviation from the "standard" space requirements must be included in the approved ACUC protocol as non-standard housing.

    a) Swine may be supplied with rubber mats to supplement housing on concrete at the discretion of the husbandry and veterinary staff.

8. The principal investigator is responsible for all aspects of animal care, handling and research according to Unit Guidelines, SOPs and protocols.

9. It is recommended that approximately two weeks prior to a scheduled use, the P.I. or their designated individual, meet with the Research Maintenance Technician to discuss responsibilities and conditions needed for the project. During this meeting the P.I. will designate an individual who will be responsible for setting up and removing the animal housing equipment. The Research Maintenance Technician will assist when needed to prepare the rooms.

10. Protocol number, name of primary investigator, and names of personnel working with the animals should be written on the dry erase boards located inside the entrance of each room. Work and home phone numbers for each individual should be included. Also, each animal's individual identification number and appropriate pen, stall, etc. will be written and kept current on the dry erase board.

11. To prevent injuries to animals and animal caretakers, cattle housed in the large animal housing facilities will be "trained" to a halter well enough to be led to their pens or stanchions, prior to arrival.

12. Observation: All animals will be observed at least once daily including weekends and holidays and documented by completing the "Daily Summary of Animal Health Observation" and "Large Animal Daily Activity Check Sheet."

13. Watering: All animals must have access to clean, potable, water at all times, unless approved experimental procedures dictate otherwise. Assurance is documented by completing the Large Animal Daily Check Sheet.

a) Automatic waterers are used in the Large Animal Facility and must be checked daily to ensure they are functioning properly.

14. Feeding: The P.I. is responsible for feeding animals in a manner which meets NRC recommendations for the species and class of animal unless approved experimental procedures dictate otherwise. The feed should be clean and free of contaminates. Assurance is documented by completing the Large Animal Daily Check Sheet.

    a) Animals should be fed by 9:00 a.m. each morning, including weekends and holidays, unless otherwise stipulated by protocol.

    b) Bagged feeds should be stored in the feed rooms on pallets at least six inches from the walls.

    c) Opened feed bags should be stored in feed rooms in plastic containers with tight-fitting lids.

    d) The feed milling date, located on the feed tag, must be recorded on the lid of the feed container when the new feed is placed in the barrel. Feed with additives should be used within 6 months of milling date, or discarded. Feed tags on bags of feed mixed at the MU Feed mill don't contain milling dates. Thus, feed containing additives must be ordered in quantities that will be utilized within six months of milling or discarded.

    e) Bulk feed will be stored in bins and covered at all times. Milling dates must be transferred to the storage bins. Bulk feeds containing additives should be used within six months of milling.

    f) Spilled feed must be immediately cleaned up and deposit in the dumpster located at the loading dock in the rear of each unit.

15. Hallways leading to the animal rooms in Unit C are painted concrete and are slick for the animals. To prevent injuries, rubber mats must be placed over the concrete floors before animals are walked in the hallways of Unit C.

Table 1. Recommended Spaces for Farm Animals Commonly used in Biomedical Research [d]

Animals/Enclosure	Weight, kg [a]	Floor Area/Animal, ft^2 [b]
Sheep and Goats		
1	<25	10.0
	Up to 50	15.0
	>50 [c]	20.0
2 – 5	<25	8.5
	Up to 50	12.5
	>50	17.0
>5	<25	7.5
	Up to 50	11.3
	>50 [c]	15.0
Swine		
1	<15	8.0
	Up to 25	12.0
	Up to 50	15.0
	Up to 100	25.0
	Up to 200	48.0
	>200 [c]	≥60.0
2 – 5	<25	6.0
	Up to 50	10.0

	Up to 100	20.0
	Up to 200	40.0
	>200[c]	≥52.0[c]
>5	<25	6.0
	Up to 50	9.0
	Up to 100	18.0
	Up to 200	36
	>200[c]	≥48.0[c]
Cattle		
	<75	24.0
	Up to 200	48.0
	Up to 350	72.0
	Up to 500	96.0
	Up to 650	124.0
	>650[c]	≥144.0
2 – 5	<75	20.0
	Up to 200	40.0
	Up to 350	60.0
	Up to 500	80.0
	Up to 650	105.0
	>650[c]	≥120
>5	<75	18.0
	Up to 200	36.0
	Up to 350	54.0
	Up to 500	72.0
	>650	≥108.0

[a] To convert kilograms to pounds, multiply by 2.2

[b] To convert square feet to meters, multiply by 0.09

[c] Larger animals might require more space to meet performance standards

[d] Adapted from *The Guide*

Table 2. Recommended Spaces for Sheep and Goats Used in Agricultural Research and Teaching[ab]

	Floor Type	Weight, kg[a]	Floor Area/Animal ft[2 b]
Sheep and Goats			
Rams	Solid	65 to 90	20 to 30
	Slotted		14 to 20
Dry Ewes	Solid	65 to 90	12 to 16
	Slotted		8 to 10
Ewes and Lambs (additional creep area required)	Solid		15 to 20
	Slotted		10 to 12[c]
Lamb creep area	Solid	2 to 4	1.5 to 2.0
	Slotted		1.5 to 2.0
Feeder Lambs	Solid	14 to 50	8 to 10
	Slotted		4 to 5
Swine			

[a] Adapted from the *Ag Guide*

[b] Space requirements should be increased for fully fleeced or horned sheep, and during hot weather.

[c] Increase space if lambing rate is >170%.

Table 3. Recommended Spaces for Swine Used in Agricultural Research and Teaching

Stage of Production	Individual pigs (per pig)	Groups of pigs (per pig)[a]
	(ft^2)	(ft^2)
Litter and lactating sow, pen	35	
Litter and lactating sow, sow portion of crate	14	
Nursery, 3 to 27 kg of body wt	6	1.7 to 4.0
Growing, 27 to 57 kg of body wt	10	4.0 to 6.0
Finishing, 57 to 104 kg	14	6.0 to 8.0
Late finishing, 104 to 125 kg	14	8.0 to 9.0
Mature adults[b]	14	16.0

[a] Group area allowances for growing pigs range from starting to ending body weight in each phase. The needed floor area per pig decreases as group size increases. The data presented here are for typical sizes from 5 to 20 pigs per pen. For smaller group sizes (2 to 4 pigs), the pens should be longer than the body length of the largest pig in the pen.

[b] Stall size minimum width should be 22 inches, and minimum length, should be 7 feet. Young adult females may be housed in stalls of 6.5 ft length.

Table 4. Recommended Spaces for Beef Cattle used in Agricultural Research and Teaching[a]

	Floor Type	Weight, kg	Floor Area/Animal ft^2
Beef Cattle			
Calves	Solid	180 to 380	20 to 25
	Slotted		12 to 18
	Solid	360 to 545	30 to 35
	Slotted		18 to 25
Bred Heifers	Solid	360	30 to 35
	Slotted		18 to 25
Cows	Solid	455	35 to 40
	Slotted		20 to 25
	Solid	590	40 to 50
	Slotted		22 to 28
Bulls	Solid	680	45 to 50
	Slotted		30

[a] Adapted from the *Ag Guide*

Table 5. Recommended Spaces for Dairy Cattle used in Agricultural Research and Teaching[a]

	Floor Type	Weight, kg	Floor Area/Animal ft^2
Dairy cattle			
Individual calves	Bedded pen	Up to 91	24 to 32
	Stall	Up to 182	10 to 15
Groups of weaned calves (3-12/group)	Inside pen	182	25 to 30
Dry cows and heifers	Solid	454	4 to 6ft^2/cwt
Maternity or isolation pens	Solid nonslip		100 to 160
Individual mature bulls	Rugged		140 to 240
Milking cows	Solid		100

[a] Adapted from the *Ag Guide*

Cleaning and Sanitation

Policy: It is the policy of the Animal Science Research Center (ASRC) that the large animal housing areas will be kept clean and orderly in accordance with the *Guide for the Care and Use of Laboratory Animals* to reduce the risks of disease spread from animal to animal and provide a safer environment for the animal-care personnel to perform their duties.

Applicable: All faculty and scientific staff of the University of Missouri, College of Agriculture, Food and Natural Resources, CAFNR Farms and the Animal Sciences Research Center (ASRC) designated as principal investigators on ACUC protocols that utilize animals for or within the large animal facilities of the ASRC.

Introduction: Accumulated animal waste and spilled feed increases vermin numbers and the risks of disease transmission from animal to animal, as well as, from animal to man. Investigators must provide an adequate number of properly trained personnel to care for their animals. Care includes cleaning and sanitizing the animal housing areas as described in this document. The ASRC Facility Manager provides training to investigator's personnel regarding proper cleaning and sanitation and provides additional personnel to ensure that the common areas are properly cleaned and sanitized. Documentation of daily cleaning and biweekly sanitation of the animal housing areas is recorded on the Daily Observation Sheets by the investigator's staff. The ASRC Facility Manager maintains a log documenting that the common areas are sanitized every two weeks.

Procedures:

1. Cleaning: The P.I. is responsible for ensuring that animal housing areas are kept clean and orderly. Assurance is documented by completing the Large Animal Daily Check Sheet.
2. Animal pens and floors in Unit C, D2 and Unit F will be cleaned of gross waste and debris twice daily (before 9 a.m. and after 3 p.m.) in a manner appropriate for the species and housing system.
3. Animal pens in Units D1 and D3 utilize slatted concrete floors or raised wire flooring, thus, once daily cleaning (brooms and scrapers) and three times weekly hosing may be appropriate depending on the animal stocking density and diets fed. The ASRC Facility Manager will monitor the cleanliness of the pens to determine if more frequent cleaning is needed.
4. Pens should be disinfected every two weeks. This is accomplished by power-washing the floors, penning material, feeders and waterers, to remove animal waste, followed by applying an appropriate disinfectant (e.g. Process NPD, ½ oz. / gal. or fresh 10% bleach, 1 oz. / gal. of water). The disinfectant should be allowed to stand for 10 minutes followed by rinsing with water. Deviation from the "standard" cleaning and disinfection schedule must be included in the approved ACUC protocol as non-standard housing.
5. Investigators should ensure that support areas are kept neat and orderly at all times. These areas should be cleaned daily and disinfected every two weeks. Areas where feed is stored should be disinfected at the completion of the experiment, so that feed isn't contaminated. The ASRC Facility Manager may provide additional staff and document that the support areas are being properly maintained.
6. Walls and ceilings will be washed as frequently as necessary to maintain a clean animal-housing environment.
7. Waste pits and gutters should be flushed at the time of hosing, in rooms that use them as a means of removing animal waste.
8. Hallways and loading docks should be washed as soon as animals have been moved.
9. At completion of experiments, all surfaces (pens, feeders, walls, ceilings, overhead pipes, waste pits and gutters) will be thoroughly cleaned and sanitized. **DO NOT** use pressure washer on walls, ceilings or overhead pipes, as it will remove the paint. Walls and ceilings should be cleaned using a regular hose with soap and brush as necessary. All feed is to be removed from the feed room. Cleaning is to be completed within 24 hours after animals are removed. Room charges will continue until cleaning is completed and the ASRC Research Facility Manager verifies that the cleaning is completed.

Daily Documentation and Environmental Monitoring

Policy: It is the policy of the Animal Science Research Center (ASRC) that the large animal housing areas will comply with the recommendations contained in the *Guide for the Care and Use of Laboratory Animals* or *The Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching*, regarding temperature, humidity and ventilation. Also, the health status, as well as, daily feeding, watering and cleaning of each animal will be documented, every day of the year.

Applicable: All faculty and scientific staff of the University of Missouri, College of Agriculture, Food and Natural Resources, CAFNR Farms and the Animal Sciences Research Center (ASRC) designated as principle investigators on ACUC protocols that utilize animals for or within the large animal facilities of the ASRC.

Purpose: To ensure that all animals receive adequate care every day of the year.

Procedures:
Each animal housed in the ASRC large animal housing areas should be observed and its health status noted every day of the year. Animal observation and health status should be completed by 1:00 p.m. and documented on the *Daily Summary of Animal Health Observations* form provided by the ASRC Animal Facility Manager. If the animal(s) appears healthy, the first column (All animals observed to be in good health) should be checked and the form signed by the person observing the animals. If the health of an animal(s) appears abnormal, the second column (Abnormal health condition was observed) should checked and the form signed by the person observing the animals. If an abnormal health condition is observed a Laboratory Animal Clinical Record (Blue Card) should be initiated and the Animal Facility Manager or the CAFNR Veterinarian notified, so that appropriate therapy can be provided. If an abnormal health condition is noticed after normal business hours, the OAR Emergency Veterinarian should be paged (573 441 4198) or the MU CVM (573 882 4589) contacted to provided treatment. If an animal is found dead the third column (Mortality # observed) should be checked; the form signed by the person responsible for observing the animals and the animal submitted for autopsy or disposed of appropriately.

Room temperature, feeding, cleaning, sanitizing and animal numbers should be noted on the *Large Animal Daily Activity Sheet*, provided by the ASRC Animal Facility Manager and initialed by the person performing the duties.

P.I. Name: _____ ROOM # (Pen #) _____

Daily Summary of Animal Health Observations

(Observations to be completed prior to 1:00 p.m. daily)

1. Check items that apply to the status of the health of animals observed in this room on the date indicated.
2. Report all abnormal health conditions to Gail Kraus as soon as possible.
3. Record specific details on the individual animal's Health Card (*Blue Card*)
4. Record animal death information in Manager's Log located in Room N154.

Note: All drugs used for treatment must be obtained through Dr. Mike Linville.

Mar.'05	All animals observed to be in Good Health	Abnormal health condition was observed.	Mortality # observed.	Signature of Observer	Signature of ASRC Compliance Staff	*Comments*
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						

(The P.I. will be assessed a fee for each occurrence of an incomplete check sheet found after 1:00 p.m. daily.)

Remember: Always record occurrences of any of the following conditions on the "blue card":					
	Abscess, Cuts, or Lesions	Blood or Discharge	Disease	Any Abnormal Behavior	*Remember*: Record all treatments given.--Always!

Revised 7/1/00
Effective 7/1/98

g:\shared\asrcscp\Healthsh-Rev 2000.xls

LARGE ANIMAL DAILY ACTIVITY SHEET

SPECIES_____ INVESTIGATOR_____

ROOM#_____

Mar. '05	Date	Temp	Pen #'s Used	Checked Animals AM	PM	Fed Animals	Cleaned Pen	Flushed Crates	Flushed Pit	# of Animals (Pen) NSRRC	eNOS	RSP	# of Crates Used		Animals Checked by:
Tues.	1														
Wed.	2														
Thurs.	3														
Fri.	4														
Sat.	5														
Sun.	6														
Mon.	7														
Tues.	8														
Wed.	9														
Thurs.	10														
Fri.	11														
Sat.	12														
Sun.	13														
Mon.	14														
Tues.	15														
Wed.	16														
Thurs.	17														
Fri.	18														
Sat.	19														
Sun.	20														
Mon.	21														
Tues.	22														
Wed.	23														
Thurs.	24														
Fri.	25														
Sat.	26														
Sun.	27														
Mon.	28														
Tues.	29														
Wed.	30														
Thurs.	31														

Responsibilities of the Principal Investigator

Policy: It is the policy of the Animal Science Research Center (ASRC) that any teaching or research endeavor involving the use of animals be conducted in a manner compliant with the Animal Welfare Act, Public Health Service Policy, The University of Missouri-Columbia Animal Care and Use Committee and the *Guide for the Care and Use of Laboratory Animals.*

Applicable: All faculty and scientific staff of the University of Missouri, College of Agriculture, Food and Natural Resources, CAFNR Farms and the Animal Sciences Research Center (ASRC) designated as principle investigators on ACUC protocols that utilize animals for or within the large animal facilities of the ASRC.

Purpose: To assure that the Animal Care and Use Program of the ASRC is compliant with all legal and the Institutional Animal Care and Use Committee requirements.

Introduction: The Animal Sciences Research Center allows individual scientists to provide for the routine care and husbandry of animals used in their research and teaching. This privilege requires a serious commitment on behalf of the Principal Investigator. All animals must be cared for and used in compliance with several governmental agencies and in a manner that complies with the requirements of the UMC Animal Care and Use Committee, the *Guide for the Care and Use of Laboratory Animals*, or the *Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching*. The ASRC animal care and use program to which the principal investigator must adhere has been developed to comply with these requirements.

Procedures – Principal Investigator:

1. Ensure that adequate numbers of properly trained staffs are available to conduct their required work.
2. Ensure that all employees coming in contact with animals, animal tissues, or animal fluids are enrolled in the UMC Occupational Health and Safety Program.
3. Ensure that all animal care personnel have completed the ACUC "Basic Training for Animal Care and Animal Use at MU" before animal contact.
4. Ensure that all applicable animal care and use Standard Operating Procedures are followed.
5. Ensure that all animals utilized for research or teaching are included on an approved UMC ACUC protocol and that a "Large Animal Request for Housing" has been approved.
6. Ensure that hazardous agents are used in a manner compliant with University Policy and in accordance with all applicable laws and regulations.
7. Ensure that all animals are observed at least once daily for signs of illness, injury or abnormal behavior and when an abnormal condition is noticed a veterinarian is notified to provide treatment.
8. Ensure that all applicable records and logs are properly completed.
9. Ensure that all animals are housed in an appropriate manner.
10. Conduct animal experiments in a manner which minimizes animal and human stress and anxiety.
11. Ensure that animal pain, discomfort or distress is alleviated by the proper use of analgesics, anesthetics or tranquilizers.
12. Ensure the psychological well-being of all animals under their care is maintained.
13. Ensure that proper sanitation practices are followed before, during and after animal experimentation.
14. Report any violations of the Animal Welfare Act, PHS Policy, UMC-ACUC policies, the *Guide* or SOPs to the ASRC Facility Manager and the Animal Care and Quality Assurance, Director.

Animal Care Personnel Training

Policy: It is the responsibility of the P.I. to provide an adequate number of properly trained personnel to maintain their animals during both the week and weekend hours, including holidays. Any person engaged in the care and use of animals within the Animal Sciences Research Center (ASRC) should be adequately trained to perform their duties in a humane manner and in compliance with all applicable laws, regulations and policies.

Applicable: All faculty, staff, students and employees of the University of Missouri, utilizing the animal facilities in the ASRC.

Purpose: To ensure that animals housed in the ASRC Large Animal Facilities receive appropriate care at all times and that all personnel involved in animal care and use, are adequately trained to perform their duties in a humane and lawful manner.

Introduction: Investigators must provide an adequate number of properly trained personnel to care for their animals. Personnel-training and animal care (daily husbandry practices) applicable to their species are the responsibility of the investigator. Examples of expected daily care would include, but, not limited to, observation, feeding, watering, and cleaning of the housing area, as well as the room. It is incumbent upon these investigators and the ASRC administration to ensure that all personnel working with animals do so in a proper and legal manner. This SOP outlines the principle areas of training that such persons should obtain in order to care for and use animals in CAFNR facilities.

Procedures:

1. Orientation programs will be scheduled throughout the year, as needed. Upon assignment to the Large Animal Facility, new students and animal care personnel should report to the Research Animal Facility Manager to make arrangements to attend an orientation session. The orientation session should be completed prior to any animal contact. Personnel training records will be maintained by the Research Animal Facility Manager.
2. All personnel involved in the day to day care of animals used within ASRC facilities must have completed the training module entitled “Basic Training for Animal Care and Use at MU” located at https://research.missouri.edu/acqa/ prior to animal contact.
3. Appropriate clothing and personal protective equipment will be provided and must be worn while working in the animal housing areas. The ASRC provides washers and dryers to be used to launder clothing worn in the animal areas. Washers and dryers are located in Units D4 and B. To minimize the spread of disease the Animal Facility Manager should be asked which should be used.
4. The ASRC provides hearing protection that should be worn when working with noisy species.
5. Animal care personnel must work in their assigned area and avoid indiscriminate visits to animal rooms outside their responsibility.
6. Eating, drinking and the use of tobacco products are not permitted in animal or service rooms.
7. An employee injured on the job should report immediately to their supervisors who will arrange for medical attention and completion of an accident report.
8. SOPs are provided which describe husbandry practices for livestock species commonly housed in the ASRC. Training should be provided describing their use and relevance to the species for which the personnel provide care.
9. Animal care personnel should be capable of recognizing clinical signs of common animal diseases and have an understanding of disease control practices.
10. Animal care personnel must understand the importance of security within the ASRC.
11. Animal care personnel must have an understanding of the biosecurity procedures utilized in the ASRC.
12. Animal care personnel must know how to humanely handle and restrain their animals.
13. Animal care personnel should have an understanding of the ACUC requirements for protocol review.

14. Animal care personnel should understand the proper methods of euthanasia for livestock.
15. Personnel who care for animals, handle animal tissues or fluids must be enrolled in the Occupational Health and Safety Program and recognize the health risk and zoonosis associated with the species they are working.
16. Animal care personnel must understand the importance and proper use of anesthetics/analgesics and their effects on pain management, if these agents are used.
17. Personnel providing care for animals undergoing experimental surgery are recommended to complete the ACQA's web-based Introductory Training Program in Animal Surgery located at https://research.missouri.edu/acqa_secure/survivalSurgery/index.php. This training module addresses surgical terms, pre-operative management, principles of operative technique, and post-operative care.
18. Prior to performing experimental surgeries, personnel must be certified proficient in the procedure by the PI and ACUC.
19. Animal care personnel should understand the importance of enhancing the psychological well being of research animals.
20. Animal care personnel should understand the importance of proper nutrition and feeding for all research animals.
21. Animal care personnel must understand the importance of proper personal hygiene.
22. Animal care personnel must understand the importance and proper procedure for handling and disposal of biohazards, as well as chemical and physical hazardous agents.

Security

Policy: Only authorized personnel will have access to the animal housing units within the Animal Sciences Research Center (ASRC).

Applicable: All faculty, staff, students and employees of the University of Missouri utilizing the animal facilities in the ASRC.

Purpose: To ensure that animals are housed in a secure manner and that the integrity of ongoing research is not compromised.

Introduction: Individual investigators using the ASRC are responsible for the daily husbandry of their animals. As a part of their educational process, much of the animal care is provided by undergraduate- and graduate-students; the remainder of the care is provided by investigators and research specialists. This system of animal care requires that many people have access to the animal facilities and provides opportunities for breeches in security. To minimize the security risks, the ASRC uses a magnetic, security system (Honeywell) at the entrance of each animal room. Only personnel listed on the Request for Animal Space form are issued security cards and the cards are active only for the duration of the experiment.

Procedures:

1. Animal care personnel receive training regarding the importance of security within the ASRC.
2. Only authorized personnel will have access to the large animal housing areas.
3. The Principal Investigator (P.I.) submits a request for keys, which allows entrance into the ASRC. Keys will be returned at graduation, or, if the persons employment is terminated.
4. A magnetic security card is utilized to gain entrance into the large animal housing areas. To obtain a "security card," an approved ACUC protocol along with a Request for Large Animal Housing, listing the personnel deemed necessary, must be submitted, by the P.I., to the Administrative Associate of the ASRC and the appropriate Large Animal Housing Unit Leader. Once housing is approved, personnel are issued "security cards" to the appropriate rooms for the duration of the experiment. The security system records which card, opens what door, at what time, providing a tracking tool in instances where security is breeched. If an employee is terminated or at graduation, "security cards" are returned to the Administrative Associate and deactivated. If a "security card" is not returned, it can be deactivated at any time by the Administrative Associate.
5. Doors for the animal rooms should not be propped open and should be locked at all times.
6. Personnel should watch for unfamiliar people and notify the Facility Manager, or MU Police if "strangers" are seen.

Occupational Health and Safety Program

Policy: The Animal Sciences Research Center (ASRC) supports the MU Occupational Health Safety Program – Animal Care Provider policy (OHSP) which states that any University employee (faculty, staff, students, volunteers, and visitors) should be enrolled in the OHSP program if they work with vertebrate animals, or animal tissues, fluids, secretions, and/or excretions, or if they handle caging and related equipment contaminated by animal tissues, fluids, secretions, and/or excretions.

Applicable: All faculty, staff, students and employees of the University of Missouri, utilizing the animal facilities in the ASRC.

Purpose: To ensure that all faculty, staff, students, employees and visitors of the University of Missouri, College of Agriculture Food and Natural Resources (CAFNR), CAFNR Farms and the Animal Science Research Center who have contact with vertebrate animals, or animal tissues, fluids, secretions, and/or excretions, or if they handle caging and related equipment contaminated by animal tissues, fluids, secretions, and/or excretions are enrolled in the MU-OHSP.

Introduction: It is a policy of the ASRC that all animal care employees must participate in the employee health program offered by the MU. This program is designed to protect employees from normal occupational health risk as well as risks peculiar to animal care occupations.

Safe work practices and good personal hygiene are the critical elements of a personnel health program. Proper protective clothing and devices are to be utilized as dictated by particular job responsibilities. Personnel are to practice good personal hygiene to prevent contaminating themselves, others, or laboratory animals with disease-causing organisms and materials. Medical examinations, vaccinations and tests serve as supplements to safe practices and personal hygiene, not as replacements.

Procedures:

Procedures for enrollment can be found at: https://research.missouri.edu/acqa_secure/ohsp

1. The employee completes the required online OHSP training found at the website above.
2. The director, principal investigator, or supervisor will complete the Hazard Evaluation Form (found at the above site) and email it to the OHSP Nurse Practitioner, as indicated on the form.
3. Upon receipt of the Hazard Evaluation Form, the OHSP Nurse Practitioner will contact the employee, and may ask them to complete a Confidential Health Questionnaire. If requested, once this is returned to the OHSP Nurse Practitioner by the employee, the OHSP process of enrollment has been completed. If the Nurse Practitioner does not request a Confidential Health Questionnaire, the employee is considered enrolled as long as the online OHSP training has been completed and the Hazard Evaluation Form has been turned in.
4. Both the employee and the supervisor will receive a completed copy of the OHSP Hazard Evaluation Form, with the Risk Assessment, completed by the OHSP Nurse Practitioner.
5. For questions about enrollment, please contact the OSHP Administrator at: OHSP@missouri.edu

Protective Clothing

1. The ASRC or the Principal Investigator (P.I.) will provide appropriate clothing for all personnel involved in animal care activities. This clothing is to be worn while working in the animal housing areas. Clothing is to be changed daily or as often as necessary to assure a clean appearance and to prevent contamination. Clothing is laundered by the ASRC.

2. Other protective clothing and devices such as disposable gowns, protective gloves, protective masks, face shields, safety glasses and respirators are supplied by the ASRC or P.I., as needed. Exam gloves should be worn when performing animal care or use tasks.
3. When known hazards are in use, special protective equipment, appropriate to the nature of the hazard, will be specified by EHS or the Director of OAR. In these instances, special protective equipment will be provided by the P.I. or ASRC.

Personal Hygiene

1. Sinks and hand soap are available and all employees will use them whenever moving from room to room, at the start of the work day, upon leaving work for breaks, meals, or restrooms, and when returning to work, to prevent contamination.
2. Eating, drinking, and the use of tobacco products are prohibited in animals housing and other areas where laboratory animals or hazardous agents are manipulated.

Animal Procurement

Policy: Procurement of livestock for research and teaching is the responsibility of the P.I. However, before animals may be housed in the Animal Sciences Research Center (ASRC) an approved ACUC protocol must be on file in the ACQA office and an approved Request for Large Animal Housing must be on file with the Administrative Associate for the ASRC. Additionally, animals must meet appropriate health standards before entering the animal housing units.

Applicable: All faculty, staff, students and employees of the University of Missouri utilizing the animal facilities in the ASRC.

Purpose: To ensure that animals housed in the ASRC are included on an approved ACUC protocol, that appropriate housing is available, and that animal health is maximized.

Introduction: Sources of animals housed in the ASRC vary, depending upon whether or not animals are available from CAFNR farms. Animals obtained from CAFNR farms are of known health status, while the health status of animals obtained from outside vendors may be less well known. The CAFNR veterinarian should be notified if an investigator intends to purchase animals from an outside source, so that the health status of the animals can be verified and additional vaccinations and testing performed, if needed. Animals purchased from sources of unknown health status (e.g. sale barns) will not be admitted until a quarantine observation period, required testing and vaccinations are completed. Health status of vendor animals may change quickly, so, rather than compiling a list of approved livestock vendors, the CAFNR veterinarian will verify the health status of the animals at the time of each order.

Procedures:

1. ACUC protocol submitted, approved, and on file in the ACQA office.
2. Request for large animal housing, submitted and approved.
3. P.I. determines if animals are available from a CAFNR farm.
4. If CAFNR animals are unavailable the P.I. checks with outside vendors and then notifies the CAFNR veterinarian of his intent to purchase.
5. CAFNR veterinarian contacts vendor's veterinarian and verifies health status of animals.
6. Vendor's veterinarian will supply health papers for purchased animals stating what tests were performed and the vaccination history of the animals purchased.
7. Upon arrival, the CAFNR Veterinarian will examine the health papers and health status of the animals before entry is permitted. Animals arriving from sources of unknown health status will not be allowed to enter the ASRC until an appropriate quarantine period is observed and appropriate testing and vaccinations given.
8. A period of physiological, psychological and nutritional adaptation will be provided before the experiment is begun.

Oversight of Veterinary Care for Agricultural Animals

Policy: Any agricultural animal used or housed within the Animal Sciences Research Center (ASRC) must receive adequate veterinary care in a manner that is acceptable with current veterinary practices. This policy applies to all animal units contained within the ASRC where livestock is housed and used in agricultural research and teaching.

Applicable: All faculty, staff, students and employees of the University of Missouri utilizing the animal facilities in the ASRC.

Purpose: To ensure all animals used or housed in the large animal facilities of the ASRC receive adequate veterinary care.

Introduction:

Veterinary medical care is an essential part of an animal care and use program. Adequate veterinary care for livestock, as for other species, involves implementing programs of disease surveillance, diagnosis, treatment, and end point resolution. The MU Attending Veterinarian (AV) is ultimately responsible for the veterinary care program for the ASRC. The objectives of the program include minimizing pain and distress, maintaining animal health and production, preventing zoonoses, and avoiding contaminants and residues in animal products. This document establishes standards for the organization of a livestock veterinary care program for animals housed in the ASRC.

Institutional Oversight of Veterinary Care

Animal Care and Use Committee (ACUC)

Each institution falling under the PHS Policy or the Animal Welfare Act regulations is required to have an Institutional Animal Care and Use Committee (IACUC) of a prescribed composition, and to assign the IACUC specific responsibilities. The University of Missouri-Columbia Animal Care and Use Committee (MUACUC) meets the prescribed membership requirements and is charged by the Institutional Official, (the Vice Provost for Research), with a specified set of responsibilities, which include:

- Semi-annual review of animal care and use programs;
- Semi-annual inspection of animal care and use facilities;
- Preparation of reports of the animal care and use program and facilities evaluations;
- Making recommendations to the Institutional Official regarding any aspect of the MU animal program, facilities or personnel training;
- Reviewing and approving protocols, making recommendations for modifications (to secure approval), or withholding approval of proposed and ongoing protocols involving the care and use of animals;
- Recommending suspension of activities involving animals that are not in compliance with standards;
- Reviewing concerns involving the care and use of animals at MU.

The MUACUC functions to support the efforts of investigators by:

- Assuring investigators, granting agencies, and the public of a sincere and methodical review of animal care and use to assure humaneness, a process which may allay concerns and increase support;
- Facilitating the involvement of veterinarians and other scientists in the application of new experimental animal procedures in solving problems;
- Contributing to the maintenance of quality animal care programs and facilities; and
- Advising MU on animal-related legislation and standards, and public concern.
- The OAR Director is the official Attending Veterinarian (AV) for MU and as such, is a permanent member of the MU-ACUC. The CAFNR Veterinarian is employed by OAR and serves as the alternate member for the Director as the attending veterinarian and ACUC member in case of an absence of the Director. The OAR is responsible for providing professional veterinary review of

protocols and consultation on facility and program evaluation. The OAR Director serves on the MUACUC as the attending veterinarian.

External Oversight of Veterinary Care

The United States Department of Agriculture (USDA) conducts periodic inspections of animal facilities for compliance with the Animal Welfare Act Rules and Regulations (Title 9 CFR). These inspections are unannounced and are conducted by a USDA veterinarian. All areas of the animal facilities and all animal records must be made available for inspection upon request during normal business hours. The following individuals, in descending order of preference, accompany the inspector: ACQA Director, CAFNR Veterinarian, OAR Director, Assistant Director, ASRC Facility Manager, and Building Coordinator. As a rule, deficiencies pointed out by the inspector are to be corrected immediately either by corrective action or by removal of animals to an acceptable area. At the end of the inspection, the individual who accompanies the inspector will sign the inspection report and retain a copy. The accompanying individual must be sure that each cited deficiency is clearly understood so corrections can be made. Copies of all inspection reports are filed in the ACQA, (Animal Care Quality Assurance), office.

The Public Health Service (PHS), an agency of the U.S. Department of Health and Human Services, has required that institutions, like MU, receiving PHS funding assure the humane care and use of animals. Awarded institutions must comply with the PHS Policy on the Humane Care and Use of Laboratory Animals (as well as the Animal Welfare Act). This compliance takes the form of an Animal Welfare Assurance statement filed with, and approved by, the Office for Protection from Research Risks (OPRR). MU's Assurance includes a statement of policy to comply with appropriate laws and guidelines; a listing of facilities; detailed descriptions of programs for animal care and use, occupational health, and training of personnel who work with animals; and a description of the IACUC, its functions and composition. In 1985, the Health Research Extension Act of 1985 was passed by Congress, and provided a statutory base for the PHS Policy. The OPRR reserves the right to make unannounced site visits to awardees institutions to verify compliance with PHS Policy, and is authorized to suspend funding in cases of serious noncompliance. MU has an assurance statement that covers all vertebrate animals used at MU in research and teaching.

Procedures: Institutional Organization for Veterinary Care

Attending Veterinarian and Office of Animal Resources

The Office of Animal Resources is the administrative unit that oversees the execution of the ASRC program of veterinary care consistent with the *Guide,* the *Ag Guide,* and *Animal Welfare Regulations*. The AV/Director, OAR is ultimately responsible for the veterinary care program. The AV has administrative authority, from the Office of the Vice Chancellor for Research, to exercise duties required by university policies, professional standards, and federal agencies, to ensure adequate veterinary care, ethical and humane use of animal in research and teaching. The AV may delegate authority to other staff/clinical veterinarians, to make immediate decisions when an animal's health or humane use is at risk. The AV, or their delegate, has authority to enter all animal use areas.

Manager of Clinical Veterinary Services for CAFNR (CAFNR Veterinarian)

The CAFNR veterinarian reports to the Director of OAR. This position acts as an agent for the Director of OAR and is responsible for the veterinary care and husbandry oversight of the animal care and use program within CAFNR and thus, the ASRC.

Clinical Veterinarians

The means of providing clinical veterinary care to livestock housed in the ASRC may vary, but in all cases must be provided by qualified veterinarians and under a veterinary – client relationship. Veterinarians treat

animals in consultation with the PI, but ultimately have authority to do whatever is needed to alleviate pain and distress. Veterinary care for the livestock housed in the ASRC is supplied by OAR veterinarians, the CAFNR Veterinarian and the Food Animal Section of the College of Veterinary Medicine (CVM). Emergency care must be provided 24 / 7 and may be provided by any of the above.

Health Requirements for Animal Housing

Policy: Livestock will meet and maintain a minimum health status before entering and while residing in the Animal Science Research Center (ASRC) large animal housing units.

Applicable: All faculty, staff, students and employees of the University of Missouri utilizing the animal facilities in the ASRC.

Purpose: To ensure that animals entering the ASRC are healthy and that disease transmission is minimized.

Introduction: The large animal housing units (Units C, D1, D2, D3, and F) contained within the ASRC provide intensive laboratory settings for swine, cattle and sheep. Generally, single animal species are housed within each animal room; however, some rooms are large and may be simultaneously occupied by multiple investigators. Housing of animals from multiple sources increases the likelihood of disease transmission, unless an adequate preventative health program and proper biosecurity is maintained. Livestock entering the ASRC must meet certain health standards.

Procedures:

Documentation of vaccinations and disease monitoring is required before livestock will be allowed to enter the ASRC.

The term "vaccinated" implies that the manufacturer's recommendations regarding "boosters" and ages at vaccination have been met.

The recommendations that follow should be considered as minimum standards and investigators are encouraged to expand the vaccination and testing programs to suit their individual needs.

Swine

1. All swine entering the ASRC will be free from signs of infectious or communicable diseases and will meet State and Local regulations.
2. Swine originating from locations other than Campus facilities overseen by the CAFNR Veterinarian, will be accompanied by an Official Certificate of Veterinary Inspection which must include appropriate (e.g. PRRS, PRV and brucellosis) test- dates and results.
3. Units C, D1, D2 and D3 are in close physical proximity to each other and share common hall- and entryways. This provides potential opportunities for disease transmission between animals of multiple investigators. Thus, health requirements will be similar for Units C, D1, D2 and D3. Unit F is physically separated from Units C, D1, D2 and D3 and only rarely do multiple investigators occupy this Unit at the same time. Health requirements for Unit F may be less stringent.
4. Swine originating from Campus facilities enrolled in the "PRRS monitoring program" overseen by the CAFNR Veterinarian are of known PRRS-virus status. These "PRRS monitored" animals may enter Units C, D1, D2 and D3 without further testing with regards to PRRS.
5. All swine entering Units C, D1, D2 and D3 from other sources must originate from herds in which a PRRS monitoring program is in place or must be individually tested negative for PRRS not more than 30 days prior to arrival. The CAFNR Veterinarian must verify that an acceptable PRRS monitoring program is implemented on the farms of origin and only after he has determined that the risk of PRRS transmission is minimal will animals be allowed to enter Units C, D1, D2 and D3. If individual testing is used as the method to verify PRRS status, selecting animals with negative test results from groups

where positives were detected will not be permitted; unless, the positive animal(s) has been confirmed negative using additional tests such as IFA or PCR.

6. Documentation of PRRS virus status is not required for swine housed in Unit F. However, it is suggested that investigators use caution when procuring swine from herds of unknown PRRS status. The CAFNR Veterinarian will assist investigators in determining PRRS status of non-CAFNR herds when needed.
7. All breeding swine entering Units C, D1, D2 and D3 will have a negative test for PRV not more than 30 days prior to arrival, originate from a qualified PRV-free herd, or originate from a Campus facility overseen by the CAFNR Veterinarian.
8. All breeding swine entering Units C, D1, D2 and D3 will have a negative test for brucellosis not more than 30 days prior to arrival, originate from a brucellosis validated-free herd, or originate from a Campus facility overseen by the CAFNR Veterinarian.
9. All breeding swine must be vaccinated against Lepto 5-way (Lepto *Brataslava* optional) and Parvo virus prior to arrival and will be revaccinated semiannually while residing in the ASRC.
10. All breeding swine must be vaccinated against Erysipelas prior to arrival and will be revaccinated semiannually while residing in the ASRC.
11. All breeding swine residing in the facility for an extended period of time must be included in the ASRC disease surveillance program and a sample of the animals (defined on the next page) tested for PRRS and Lepto on a quarterly basis. The large animal housing Units will fund this testing.
12. All feeder and finishing hogs entering Units C, D1, D2 and D3 must be vaccinated against Erysipelas, prior to arrival.

PRRS and Lepto monitoring for swine housed in the ASRC Units C, D1, D2 and D3 will be performed quarterly and the numbers tested for each investigator will be determined by the following formula.

Breeding animals	Number to test
1 - 10	Test all
11 - 35	Test 10 hd
>36	Test 30%, or a maximum of 30 hd

If positive results are detected during a monitoring test, the positive animal(s) must be promptly removed and all in-contact animals must be tested. If, on retest, an in-contact animal(s) is positive, all animals in the room will be tested and an appropriate PRRS elimination program, overseen by the CAFNR Veterinarian, will be instituted.

Cattle

All cattle entering the ASRC will be free from signs of infectious or communicable disease. All cattle entering the ASRC will meet State and Local regulations and if originating from a location other than a CAFNR farm, will be accompanied by an Official Certificate of Veterinary Inspection. Cattle originating from sources of unknown health status (e.g. sale barn) will be quarantined at a facility other than the ASRC and observed by the CAFNR Veterinarian for an appropriate time before admission is permitted. The ASRC has no quarantine facilities available, thus, cattle must reside at another location during this time. Additionally, cattle will meet the following requirements.

Breeding Cattle

1. All female cattle, 18 months, or older, will have a negative test for brucellosis not more than 30 days prior to arrival unless they are: 1) Officially Calfhood Vaccinated (OCV'd) and then the test age will be 20 months for dairy females and 24 months for beef, 2) originate from a certified brucellosis-free herd.
2. Bulls that are 18 months, or older, will have a negative test for brucellosis not more than 30 days prior to arrival or originate from a certified brucellosis-free herd.
3. All breeding cattle must be vaccinated against Lepto 5-way, IBR and BVD prior to arrival.
4. Breeding animals with active lesions of ringworm with resulting loss of hair or warts easily seen without close examination will not be permitted in the facility.

Feeding Heifers

1. Feeding heifers will meet the Brucellosis testing requirements as described for breeding cattle.
2. Feeding heifers must be vaccinated against 7-way Blackleg, IBR and BVD prior to arrival.
3. Feeding heifers with active lesions of ringworm with resulting loss of hair or warts easily seen without close examination will not be permitted in the facility.

Steers

1. There are no requirements regarding Brucellosis for steers.
2. Steers must be vaccinated against 7-way Blackleg, IBR, and BVD prior to arrival.
3. Steers with active lesions of ringworm with resulting loss of hair or warts easily seen without close examination will not be permitted in the facility.

Sheep

No tests are required for sheep to enter the ASRC. All sheep entering the ASRC will be free from signs of infectious or communicable disease. All sheep entering the ASRC will meet State and Local regulations and if originating from a location other than a CAFNR farm, will be accompanied by an Official Certificate of Veterinary Inspection. Sheep originating from sources of unknown health status (e.g. sale barn) will be quarantined at a facility other than the ASRC and observed by the CAFNR Veterinarian for an appropriate time before admission is permitted. Additionally, all sheep will meet the following requirements.

1. Sheep must be free from signs of "footrot," "soremouth" and "ringworm."
2. Lambs must be vaccinated against overeating disease (*Clostridium perf.* Type C & D) prior to arrival.
3. A negative test for Q fever may be required before pregnant ewes are allowed entry.

Documentation of Abnormal Health

Policy: All agricultural animals used or housed with the Animal Sciences Research Center (ASRC) will be observed at least once daily each day of the year for signs of illness, injury or other abnormality. The symptom, treatment and resolution will be fully documented to provide proof that adequate veterinary care was provided.

Applicable: All faculty, staff, students and employees of the University of Missouri, utilizing the animal facilities in the ASRC.

Purpose: To document that adequate veterinary care is provided to the animals housed in the ASRC.

Procedures – Investigative Staff

1. Animal care staffs are defined as anyone responsible for the daily care and husbandry of the animals housed in the ASRC. This is usually the investigator and their staff.
2. Animal care staffs will observe all animals under their care and use, at least once a day in the morning for any signs of illness, injury or other abnormality that may require veterinary treatment.
3. Animal care staffs will observe the current condition of the animals more frequently, than once a day, if on an experimental protocol, or if instructed by OAR veterinarians.
4. Animal care staffs will report any abnormality to the Principal Investigator and the ASRC Research Facility Manager who will then contact the attending veterinarian or designee to determine a course of action based upon the needs of the P. I. In the case of a veterinary medical emergency or if an animal is experiencing pain or distress, contact the Research Facility Manager or the attending veterinarian immediately.
5. Animal care staffs must document the abnormal condition of the animal on the Daily Summary of Animal Health Observations (located on the outside of each animal room door), complete a Laboratory Animal Clinical Record (Blue Card) on each affected animal or cage of animals, and then affix the clinical record to the animal's cage.
6. Complete the animal health record by:
    a. Filling in the top portion of the clinical record completely;
    b. Indicating the date and the abnormal condition in the space provided below the bold line;
    c. Initial or sign the entry on the same line that the entry was made.
7. The attending veterinarian or designee will then examine the animal(s) and recommend a course of action based upon the needs of the animal, the experimental protocol, and the Principal Investigator's requirements.

The attending veterinarian or designee will document the Clinical Record in SOAP format as follows:

- S – Subjective: The primary complaint or clinical observation, why the animal needs to be seen. Please see SOP on Abnormal Clinical Signs of Research Animals.
- O – Objective: Results of physical examination, clinical tests and/or other diagnostic tests.
- A – Assessment: Clinical diagnosis, tentative diagnosis including "rule-outs". In the case of multiple diagnoses, all will be numbered separately and addressed individually in the treatment plan.
- P - Plan: Will list a plan for resolving each diagnosis and appropriately numbered. The treatment plan will be prescribed completely with the following information:
- Specify drug name, strength and form and the amount to be given;
- Specify the route of administration and the frequency;
- Specify the length of time the medication is to be given.
- All administrations are to be documented when given; a check off box initialed by the person

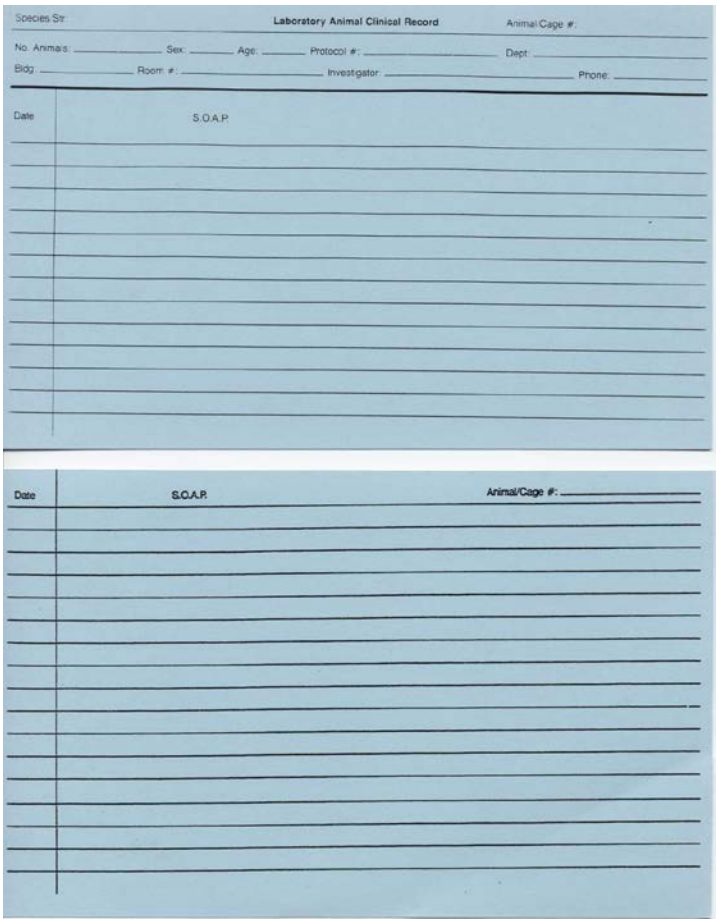
administrating the medication is the recommended method of documentation.

- Daily observations of clinical condition of the animal are to be documented by the person assigned to give medications.
- Each entry onto the clinical record is to be signed or initialed by the person making the entry.
- Clinical resolution of the case will be documented and signed off by the attending veterinarian and will indicate finalization of the record.

Following resolution, the ASRC Facility Manager or CAFNR Veterinarian retains all documentation.

Procedures – Animals Found Dead

1. It is the responsibility of the animal care staffs to observe each animal at least once each day of the year.
2. If an animal is found dead, the cause of death will be investigated. The ASRC Animal Facility Manager and/or the CAFNR veterinarian will be notified immediately if the death was unexpected (mortality not expected as part of an approved protocol). Note* - Anesthetic deaths are not to be expected.
3. The animal will be saved and placed in the appropriate cooler to await disposition. (MU-College of Veterinary Medicine, Veterinary Medical Diagnostic Lab cooler)
4. Mortality will be recorded on the "Daily Summary of Animal Health Observations" located on the animal room door or animal housing area.
5. Upon review of the situation, the CAFNR Veterinarian will determine the disposition of the animal.
6. Any unexplained deaths will be investigated by the MU-CVM, VMDL at the order of the CAFNR-, OAR-, and Clinical-, veterinarian or the Principal Investigator. A copy of all necropsy reports should be sent to the CAFNR Veterinarian.



Aseptic Surgical Preps

Policy: Surgical preparations will be done in an aseptic manner for agricultural animals housed in the Animal Sciences Research Center (ASRC).

Applicable: All faculty, staff, students and employees of the University of Missouri, College of Agriculture Food and Natural Resources and CAFNR Farms, utilizing the ASRC surgical facilities.

Purpose: To ensure that surgical preps are performed in a manner that will maximize asepsis.

Procedure:

1. **Clipping the hair:**
   Clip an area large enough to insure the surgical area will not become contaminated with animal hair.
   Step I. Clip the area against the grain of the hair coat using a 40/10 clipper head.
   Step II, Clip the area against the grain of the hair coat using a 40 clipper head.
   Step III, Vacuum entire animal.

2. **Rough Scrub:**
   Non-Aseptic procedure to remove organic matter and dead epithelium, to be preformed in the animal prep area.
   Step I. Using tap water and 4x4s, dampen the clipped area.
   Step II. Apply 1cc Chlorhexadine or Betadine Scrub per 20-30sq. inches.
   Step III. Scrub area using a circular pattern, starting from the center working outward to the edge.
   Step IV. Wipe off Chlorhexadine or Betadine using 70% Alcohol and 4x4s.

3. **Aseptic Surgical Scrub:**
   This procedure is performed in the OR and supervised by the surgeon.
   Step I, Proper attire for performing aseptic scrub: sterile gloves, mask, nurses cap and a scrub top.
   Step II. Using aseptic technique remove Chlorhexadine/Betadine soaked 4X4s from their glass container, and clean surgical site with a circular motion as in Step 3 above. Alternate with 4x4s soaked in 70% alcohol. Repeat each scrub 3 times.
   Step III. Using Aseptic technique apply a thin layer of full strength Chlorhexadine/Betadine Solution by painting or spraying. If the solution pools, blot dry with Sterile 4x4s, otherwise let it air-dry.

4. **Draping:**
   The surgeon drapes the patient, using sterilized drapes.

Technical Assistance:

Technical assistance is available from the OAR or the CAFNR Veterinarian.

Experimental Surgery and Documentation of Post-Surgical Care

Policy: Documentation of post-surgical care (pink card) is required for all livestock used or housed in the Animal Sciences Research Center (ASRC) to ensure that adequate veterinary care was provided.

Applicable: All faculty, staff, students and employees of the University of Missouri that utilize the animal facilities in the ASRC.

Purpose: This policy ensures that experimental and educational uses of livestock, as surgical subjects, are in compliance with applicable federal regulations, NIH policies and guidelines, and AAALAC accreditation standards.

Introduction:

Experiments Involving Survival Surgery

MU's policy on the use of animals in experiments involving survival surgery covers all UMC research, educational, and testing uses of animals that involve surgical procedures. This policy ensures that experimental and educational uses of animals, as surgical subjects, are in compliance with applicable federal regulations, NIH policies and guidelines, and AAALAC accreditation standards.

In compliance with MU's policies, all proposed experimental and educational uses of vertebrate animals must be reviewed and approved by the MU Animal Care and Use Committee prior to initiation of the project, regardless of the source of funding support.

Survival surgery on livestock should be performed using sterile instruments, gloves and aseptic procedures, in a designated surgical facility. Within the ASRC this corresponds to Unit D4, rooms E 142 (surgery) and E 149 (surgery prep). Office of Animal Resources- or the CAFNR- Veterinarian is available to provide general or specific assistance and training in aseptic techniques and/or basic surgical techniques.

Qualifications of Personnel Participating in Animal Surgeries:

1. All principal investigators, students, and animal-care personnel will have at least completed the "Basic Training in Animal Surgery" tutorial, available on-line at the ACQA web-site, before assisting with an experimental animal surgery.
2. All principle investigators, students, and animal-care personnel will have completed an approved experimental animal surgery class, demonstrated proficiency in the procedure to qualified OAR staff and documented their proficiency with ACQA before performing surgical procedures unassisted.

Animal Fasting Prior to Surgery:

Animal feed should be withheld for at least 12 hours prior to surgery to prevent regurgitation and aspiration pneumonia, unless otherwise noted in the experimental protocol or by the direction of a Clinical Veterinarian directly involved with the case. Depending on the animal species, water may be provided until the time the animal is anesthetized. Cattle may require an extended fast before undergoing general anesthesia.

Surgery Facility Standards:

1. A facility used for aseptic surgery should be used only for that purpose, and should be maintained and operated to insure its cleanliness.
2. . The operating room for aseptic surgery should be separated from areas used for preparation of the subject and preparation of the surgeon. Another separate area should be provided for storage of surgical

instruments, supplies, and preparation of surgical packs.

3. The operating room should contain only the equipment, instruments, apparatus, and supplies necessary for the procedure at hand.
4. The operating room design and construction should facilitate sanitary maintenance by having only smooth, sealed, seamless and impervious surfaces which resist the accumulation of dirt and which are also easy to clean and sanitize.
5. The operating room should be cleaned and sanitized before and after surgery.

Minor and Emergency Surgeries Performed in Locations Other Than a Surgery Room:

It is occasionally in the best interest of the experimental animal that minor and emergency surgeries be performed in the area where the animal is normally housed. In these instances it is expected that aseptic surgical techniques will be used in conjunction with adequate anesthesia and analgesia.

Multiple survival surgeries on a single animal are generally not permitted:

Cost alone is not adequate justification. Multiple surgeries may be permitted, provided they are related components of a research or instructional project requiring more than one intervention in the same animal and are approved by the ACUC.

Post-surgical care is the responsibility of the Principal Investigator or Instructor:

1. Required post-surgical care, as defined in the ACUC approved protocol includes: observation of the animal until it has recovered from anesthesia, administration of supportive fluids, antibiotics, analgesics, tranquilizers, and other drugs, where appropriate, to ensure the animal's physical comfort and optimal recovery. A pink surgical record must be maintained nearby, and annotated daily, as to the animals' progress for 14 days, or until removal of sutures/staples. Following the animals post-surgical recovery, the case should be noted as resolved on the "pink card" and given to the ASRC Facility Manager for retention.
2. Appropriate facilities, equipment, and trained personnel to deal with emergencies should be available for the post-surgical care of animals. Surgery should be scheduled so as to ensure availability of such personnel during the postoperative recovery period.
3. The P.I. is responsible for monitoring postoperative care, however, OAR veterinarians and the CAFNR Veterinarian are available to advise and assist in the provision of postoperative care, when needed.
4. If in the judgment of the Attending Veterinarian or their designate, adequate postoperative care is not being provided, the investigator or instructor will be provided with specific recommendations for improving care.
5. If the investigator or instructor cannot be contacted or if adequate care is not provided after contact, OAR will provide the necessary care, bill the investigator's project or will euthanize the animal.

Medical records are required to document the postoperative care of animals:

Individual records must be maintained with the animal for each animal housed in the ASRC. These cards are available from the ASRC Facilities Manager. During postoperative care, the card will remain with the animal. A pink tag can be substituted on the cage or run, as long as the card is nearby and accessible. At the conclusion of the postoperative care, this record is returned to the ASRC Facility Manager for retention.

Date _____ **Laboratory Animal Surgery/Anesthesia Record** Animal # _____

Species _____ Protocol # _____ PI _____

Dept _____ Surgeon/Tech _____ Phone _____

Summary of Surgical Procedures _____

Pre-Surgical Evaluation	WT	Temp	HR	RR	MM
	Other				

Preanesthetic Drug(s)				Anesthetic Induction			
Drug	Dose	Route	Time	Drug	Dose	Route	Time

Anesthesia Method _____ Time of Anesthesia Termination _____

The Principal Investigator is responsible for maintaining a record of postoperative care (see reverse). Information and training on appropriate postoperative treatments and procedures is available from the facility veterinarian or the Office of Laboratory Animal Medicine (OLAM).

Person(s) Responsible for Post-Op Recovery _____ Phone _____

POST OP RECORD *(Be sure to note return of reflexes, regaining consciousness, and ability to maintain sternal recumbency as well as TP*

DATE	TIME	OBSERVATIONS	TREATMENT

Postoperative Care of Animals

Policy: The Animal Sciences Research Center (ASRC) supports the regulatory guidelines of "The Animal Welfare Act", "*The Guide for the Care and Use of Laboratory Animals*", and "*The Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching*", and current standards of veterinary care which require the provision of adequate postoperative care for research animals and the maintenance of appropriate postoperative medical records. These responsibilities lie with the principle investigator.

Applicable: All faculty, staff, students and employees of the University of Missouri utilizing the animal facilities in the ASRC.

Purpose: To ensure that adequate veterinary care is maintained throughout the postoperative period.

Procedures:

Anesthetic Recovery Phase

1. Animals should be placed in a clean, quiet environment where they can be observed closely and continuously while they recover from anesthesia Table 1).
2. All food and water bowls and any other physical hazards should be removed from the cage where the animal is recovering from anesthesia
3. Trained personnel should be available to deal with any emergencies.
4. Temperature, pulse, and respiration should be monitored, with a frequency determined by the animal's condition (Table 1).
5. Water-circulated heating pads or heat lamps should be used for appropriately sized animals to help maintain body temperature, since hypothermia may occur. This should be done especially after procedures that involve intensive dissection.
6. Care should be taken not to accidentally overheat or burn the animal.
7. The animal's condition, and the surgical procedure performed, determines the need for further supportive care, e.g., fluids, electrolytes, analgesics, antibiotics, etc.
8. The anesthetic recovery phase is concluded when the animal is reasonably alert and has recovered its protective reflexes, (e.g., swallowing), will fight if breath is held off (Table 1).

Long term postoperative care

1. Small amounts of food and water may be given once the animals have recovered from anesthesia. Depending on the surgical procedure, routine feeding and watering may be resumed on the day after surgery.
2. Assess the postoperative pain and administer analgesics, sedatives, or tranquilizers as required.

Table 1. Anesthetic Monitoring and Recovery
Print the table below for future reference.

State of Recovery	Examination Frequency	Surgical Record Notation Includes	Other Supplemental Care
Unconscious or semi-conscious; Not sternally recumbent	Not less than once every hour	Body temperature Heart and respiratory rates Capillary refill time Jaw tone Toe pinch response Time of extubation	Turn laterally-recumbent animals side to side frequently Maintain dry Adjust ambient temperature and inject fluids as necessary
Conscious; Sternally recumbent; May sit, but cannot stand	Not less than once every 6 hours	Body temperature Capillary refill time Condition of incision site	Maintain dry Adjust ambient temperature as necessary Consider additional analgesics
Standing and moving about; Not eating/drinking normally	Twice daily	Body temperature Degree of alertness and activity Food/water consumption Condition of incision site	Examine for abnormalities Consider additional analgesics
Active and alert; Eating/drinking normally; Skin sutures still in place	Daily	Notation of surgical site care until suture removal	Remove sutures 10-14 days post-surgery
Animal normal; Skin sutures removed	Post-surgical records and care not required		

Anesthetics, Analgesics and Tranquilizers (AATs)

Policy: NIH guidelines and institutional policy require that anesthetics, analgesics and tranquilizers (AATs) be used whenever experimentation would otherwise cause pain, discomfort, or distress to laboratory animals. The Animal Sciences Research Center (ASRC) supports and will ensure that these guidelines are met for all animals housed in their facilities.

Applicable: All faculty, staff, students and employees of the University of Missouri utilizing the animal facilities in the ASRC.

Purpose: To ensure that the NIH and institutional policy guidelines, regarding AATs, are met for all livestock housed in the ASRC.

Introduction: NIH guidelines and institutional policy require that AATs be used whenever experimentation would otherwise cause pain, discomfort, or distress to animals. If a procedure must be conducted without the use of AATs (because such would defeat the purpose of an experiment) it must be justified and approved by the MU Animal Care and Use Committee. Muscle relaxants or paralytic drugs (e.g., Succinylcholine or other Curariform drugs) are not anesthetics, and are not permitted.

In general procedures which by themselves induce no more pain, stress, or discomfort than the administration of these drugs, may be done without them. This includes injections, blood samplings, and routine medical treatments.

Individuals, who use AAT agents in the conduct or support of animal research and teaching, share in the responsibility of minimizing animal pain and distress. Proper use of AAT agents requires knowledge of the pharmacology of these agents as well as species differences in drug response. All users of AAT agents should consult with an OAR, CAFNR, or the attending veterinarian for their research facility, before initiation of a project requiring these drugs. The OAR veterinary staff reviews the use of AATs as part of the ACUC protocol review. The research staff must use these agents as approved.

The attending veterinarian for a research facility is responsible for providing guidelines and consultation on the appropriate use of AATs, in order to effectively minimize pain and/or discomfort in livestock. At MU, the use of these agents will, in general, be limited to investigators and their technicians, OAR and CAFNR veterinarians, or OAR technical staff under veterinary supervision.

In addition to veterinary consultation on the appropriate use of AATs, research personnel should be trained on proper delivery of the agents. The training should be provided by the OAR veterinary staff, the CAFNR Veterinarian, or a clinical veterinarian associated with the project.

Recognition of Pain

Physiological responses to pain, particularly acute pain, include increased blood pressure and heart rate, dilation of pupils, increased respiration, elevated temperature, and an arousal response on the electroencephalogram. Changes in blood cell counts, cardiovascular factors, and circulating levels of cortisol, free fatty acids, glucagons, and acute phase reactant proteins may serve as indicators that an animal is experiencing pain or distress during an experiment. Behavioral responses to pain vary among species, and among individuals within species. To recognize animal pain one must be familiar with the normal and abnormal behavioral repertoire of the species and individual animals.

Behavioral signs of acute pain include:

- guarding (protecting the painful area)

- vocalizing (whining and crying when moved or the painful area is palpated)
- licking, biting, or scratching a particular area
- restlessness, pacing, and repeatedly lying down and getting up again
- lack of mobility (with joint, colic or gut pain)
- failure to groom, causing an unkempt appearance; and
- abnormal resting postures, hunched-up, saw-horse stances.
- reluctant to move
- not eating or drinking normally

In chronic pain, animals become more tolerant, making recognition of behavioral signs more difficult. Typically, animals become withdrawn and inattentive and show little other behavioral evidence of suffering when pain becomes chronic. In the absence of evidence to the contrary, procedures or conditions that would be painful for humans should be assumed painful for animals.

Distress is due to prolonged or intense stimuli that evoke harmful responses that interfere with well-being, comfort, and/or reproduction, and are capable of inducing pathologic changes. Distress responses may cause a variety of disorders in animals, such as alterations in feeding behavior, hypertension, inefficient reproduction or feed conversion, gastric and intestinal ulceration, electrolyte imbalance, urticaria, and immune system abnormalities.

Use of Anesthetics, Analgesics and Tranquilization

Definitions:

1. **Anesthetic** - drug or agent that is used to abolish the sensation of pain. Local anesthetics such as procaine, lidocaine, and bupivicaine produce regional anesthesia of tissues around the site of local infiltration or prevent afferent nerve conduction through an infiltrated area. General anesthetics such as thiopental, thiamylal, and pentobarbital when injected, or halothane, isoflurane, or sevoflurane when inhaled, depress the central nervous system and induce deep sleep during which the sensation of pain is lost.

2. **Analgesic** - drug which alleviates pain without causing a loss of consciousness. (Examples include morphine, meperidine, pentazocine, buprenorphine, aspirin, and phenylbutazone.)

3. **Sedative** - agent which allays activity and excitement by producing a mild degree of central nervous system depression in which the patient is awake but calm and free of nervousness.

4. **Tranquilizer** -A drug which acts on the emotional state to calm and quiet the animal without loss of consciousness. These drugs increase the threshold to environmental stimuli and depress many physiological functions, but do not produce sleep or analgesia. When used in combination with dissociative anesthetics, a degree of general anesthesia is produced which is effective for certain procedures. Acepromazine, xylazine and valium are examples.

5. **Controlled drug**. A drug classified as having the potential for human abuse by the Drug Enforcement Agency (Federal) and the Bureau of Narcotics and Dangerous Drugs (State). Controlled drugs are commonly used as AATs in veterinary medicine and require scrupulous record keeping regarding their disposition. The CAFNR Veterinarian or the OAR is available to assist investigators in procuring, storing and record keeping for Controlled Drugs. The Director of the Division of Animal Sciences maintains a DEA and BNDD registration to facilitate the procurement of ACUC approved controlled drugs for the investigators within the Division.

General Guidelines:
No specific guidelines for a particular animal species and drug can properly meet the needs of every experiment. All users of AAT agents in research and teaching are urged to contact an OAR or CAFNR veterinarian in the planning of their experimental use of AATs . The following tables list commonly used AAT compounds and dosages used for swine and cattle.

Swine

Injectable Anesthesia				
Agent	**Dosage (mg/kg)**	**Route**	**Duration**	**Withdrawal[a]**
Ketamine	11-33	IV, IM	15 min	3 d
Ketamine/acepromazine	22/1.1	IM		7 d
Ketamine/xylazine	20/2	IM	30-45 min	10 d
Ketamine/xylazine /oxymorphone	2/2/0.075	IV	20-30 min	?
Propofol	2-8	IV	10 min	?
Telazol	4-6	IM	30 min	?
Telazol/xylazine	4-6/2.2	IM	20-30 min	?

Inhalation Anesthesia			
Agent	**Dosage (mg/kg)**	**Route**	**Comments**
Isoflurane	4-5% induction 1.-2% maint.	Inhalation	Requires use of a precision vaporizer

Analgesics					
Agent	**Trade Name**	**Dosage (mg/kg)**	**Route**	**Duration**	**Withdrawal[a]**
Aspirin		10-20	PO	4 hr	1 d
Buprenorphine	Buprenex	0.005-0.02	IM, IV	6-12 hr	?
Butorphanol	Torbugesic	0.1-0.3	SC, IM, IV	4 hr	?
Carprofen	Rimadyl	2-3	IV, SC, PO	24 hr	?
Fentanyl		0.02-0.05	IM	2 hr	?
Flunixen	Banamine	2.2-4.4	IV, IM, SC	12-24 hr	15 d
Meperidine	Demerol	2-10	IM	4 hr	?
Oxymorphone		0.15	IM	2-4 hr	?
Phenylbutazone		10-20		12 hr	?

Sedatives and Tranquilizers				
Agent	**Dosage (mg/kg)**	**Route**	**Comments**	**Withdrawal[a]**
Acepromazine	0.2-1.1	IM, IV		7 d
Diazepam	0.5-1.5	IV		?

Miscellaneous				
Agent	**Dosage (mg/kg)**	**Route**	**Comments**	**Withdrawal[a]**
Atropine	0.04-0.09	IM	Anticholinergic	7 d
	0.02	IV		

Yohimbine	0.1-0.15	IV	α_2-antagonist	3 d ?

[a] Withdrawal times should be considered minimum times before humane harvest. Estimated times were taken from the Food Animal Residue Avoidance Databank website or manufacture's package inserts.

Cattle

Injectable Anesthesia				
Agent	**Dosage (mg/kg)**	**Route**	**Comments**	**Withdrawal[a]**
Xylazine/ketamine	0.1-0.2/10-15	IM	Calves	5 d meat, 72 hr milk
	0.03-0.05/3-5	IV	Calves	5 d meat, 72 hr milk
	0.1-0.2/2	IV	Adults	5 d meat, 72 hr milk
Diazepam/ketamine	0.1/4.5	IV		?
Medetomidine/ketamine	20µg/0.5	IV	Calves	?
Guaifenesin 5%/Ketamine 1-2 mg/ml	2 ml/kg	IV		?
Guaifenesin 5%/thiobarbitrate 2-4 mg/ml	2 ml/kg	IV		?
Guaifenesin 5%/ketamine 1-2 mg/ml/xylazine 0.1 mg/ml	0.5-1 ml/kg 1.5 ml/kg/hr 2 ml/kg/hr	IV IV IV	Induction Maint calves Maint adults	? ? ?
Tiletamine-zolazepam	4	IV	Healthy calves	?
Xylazine/ tiletamine-zolazepam	0.1/4.0	IM	Healthy calves	?
	0.05/1.0	IV	Healthy calves	?

Inhalation Anesthesia			
Agent	**Dosage (mg/kg)**	**Route**	**Comments**
Isoflurane	4-5% induction 1.-2% maint.	Inhalation	Requires use of a precision vaporizer

Analgesics					
Agent	**Trade Name**	**Dosage (mg/kg)**	**Route**	**Duration**	**Withdrawal[a]**
Aspirin		10-20	PO	8 hr	1 d meat, 24 hr milk
Buprenorphine	Buprenex	0.05-0.1	IM	8-12 hr	?
Butorphanol	Torbugesic	0.1-0.3	SC, IM, IV	4-6 hr	?
Carprofen	Rimadyl	0.5-4	IV, SC, IM	24 hr	?
Ketoprofen		1.0-3.0	SC, IM, IV	24 hr	?
Flunixen	Banamine	1.1-2.2	IV, IM,	24 hr	10 d meat, 72 hr milk
Phenylbutazone		2.0-5.0 4.0-8.0	IV PO	24 hr 24 hr	40 d meat, 120 hr milk, do not use in female dairy > 20 months of age

Miscellaneous

Agent	Dosage (mg/kg)	Route	Comments	Withdrawal[a]
Atropine	0.06-0.1	IV	Anticholinergic	7 d meat, 24 hr milk
Glycopryrrolate	0.005-0.01 0.002-0.005	IM IV	Anticholinergic	?
Yohimbine	0.1-0.15	IV	α_2-antagonist	5 d meat 72 hrs milk

Sedatives and Tranquilizers				
Agent	**Dosage (mg/kg)**	**Route**	**Comments**	**Withdrawal[a]**
Acetylpromazine	0.03-0.1	IM		7 d meat, 48 hr milk
Xylazine	0.015-0.025	IM or IV	Sedation	5 d meat, 72 hr milk
	0.1	IV	Recumbency	5 d meat, 72 hr milk
	0.2	IM	Recumbency	5 d meat, 72 hr milk
Detomidine	2.5-10µg/kg	IV	Sedation	?
	40µg/kg	IV	Recumbency	?

[a] Withdrawal times should be considered minimum times before humane harvest. Estimated times were taken from the Food Animal Residue Avoidance Databank website or manufacture's package inserts.

Environmental Enrichment

Policy: Environmental enrichment provides many positive rewards to research animals and those individuals who work them on a daily basis. The ASRC supports the MU Animal Care and Quality Assurance (ACQA) policy and attempts to provide enrichment for all animals housed in its large animal facilities.

A**pplicable:** All faculty, staff, students and employees of the University of Missouri utilizing the animal facilities in the ASRC.

Purpose: To ensure that species specific enrichment or socialization programs are provided for animals housed in the ASRC which meet or exceed any minimum standards as described in the Animal Welfare Act or PHS Policy.

Procedures:

Cattle

Cattle are considered to be herd animals, and prefer to be housed in similar groups. If it is necessary to house animals individually, they should have visual and olfactory contact with similar animals (numerous "toys" such as chains or suspended milk cartons can be provided to cattle to prevent boredom, however, few individuals will use these objects). In the wild, cattle graze throughout the day and spend the rest of the time ruminating. Whenever possible, feeding practices should be altered to allow animals to eat slowly over several hours time, and a clean dry area should be provided to allow these animals to lie down.

Sheep

Sheep are considered to be social animals, and prefer to be housed in similar groups. If it is necessary to house animals individually, they should have visual and olfactory contact with other sheep (numerous "toys" such as chains or suspended milk cartons can be provided to cattle to prevent boredom, however, few individuals will use these objects). In the wild, sheep graze throughout the day and spend the rest of the time ruminating. Whenever possible, feeding practices should be altered to allow animals to eat slowly over several hours time, and a clean dry area should be provided to allow these animals to lie down.

Swine

Enrichment is considered important in swine for several reasons. Enrichment helps prevent boredom, reduces behavioral vices and prevents aggression in social groupings. Enrichment also helps reduce adverse responses and stress in response to human contact.

Several types of enrichment objects can be used with pigs such as rubber hoses: metal chains or cloth strips attached to pens, hard plastic balls, or bowling balls can be placed on cage floors or attached to the side of cages or pens. Additionally, clean empty plastic 2 liter soda bottles, or empty milk jugs can be placed within the animal pen and discarded once they are crushed or excessively worn. Enrichment objects allow pigs to exhibit natural behaviors such as chew, tug and root and more importantly act as a method of stimulation for the pig. Some potential down sides to the above objects are that pigs don't like to play with the balls once they have rolled in manure, so they need to be routinely cleaned or hung from the side of the pen. Radios may also be used in swine rooms; if the animal care staff randomly selects the channels and usage times.

Another area of enrichment is directed toward the pig's natural foraging activity. Contact bedding such as straw

or shavings in their pens is very effective to help stimulate swine. Straw is also desirable for pregnant sows, so as to make a nesting area if the animals are not placed in farrowing crates. This type of bedding can clog drains, so its use is encouraged in outdoor facilities and areas where floor drains are not used.

Interaction between swine and humans is also an important enrichment area. Caretakers, technicians and veterinarians should talk to and stroke animals in cages several times a week. Interactions with the pigs, helps reduce their anxiety towards humans. In this same fashion, leaving a radio playing in a pig room will help pigs be less startled by humans and human associated noises.

Another area of enrichment pertains to a pigs preferment for group housing. Every attempt should be made to group house compatible pigs, when space constraints and protocols allow.

Finally, exercise can be worked into cage cleaning regimens. Pigs can be allowed to run up and down the aisles in the room during pen cleaning. It is perceived that pigs get a great deal of enjoyment from this.

Controlled Drugs

Policy: Controlled drugs used in animal research must be included in approved ACUC protocol and must be procured, stored and used in a manner compliant with State and Federal regulations.

Applicable: All faculty, staff, students and employees of the University of Missouri utilizing the animal facilities in the ASRC.

Purpose: To ensure that State and Federal regulations are met with regards to the procurement, storage and use of controlled drugs within the ASRC.

Procedures:
Principal investigators are responsible for obtaining an individual Federal (DEA) and State (BNDD) research license and to procure, store and use controlled drugs in a manner that is compliant with Federal and State regulations.

The OAR veterinary staff and CAFNR Veterinarian are available to assist with this process. The Director of the Division of Animal Sciences maintains a DEA and BNDD registration to facilitate the procurement of ACUC approved controlled drugs for the investigators within the Division.

Animal Euthanasia

Policy: Animal euthanasia will be performed in a humane manner in accordance with the AVMA Guidelines for Euthanasia of Animals: 2013 This policy applies to all Animal Sciences Research Center (ASRC) Large Animal housing units where livestock is housed and used in biomedical research, agricultural research, and teaching.

Applicable: All faculty, staff, students and employees of the University of Missouri utilizing the animal facilities in the ASRC.

Purpose: To ensure that euthanasia is performed in a uniform, humane manner, in accordance with the AVMA Guidelines for Euthanasia of Animals: 2013.

Introduction: Animal euthanasia can be defined as the intentional induction of death by a procedure which is painless to the animal being killed. Current moral, scientific and legal principles dictate that animals be killed only by methods which fulfill the definition of euthanasia. It follows from the intent of killing by euthanasia that gentle, careful handling of subject animals is of the utmost importance during the procedure in order to minimize distress to the animal and to the operator. It is also of critical importance to ensure that death has occurred to avoid recovery after disposal.

The ASRC houses a wide variety of animals used in teaching and research. Many of the approved methods of euthanasia require technical proficiency for and should not be attempted without prior training (e.g. intravascular injection methods). Training in proper technique is available through the Office of Animal Resources or the CAFNR Veterinarian. Documentation and maintenance of training records is the responsibility of the P.I.
It is beyond the scope of this SOP to describe in detail all acceptable methods of euthanasia for each species housed in the ASRC Large Animal units,, thus the reader is referred to the AVMA Guidelines for Euthanasia of Animals: 2013 located at the following web address http://www.avma.org/issues/animal_welfare/euthanasia.pdf for further information.

Procedures: Animals housed in the ASRC Large Animal housing units are associated with approved ACUC protocols. When animals are euthanized, as a part of the experimental design, the procedure is described in the protocol and approved by the ACUC. ACUC policy requires that animals are euthanized to the standards of the most current version of the AVMA guidelines. Thus, methods to euthanize animals, due to the experiment, are described and approved in the ACUC protocol. Occasionally, animals become sick or injured, need to be euthanized, and the cause is not associated with the experiment. In these instances the veterinary staff will euthanize the animal in accordance with the AVMA standards. ,OOccA

Restraint, Confinement and Tethering

Policy: It is the policy of the Animal Sciences Research Center (ASRC) that all livestock housed within their facilities will comply with the policies described within the *Guide, Ag Guide*, MU Handbook on Humane Animal Care and Use and the MU ACUC Policies with regard to restraint, confinement and tethering.

Applicable: All faculty, staff, students and employees of the University of Missouri utilizing the animal facilities in the ASRC.

Purpose: To ensure that livestock is humanely housed within the ASRC.

Introduction: The ASRC large animal housing facilities represent an "Intensive Laboratory Environment" as defined in the *Ag Guide*. The *Guide for the Care and Use of Laboratory Animals* (*The Guide*) provides space recommendations for farm animals commonly used in biomedical research. These should be distinguished from guidelines presented in the *Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching* (*Ag Guide*) which provides minimum floor area recommendations for swine, cattle and sheep used in agricultural research and teaching (i.e., production studies). The policy presented within this SOP is representative of the MU ACUC guidelines and is applicable to both biomedical research and production studies for the three species of livestock (swine, cattle and sheep) commonly housed within the ASRC.

Procedure: Scientific justification must be provided in an approved protocol, or the following ACUC policies must be followed

Swine

Gestating Stall

Policy: Gestating stalls that are used to house swine for any purpose other than agricultural research in a production-type setting (i.e., on a farm) shall be considered non-standard housing and will require scientific justification unless the floor space provided by the stall falls within the *Guide* and *Ag Guide* space recommendations for the size of pig housed therein.

Reasoning: Housing pigs in gestating stalls does not meet the definition of physical restraint as presented in the Guide (i.e., these are not mechanisms that allow for collection of samples, therapy, experimental manipulation, etc.). Nevertheless, the *Guide*(which is relevant to animals housed in a non-production setting) recommends "an animal must have at least enough space to turn around and to express normal postural adjustments". Further, interpretation of the Animal Welfare Act regulations by the USDA prohibits the use of gestation stalls for USDA covered pigs. Consequently, scientific justification and approval by the Animal Care and Use Committee (ACUC) are required to house swine in gestating stalls if they are not in a farm-type setting and the gestation stall is not of adequate size as recommended by the *Guide* and *Ag Guide* for the size of pigs housed therein.

Farrowing Pen/Crate

Policy: Farrowing pens/crates are classified as standard housing by the ACUC. Sows may be confined to farrowing crates from Day 109 of gestation until the piglets are weaned. Housing in farrowing crates beyond this timeframe requires justification and approval by the ACUC.

Reasoning: Housing pigs in farrowing crates does not meet the definition of physical restraint as presented in the *Guide*. The *Ag Guide* mentions that some degree of confinement of periparturient sows is both necessary and preferred. These systems measure ~22-24 inches in width by ~7 feet in length, and this meets

the minimum size recommendations presented in the *Ag Guide* for lactating sows. Furthermore, the ACUC recognizes that there is protection afforded to the offspring with the use of farrowing crates. The recommended timeframe (day 109 to weaning) for housing in farrowing crates is the period specified in the *Ag Guide.*

Metabolism Stall

Policy: Metabolism stalls shall be classified as a mechanism of restraint that requires ACUC approval. Flooring and penning materials should be appropriate for animal size and, if so, pigs may be housed in metabolism stalls for extended periods of time. Pigs should be held in metabolism stalls no longer than is required to meet the research objectives as defined in the approved animal care protocol, and twice-daily interactions (or more) between animal care staff and the pigs are essential.

Reasoning: Metabolism stalls are used to house swine individually. Usually in these systems, pig movement is restricted, there may be no visual interactions with other pigs, and samples of urine, feces, blood, etc. are collected. Thus, housing in a metabolism stall meets the definition of physical restraint as presented in the *Guide.* Further, the *Ag Guide* recommends that metabolism stalls be used to house pigs only with ACUC approval.

Restraint Cage, Cradle or Stand

Policy: If used for more than 30 minutes, these devices will be classified as mechanisms of prolonged restraint that require ACUC approval. Swine should be maintained in these devices no longer than is required to meet the objectives of the study as defined in the approved animal care protocol. Users should be aware that these systems are generally useful for pigs weighing 25-150 kg and that increased attention is required from animal care staff during their use.

Reasoning: Pigs are held under duress in these systems and they will usually struggle and vocalize. Acute and chronic stress indicators (i.e., increased corticosteroid levels, decreased feed conversion and growth rates) have been reported using these methods.

Passive (or Panepinto) Sling

Policy: This shall be classified as a mechanism of restraint that requires ACUC approval. Swine should be maintained in these devices no longer than is required to meet the objectives of the study as defined in the approved animal care protocol. Large slings may be used for pigs weighing as much as 100-150 kg. Slings work well for short duration restraint. However, for sling restraint of long duration (=4 h), alternative systems should be considered.

Reasoning: Sling restraints work well for short duration experiments especially using smaller breeds of pigs. However, the lack of weight-bearing effort may result in peripheral edema during prolonged use. Also, sling restraint may modify ventilation in pigs when compared to lying supine on an operating table (Lighty et al. 1992. Cornell Veterinarian 82:131-40).

Cattle

Environmental Chambers Stanchions and Metabolism Stalls

Policy: Within the ASRC, environmental chambers stanchions and metabolism stalls shall be classified as mechanisms of restraint that requires ACUC approval. Housing in such facilities should be avoided unless

required by the experimental protocol (e.g., complete urine or feces collection, frequent sampling, or environmental control) and cattle should be maintained in these devices no longer than is required by the approved animal care protocol. Cattle used in space-intensive conditions should have calm dispositions and be adapted to frequent contact with animal care personnel. Tethering or the use of stanchions to maintain cattle for more than 3 weeks is considered to be non-standard husbandry. Its use must be scientifically justified in the animal-use protocol. Health and disposition of individuals should be monitored closely during such studies, and particular attention should be give to alertness of the animal, appetite, fecal and urinary outputs, and condition of the feet, legs and hock joints. Rubber mats or suitable alternatives should be used to increase the comfort of cattle maintained for lengthy periods on hard surfaces. Cattle are social animals, thus, whenever possible they should be able to maintain visual contact with others.

Reasoning: The *Guide* states that restraint devices are not to be considered normal methods of housing; that restraint devices should not be used simply as a convenience in handling or managing animals, the period of restraint should be the minimum required to accomplish the research objectives that animals to be placed in restraint devices should be given training to adapt to the equipment and personnel, provisions should be made for observation of the animal at appropriate intervals, as determined by the IACUC, and that veterinary care should be provided if lesions or illnesses associated with restraint are observed.

Sheep

Environmental Chambers Stanchions and Metabolism Stalls

Policy: Within the ASRC, environmental chambers stanchions and metabolism stalls shall be classified as mechanisms of restraint that requires ACUC approval. Housing in such facilities should be avoided unless required by the experimental protocol (e.g., complete urine or feces collection, frequent sampling, or environmental control) and cattle should be maintained in these devices no longer than is required by the approved animal care protocol. Tethering or the use of stanchions to maintain sheep for more than 3 weeks is considered to be non-standard husbandry, and as such, its use must be scientifically justified in the animal-use protocol. Health and disposition of individuals should be monitored closely during such studies, and particular attention should be give to alertness of the animal, appetite, fecal and urinary outputs, and condition of the feet, legs and hock joints. Rubber mats or suitable alternatives should be used to increase the comfort of cattle maintained for lengthy periods on hard surfaces. Sheep are very social animals, thus, whenever possible they should be able to maintain visual contact with others.

Reasoning: The *Guide* states that restraint devices are not to be considered normal methods of housing; that restraint devices should not be used simply as a convenience in handling or managing animals, the period of restraint should be the minimum required to accomplish the research objectives that animals to be placed in restraint devices should be given training to adapt to the equipment and personnel, provisions should be made for observation of the animal at appropriate intervals, as determined by the IACUC, and that veterinary care should be provided if lesions or illnesses associated with restraint are observed.

Transportation of Agricultural Animals

Policy: Livestock housed in the Animal Sciences Research Center (ASRC) will be transported in a humane manner which prevents escape, maximizes the safety of the animal and animal care personnel and reduces the transmission of disease.

Applicable: All faculty, staff, students and employees of the University of Missouri utilizing the animal facilities in the ASRC.

Purpose: To ensure that livestock is transported in an appropriate manner.

Introduction: The transport of livestock involves a complex of operations, hence it is often difficult to determine which component or combination of components is most responsible for transportation stress.

The safety, comfort and security of the animal should be the primary concerns. Unhealthy, weak, or nonambulatory animals must not be loaded or transported unless necessary for medical attention. If animals become injured during the course of transport, appropriate steps should be taken immediately to segregate such animals and care for their special needs.

Proper ventilation should be ensured when animals are transported. Animals should be acclimated to environmental temperatures prior to transport and extreme temperatures, both hot and cold should be avoided. Truck beds and livestock trailers should be clean, dry, and equipped with a well-bedded flooring that minimizes slipping. They should be sanitized before and after use to prevent spread of disease. The inside walls and lining should have no sharp edges or protrusions that would be likely to cause injury.

Animals should be loaded and unloaded easily and promptly. Chutes should be well-designed for the animals being handled. The type of transport vehicle should be appropriate for the species being hauled and the animals should be checked frequently during transit.

Unlike the loading systems used for livestock, poultry are caught manually and loaded into transport crates that are stacked on an open bed truck. Special attention to developing skilled staff for catching, loading, and transport of poultry is important.

Procedures:

1. Select appropriate means of transportation.

Livestock housed in the ASRC may be transported in University owned vehicles or by commercial transportation companies. Most College of Agriculture Food and Natural Resources (CAFNR) farms have their own trucks and livestock trailers which are appropriate for the species of animals housed on their farms. In most instances “farm trucks and trailers” would be appropriate to transport animals to and from the ASRC.

When large numbers of animals are transported long distances it is frequently more economical to hire a commercial transportation company to haul the animals. In these instances transportation companies are selected who can supply equipment appropriate for the animals to be transported in a humane manner.

2. Animals are to be gathered and held for loading in an appropriate manner.

Livestock should be gathered as quietly and stress free as possible. Prior to loading, the animals should be held in an area large enough to prevent overcrowding. This area should be strong enough to prevent escape and sharp edges or protrusions that may cause injury.

3. Loading and unloading should be performed in a safe and humane manner.
Depending on the species and means of transportation, appropriate alley ways and loading chutes should be used. Proper selection and maintenance of this equipment is instrumental in preventing escape and injury to the animals being loaded and unloaded. When animals refuse to move through the loading facilities, use of a slapper, rattle paddle, streamers tied to the end of a stick or whip may be used. As a last resort, an electric prod may be appropriate. Efforts should be made to minimize the force required to move the animal through the loading facility.

Recommended Area allowances in Transportation Accommodations for Groups of Animals Used in Agricultural Research and Teaching

Species	Average body weight		Area per animal			
Cattle (calves)	(kg)	(lb)	(m^2)		(ft^2)	
	91	(200)	.32		(3.5)	
	136	(300)	.46		(4.8)	
	182	(400)	.57		(6.4)	
	273	(600)	.80		(8.5)	
			Horned		Hornless	
			(m^2)	(ft^2)	(m^2)	(ft^2)
Cattle (mature fed cows and steers)	364	(800)	1.0	(10.9)	.97	(10.4)
	455	(1000)	1.2	(12.8)	1.1	(12.0)
	545	(1200)	1.4	(15.3)	1.4	(14.5)
	636	(1400)	1.8	(19.0)	1.7	(18.0)
			Winter		Summer	
Swine	45	(100)	.22	(2.4)	.30	(3.0)
	91	(200)	.32	(3.5)	.37	(4.0)
	114	(250)	.40	(4.3)	.46	(5.0)
	136	(300)	.46	(5.0)	.55	(6.0)
	182	(400)	.61	(6.6)	.65	(7.0)
			Shorn		Full fleece	
Sheep	27	(60)	.20	(2.1)	.21	(2.2)
	36	(80)	.23	(2.5)	.24	(2.6)
	45	(100)	.26	(2.8)	.27	(3.0)
	55	(120)	.30	(3.2)	.31	(3.4)
			Dimensions		Area	
			(m)	(ft)	(m^2)	(ft^2)
Horses	250 to 500	(550 to 1100)	.7 x 2.5	(2.3 x 8.2)	1.75	(18.8)
Foals (<6 mo)			1.0 x 1.4	(3.3 x 5.4)	1.4	(15.1)
Young horses 6 to 24 mo)			.6 x 2.0	(2 x 6.6)	1.2	(12.9)
			1.2 x 2.0[a]	(3.9 x 6.6)	2.4	(25.8)

For a journey longer than 48 hours, extra width for lying is required.

Vermin Control

Policy: It is the policy of the Animal Sciences Research Center (ASRC) that populations of vermin, are to be suppressed to minimize the risk of disease transmission to the animals housed in the facilities and to the animal care personnel.

Applicable: All faculty, staff, students and employees of the University of Missouri utilizing the animal facilities in the ASRC.

Purpose: To ensure that populations of vermin are kept to a minimum, thus reducing the risk of disease transmission to the animals and animal care personnel.

Introduction: A control program is instituted within the ASRC in to suppress populations of vermin in order to minimize the risk of transmission of disease to the animals housed in the facilities. Vermin include but not limited to roaches, wild and escaped rodents and flies. The control program is accomplished by the elimination of harborage, good programs of sanitation, housekeeping, and utilizing a professional exterminator who provides service on a bi-monthly basis. The ASRC also uses roach bait, mouse traps and poison, and applications of pesticide for fly control.

Procedures:

1. Animal caretakers should report areas where vermin are observed to the ASRC Facility Manager who is responsible for evaluating problems and initiation of corrective action.
2. Animal caretakers should ensure that feed is stored on pallets and kept 6” away from walls.
3. Animal areas should be kept free of clutter, thus, eliminating hiding areas for vermin.
4. Once feed bags are open they should be stored in containers with tight fitting lids.
5. Spilled feed should be immediately swept up and remove from the floors.
6. Trash cans should be regularly emptied into dumpster outside of the building.
7. Cardboard should be discarded, thus, eliminating areas of harborage.
8. A professional exterminator is utilized to treat the facility on a bi-monthly basis, or more frequently as needed.
9. During periods of increasing rodent populations (especially fall and winter) the Attending Veterinarian may ask investigators for permission to utilize rodent poison. Care will be used to reduce human and animal exposure.
10. Animal rooms D1 (E121), D2 (E122) and D3 (E123) are equipped with, timer controlled, mosquito insecticide misting systems (pyrethrum) that are used to control “pit flies.”

Baby Pig Processing

Policy: Routine processing of baby pigs may be performed without direct veterinary supervision by animal care personnel trained in the procedures. However, standards described in the *Ag Guide* will be met.

Applicable: All faculty, staff, students and employees of the University of Missouri utilizing the animal facilities in the Animal Sciences Research Center (ASRC).

Purpose: To ensure that baby pigs are processed in a uniform humane manner.

Introduction: Standard agricultural practices that cause only brief pain or distress in the baby pig but that prevent more serious distress or injury later in the pig's life should be performed at a young age. The use of injectable iron compounds to prevent piglet anemia is widespread. Needle teeth are routinely clipped to reduce damage to littermates and sows. Tail docking is commonly performed to reduce tail-biting. Ear notching is a permanent means of identification and causes only minor discomfort when performed at a young age. Although castration causes clear signs of pain and discomfort for pigs castrated at any age, the *Ag Guide* states that if teaching and research pigs are to be marketed in commercial chains, castration is recommended. If the research intends to reflect commercial pork production, castrated males are appropriate animal models.

The following SOP describes proper technique for performing these common procedures.

Procedures:

A. Iron injections

1. Should be administered at approximately 24 hours of age.
2. Proper compounds should be selected and the recommended dosage followed (usually 1cc) per piglet.
3. Piglet should be properly restrained to prevent injury to the animal or caretaker.
4. Aseptic technique should be used when drawing iron into the syringe.
5. Properly sized needle should be used for the injection (18g or 20g ¾" to 1" in length).
6. Iron should be injected into the muscle (preferably of the neck).

B. Needle teeth clipping

1. Needle teeth should be clipped at approximately 24 hours of age.
2. Piglet should be properly restrained to prevent injury to the animal or caretaker.
3. Needle teeth pliers should be used to remove no more than one half of both the upper and lower canine teeth.
4. Care should be taken not to injure the gums or break the teeth, as this could serve as a source of gum infection and impede piglet nursing.

C. Tail docking

1. Tails should be docked at approximately 24 hours of age.
2. Piglet should be properly restrained to prevent injury to the animal or caretaker.
3. Tail docking may be performed using the same pliers use to clip needle teeth.
4. Tails should be docked to approximately ¾ inch. Tails should not be cut too short as this can lead to infection and may contribute to an increased incidence of rectal prolapse.
5. Tails may be sprayed with a disinfectant following docking.

D. Ear notching

1. Piglets should be ear notched at approximately 24 hours of age to insure identity.
2. Piglet should be properly restrained to prevent injury to the animal or caretaker.
3. Appropriately sized ear notchers should be used.
4. It should be insured that the proper numbering system is being used before notching is begun. Examples of the proper ear notching system are posted on the dry erase board at the entrance of Units D1 and D3.

E. Castration

1. Piglets are normally castrated at approximately 7 days of age. Piglets will not be castrated older than 14 days of age without the use of local or general anesthetics, under prescription of the attending veterinarian.
2. Piglet should be properly restrained to allow proper technique will preventing injury to the animal or caretaker. Castrations are commonly performed using a scalpel which can be dangerous if the animal is not properly restrained.
3. Piglets should be checked for inguinal hernias prior to castration. If inguinal hernias are detected, only personnel trained in there repair should perform the castration.
4. A scalpel should be used to incise the scrotum to expose each testicle. If the tunic surrounding the testicle is incised the testicle will pop out through the incision. If this does not occur the testicle should be pressed through the skin incision.
5. Each testicle is grasped separately, pulled upward, and removed. The cord and as much loose tissue as possible is removed.
6. Incisions may be sprayed with a disinfectant when the procedure is completed.
7. When done properly, very little bleeding occurs and two small clean incisions remain.

Treatment of Dystocia in Swine

Policy: Initial treatment of dystocia in swine is permitted without direct veterinary supervision.

Applicable: All faculty, staff, students and employees of the University of Missouri utilizing the animal facilities in the Animal Sciences Research Center (ASRC).

Purpose: To ensure that all swine housed in the ASRC are treated for dystocia in an appropriate manner.

Introduction: Knowledge of the normal process of parturition in swine is essential if the need for obstetrical assistance is to be recognized.

Prepartum sows exhibit conspicuous signs of the approach of parturition. Swelling of the vulval lips occurs a few days before parturition. The lining of the vagina and vulva remain rather dry until shortly before the birth of the piglet when the passage of a small amount of amniotic fluid moistens it. The mammary glands may remain flaccid until 3-4 hours before birth, but usually become enlarged a few days before parturition. The distal extremities of the glands become cone shaped, turgid, and tense during the last 2 days before farrowing. Generally, a serous secretion is present 48 hours before farrowing. Once this secretion becomes milky, parturition usually occurs within 24 hours. When milk secretion becomes abundant, parturition commonly occurs within a few hours.

Piglets are usually delivered while the sow is in lateral recumbency. Intermittent abdominal straining is common before the birth of the first pig, but is less so before the birth of the remaining pigs. Delivery is normally completed within a few hours but may take longer. Expulsion of the fetal membranes commonly occurs a few hours following delivery but is not a reliable indicator that farrowing is complete. Portions of the placenta are often passed during the farrowing period.

Dystocia (difficult birth), generally represents only a small portion of the problems and potential losses in swine production. Signs of dystocia can include: prolonged gestation, appearance of blood-tinged vulvar discharges, meconium without signs of straining, straining without delivery of one or more piglets, cessation of labor after previous straining and delivery of piglets, foul-smelling and discolored vulvar discharge, depression, weakness, and exhaustion after prolonged labor. Dystocia in swine can be caused by problems in either the sow or piglet.

Procedures: Treatment of Dystocia in Swine

1. Determine that the sow is having a difficult birth using the above criteria.
2. Restrain sow in a manner which will minimize the likely hood of injury to the caretaker or animal.
3. Prepare for an initial vaginal examination by performing a thorough washing of the sow's hind parts.
4. Fingernails must be cut short and hands and arms washed.
5. A clean, well lubricated, disposable obstetrical sleeve should be worn to reduce friction and reduce contamination to the sow and caregiver.
6. The vagina should be well lubricated using an appropriate lubricant.
7. The caregiver's hand which represents the side the sow is lying on should be cupped in the shape of a cone, and the lips of the vulva carefully separated and the coned hand is inserted into the birth canal.
8. After entering the vulva the hand passes into the vagina, which is confluent with the uterus, and the bony pelvis can be felt below and to the sides of the vagina.
9. The hand can usually be passed through the pelvic opening in sows, but in some gilts this is impossible.
10. Piglets encountered will fill the entire diameter of the birth canal, making determination of position relatively easy. If in cranial presentation, the head, lower jaw, or feet may be grasped. If in caudal presentation, the feet are grasped. A gentle, steady traction is usually effective to accomplish delivery of

most pigs.

11. If delivery of the piglet is not possible using a hand, obstetrical instruments are available which can be used to facilitate the procedure. However, these instruments may cause damage to the sow or piglet if used improperly, thus prior training in their use is required.
12. Immediately after delivery, live pigs must have the membranes and mucous removed from their airway by gently shaking and massage in a head-down position.
13. Following delivery the naval cord should be dipped or sprayed with iodine to prevent infections.
14. Once the dystocia is relieved, the birth canal should be reexamined for additional fetuses and all easily accessible fetuses delivered.
15. Sows that have had manual intervention of farrowing should be injected with oxytocin (3 ml, IM) and an appropriate antibiotic (Penicillin G, 3-4 ml/cwt. IM; or Naxcel, 2-3 ml/cwt. IM).
16. If the caregiver is unable to deliver the piglets safely or humanely, a veterinarian should be contacted immediately to provide treatment.
17. An animal health record (blue card) should be completed describing the treatment, outcome and medications used.