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SWINE CARE HANDBOOK 2018

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PREFACE ON ETHICS

Animal husbandry is traditionally understood as a blend of the producer's self-interest and duties of humane treatment for the animals on which we depend. A livestock operation cannot prosper without healthy and reproductively fit animals, and thus the profitability of the farm has tended to be regarded as a good indicator of well-being for its animals. Yet while profits provide an economic incentive for husbandry, livestock producers have never evaluated animal welfare solely in terms of dollars and cents. Taking proper care of one's animals has always been understood as an ethical responsibility, as well as a necessary business practice.

The ethical responsibilities of animal husbandry have usually been thought of as duties that individual people—farmers and their employees—must perform on behalf of the animals in their care. Although it is still true that the husbandry imposes ethical duties on those who practice it, animal agriculture has changed dramatically in scope and complexity over the last few decades. New technologies pose challenges to the way that we understand how animals fare in a given production system. New methods may seem to enhance one dimension of animal health and well-being, while seemingly causing a decline in another. New scales of production can provide opportunities for improvements in overall herd health, reproductive success and profitability, while reducing the amount of care and attention that can be given to an individual animal. Emerging trends in marketing and contracting constrain producers' flexibility and introduce powerful new actors into decision-making roles that affect animal health and well-being.

Science and imagination are needed to assess the overall impact of these trends in animal production, and it is important to ensure that the ethical side of animal husbandry does not lose out. But in a technologically complex world in which a producer's choices are sharply limited, it is no longer appropriate to place the entire burden of ethical responsibility on the shoulders of individual farmers. Above all, consumers must not expect individual farmers to undertake practices that will make them uncompetitive in the marketplace. Livestock producers will do what is necessary to compete, or else they will not be livestock producers for very long. This means that the ethics of farm animal welfare will increasingly come to be seen in terms of industry standards, market structure and government regulation, in addition to individuals' responsibility to the animals in their care.

We are entering a time when the public's demand for ethical treatment of farm animals is starting to register in the form of price premiums and special contracting requirements, as well as pressure for government action. Clearly, there is a danger that the emerging system will serve neither animal nor human interests well. Scientifically validated and ethically grounded industry standards can provide an alternative to rules and regulations, but only if three key conditions can be met. First, it must be clear that the ethical goals and principles place appropriate weight on the welfare and interests of farm animals themselves, while at the same time recognizing the role of animal agriculture in satisfying vital human needs. Second, consumers must have confidence that standards are taken seriously and that livestock producers faithfully follow recommended practices. Third, producers themselves must believe that standards are fairly established and administered. Although some mix of market incentives, government regulation and self-administered industry standards may eventually emerge to address the new challenges of ethical husbandry, only a system that meets all three of these criteria can truly be said to be ethically justified.

Who will take the lead in formulating and implementing such a system? Producers can seize the initiative, either through existing commodity groups or through some yet-to-be-formed organization that would be one step removed from the day-to-day concern with farm policy and profitability. They will need to work with scientists and government, as well as finding new partners among non-farm groups with an interest in animal care. One thing is certain. If producers undertake an effort to provide assurance that animal interests are being taken into account in contemporary husbandry, they can be sure that people from outside will be watching carefully, even skeptically. Also, such an undertaking will almost certainly meet opposition from people whose view of animal protection leaves no room for animal agriculture. At present, the broader public is caught between these extremists on the one hand, and on the other a farm community polarized by extreme views and reluctance to take any coordinated action at all. Producers can and should accept the challenge of ending this gridlock, for no one is truly served by it and public confidence in the food system is its greatest casualty.

Preface on Ethics, continued

As science and technology advance, we have come to expect that standards for husbandry will evolve, and that periodic updating and revision will be the norm. The complex trade-offs between animal welfare, consumer prices and producer profitability will also be affected by shifting social values and technical change. Ethics itself must come to be seen in terms of responsiveness to change and to what we have learned. The ethics of husbandry will consist as much in how the animal industries adapt to new knowledge and altered circumstances as in the individual performance of age-old duties of animal care. This most recent guide to swine care reflects what we have learned most recently about responsible husbandry, but it also represents a commitment to continue in the search for better knowledge and better practice. Producers can meet their responsibility for ethical husbandry only by practicing what we believe to be right today and by resolving to test those beliefs, to learn and to improve in the future.

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INTRODUCTION

The purpose of this handbook is to provide pork producers and caretakers with the latest information available on pig care practices that are recommended for safe, humane, and efficient pork production. Pigs can be raised humanely in a variety of production systems. Several different types of production systems are used on U.S. farms. While they all have some common considerations for animal well-being, differing production systems may require specialized techniques or management considerations; therefore, where appropriate, system specific recommendations are addressed.

A diverse task force of academics, producers and veterinarians made the 2018 handbook updates. The group worked to create recommendations that considered and balanced scientific data, practical experience, ethics, and consumer perspectives. Further background on the ethics of animal care in the pork industry can be found in the Preface on Ethics section. Each of the topics covered in the handbook in some way address the aspirational Five Freedoms of Animal Welfare[1]:

1. Freedom from hunger, thirst and malnutrition
2. Freedom from fear and distress
3. Freedom from physical and thermal discomfort
4. Freedom from pain, injury and disease
5. Freedom to express normal patterns of behavior

There is a growing interest among food-chain customers and the public with the way food is produced. The We Care[sm] initiative demonstrates the pork industry's commitment to continuous improvement and responsible farming. At the heart of this commitment is a statement of ethical principles that affirms all caretakers' responsibility to:

- Produce safe food
- Protect and promote animal well-being
- Ensure practices to protect public health
- Safeguard natural resources in all of our practices
- Provide a work environment that is safe and consistent with our other ethical principles
- Contribute to a better quality of life in our communities

This handbook reviews and gives recommendations for the factors that affect animal well-being. Some factors covered in this handbook, such as ventilation rates, feeding and watering practices, manure management, or euthanasia methods, will have effects in areas important to pig production other than animal well-being. Producers and caretakers must recognize that addressing animal well-being in isolation without consideration of animal health, food safety, caretaker safety and health, and the environment is not wise. Following these recommendations will enable caretakers to provide humane care to their pigs, regardless of the type of production system they manage. However, each of these other key areas also must be addressed simultaneously to provide an effective balance and maintain the pork operation's sustainability. Further, natural or man-made disasters or catastrophic disease outbreaks may result in extenuating circumstances where emergency plans and protocols are utilized to protect human safety and pig well-being.

Research and development of new production technologies are ongoing in the pork industry. As they are introduced into the industry, it is important that they be evaluated to determine their impact on animal well-being. In areas where the scientific research is limited or not proven, the recommendations are the result of consensus among animal scientists, veterinarians, animal well-being scientists and pork producers. As more information becomes available on improved production practices or facility designs, the recommendations on appropriate pig care practices provided in this handbook will be updated.

1

ANIMAL OBSERVATION AND CARE

Caretaker skills related to animal well-being

Caretaker Training

Caretakers are central to the delivery of good care. Selection of caretakers, training of those caretakers and emulation of both attitudes and skills is central to the care of pigs.

The requirements for training focus on three primary attributes[2]:

- Skills associated with the position,
- Increased understanding of the animal and improved attitude towards the animals, and
- The production system and the business goals. The required skills may vary depending on the type of farm and phase of production.

Training Programs

Training programs vary from farm to farm and company to company. Common training programs should be tailored to the needs of the particular farm and include training of employees and continuous professional development for owners and supervisors. Frequent supervision and mentorship of employees are an integral part of effective training programs. Effective training programs will embrace re-training of people when necessary.

At all levels of production, training must emphasize that there will be zero tolerance for pig abuse or purposeful neglect. Egregious acts of abuse include, but are not limited to:

- Intentionally applying prods to sensitive parts of the animal such as the eyes, ears, nose, genitals or rectum. Excessive prod use could qualify as a willful act of abuse.
- Malicious hitting/beating of an animal. This includes forcefully striking an animal with closed fist, foot, handling equipment (e.g. sorting board, rattle paddle, etc.), or other hard/solid objects that can cause pain, bruising or injury.
- Driving pigs off high ledges, platforms or steps while moving, loading or unloading (animals are falling to the ground).
- Dragging of conscious animals by any part of their body except in the rare case where a non-ambulatory animal must be moved from a life threatening situation. Non-ambulatory pigs may be moved by using a drag mat.
- Purposefully dropping or throwing animals.
- Causing physical damage to the snout or tusks of a boar as a means to reduce aggression (this excludes nose ringing and tusk trimming).
- Failure to provide food, water and care that results in significant harm or death to animals. This includes the intentional failure to provide food, water or care that falls outside of normal husbandry practices and would reasonably be considered neglect.

Some examples of training methods include:

- Working with an experienced caretaker including group training on a part-time basis.
- Informal on-farm instruction with manager/owner/other caretakers.

- Formal in-house training. This provides the benefit of direct application of training with the specifics of the particular farm.
- Industry seminars.
- External training at colleges, universities, third-party organizations, or other farms.
- Use of a designated training farm for a company.
- Continuous professional development. This requires high quality, experienced trainers and a major commitment.[3]
- Reading popular press articles, proceedings from conferences, and staying abreast of new technologies.
- Viewing training videos and participating in Pork Checkoff certification programs.

Herd health management program

A herd health management program is essential and contributes to animal health and well-being, provides a strategy for disease prevention, rapid and accurate diagnosis, and effective treatment. The details of a program will vary depending on the herd size, type of herd, location, ownership and a variety of other factors. A relationship of trust between the producer and the veterinarian is critical to a successful herd health program.

The overall goals of a herd health program are to eliminate, or at least minimize, disease outbreak risk, reduce the likelihood of new pathogen introduction, control existing diseases, and improve productivity and profit potential. A herd health management program should include[4]:

- Standard Operation Procedure (SOP) for all components of biosecurity
- Vaccination SOP
- Daily Observation of all animals for injury or signs of disease
- SOP for the prevention, detection and treatment of disease or injury, including setting targets for measuring incidences of disease and injuries
- SOP for euthanasia
- SOP for pest control
- SOP for individual animal or group identification
- Training SOP and programs for animal handlers
- SOP for introducing new arrivals to the herd
- SOP for managing sick and injured pigs
- SOP for culling animals
- A record of deaths that occur on-farm for purposes of tracking mortality rates
- Complete, accurate and reliable recordkeeping of treatments, reproduction, mortality and other production metrics

The herd health program should be modified to suit each farm and the previous list represents the minimum requirements.

Veterinary-Client-Patient Relationship (VCPR)

Every producer must maintain a current, valid VCPR. A VCPR means that all of the following are required, in addition to any state-specific requirements:

- The veterinarian has assumed the responsibility for making clinical judgments regarding the health of the patient and the client has agreed to follow the veterinarians' instructions.
- The veterinarian has sufficient knowledge of the patient to initiate at least a general or preliminary diagnosis of the medical condition of the patient. This means that the veterinarian is personally acquainted with the keeping and care of the patient by virtue of a timely examination of the patient by the veterinarian or medically appropriate and timely visits by the veterinarian to the operation where the patient is managed.

- The veterinarian is readily available for follow-up evaluation or has arranged for the following: veterinary emergency coverage, and continuing care and treatment.
- The veterinarian provides oversight of treatment, compliance and outcome.
- Patient records are maintained.

The new U.S. Food and Drug Administration- antibiotics regulations require pig farmers to have a valid VCPR. Depending on the state in which the veterinarian practices, he or she can only issue a Veterinary Feed Directive (VFD) in the context of a valid VCPR as defined by the state requirements. In simplest terms, this means a pig farmer must have a good relationship with his/her veterinarian and expect to spend more time in developing a plan that satisfies all VFD requirements. As for the veterinarian's role, he or she must be familiar with the production practices and herd health profile.

Health monitoring, vaccination and treatment protocols

The Pork Quality Assurance® Plus (PQA Plus®) Program should be used as a basis for information and training about Good Production Practices for pork production. The PQA Plus program also contains information and forms for planning an effective record-keeping system. Understanding and implementing the PQA Plus Good Production Practices will help develop a herd health program, which is an important part of providing for the pigs' well-being. Appropriate care includes availability and responsible use of a range of therapeutic medications at all stages of production. Animals should receive appropriate treatment even if marketing must be delayed or foregone due to withdrawal time as dictated by the product.

Producers should work with a veterinarian to design a herd health management program for monitoring the health status of their herds. The program might include routine herd health visits, evaluation of past results from the diagnostic laboratory, serological surveys of the herd, postmortem examinations and/or slaughter checks. The farm veterinarian should be contacted if pigs with symptoms of disease are noticed. Protocols may be written for routine treatments of diseases but the veterinarian should be informed immediately if sick pigs do not respond to treatment.

Responsible Antibiotic Use

Animal health and public health experts agree that antibiotic resistance has occurred for millennia, completely independent of human involvement and the advent of modern-day antibiotics. However, the use of antibiotics, whether in human medicine, animal medicine or the environment, applies potential selection pressures for the development of antibiotic resistant bacteria. Fortunately, there are still steps that both human and animal health professionals can take to help reduce the need for antibiotic use and to ensure that when they are used, they are used responsibly to maintain effective antibiotics for both animal and human health. Because antibiotic resistance is a global concern of both human and animal health, the "One Health" initiative continues to grow as a worldwide umbrella approach to combat antibiotic resistance. This is a collaborative effort of multiple stakeholders to attain optimal health for people, domestic animals, wildlife, plants and the environment. Medical doctors and patients, veterinarians and farmers, along with government, academia and industry stakeholders, are working together to address this issue. Pork producers play an important role in the shared effort to use antibiotics responsibly to help minimize the potential emergence of antibiotic resistant bacteria and maintain effective antibiotics for animal and human health. In the end, this comprehensive and inclusive approach will create a win-win by protecting People, Pigs and the Planet.

Vaccination Protocols

Vaccination protocols are herd- and production-phase specific. The protocols are based on the current pathogens in the herd, the risk of entry of a new pathogen, and the efficacy of the vaccines. Vaccination protocols should have sufficient detail so any employee

can use and follow the protocol with minimal assistance. Other animal health products that are administered on a regular basis, for example anthelmintics (dewormers), should also have a documented protocol.

Identification and Records
Identification is important for maintaining health records and for tracking pigs as they are moved through the farm. Identification methods may include ear tattoos, electronic transponders, ear tags, ear notches or pen recognition. Breeding animals should be individually identified with an easily read system.

The farm should have its own premises identification number (PIN) assigned for the appropriate tracking of diagnostic submissions and other regulatory purposes. Regular, frequent and routine systems for review are essential for the improvement of the production system. For this purpose, maintaining records for various production parameters and activities are needed. Records may be kept in paper or electronic format and many different record types may be retained depending on the production system. Medical records (including therapeutic use of antibiotics), production records, and nutritional information, such as feed consumption, should be maintained. Nutritional records should be retained in association with specific pens, rooms or barns for nursery and finishing pigs. Facility records should be stored for performance of routine maintenance procedures.

Each production site should maintain up-to-date medication records for pigs on the site and use these records to enhance the health of pigs. Records must be maintained in accordance with applicable state and federal requirements.

Basic biosecurity principles

Biosecurity can be defined as the implementation of preventive measures to avoid the introduction and to contain the spread of infections and diseases on farms.[5] Biosecurity can be external as well as internal. With the increased problems associated with the transmission of highly infectious diseases, farm biosecurity is critical to animal health and productivity. Several categories of biosecurity, including transport of animals, removal of dead animals, vermin control and cleaning and disinfection are significantly associated with depression of daily weight gain and feed conversion, and increased mortality rate.[6, 7] Hence, improved biosecurity is beneficial for improved pig performance in commercial production.

Information on specifics related to biosecurity are available at the National Pork Board's website, *pork.org*.[8] Producers must be aware that published recommendations regarding biosecurity practices may vary widely and it is worthwhile to discuss their biosecurity concerns with the herd veterinarian or extension specialist. An overall biosecurity strategy on a farm must be considered instead of only examining the implementation of individual practices.[9, 10] Farm biosecurity and security risk factors are unique to each farm. Therefore, a biosecurity plan should be farm-specific and include the following components: buildings and structures, consumable supplies, land area used for pork production, management procedures, owners, workers, veterinarians, consultants and visitors, and transportation of pigs.[11]

External Biosecurity
External biosecurity protocols aim to prevent new pathogen introduction to the farm environment. A biosecurity protocol should include, but not be limited to, the following potential pathogen sources:

- **Transportation.** Pig transportation represents a critical means for pathogen transmission. Cross-contamination by animal shipment between farms and markets is one of the main mechanisms to spread infectious pathogens.
- **Feed delivery.** Appropriate protocols are needed for feed delivery as feed trucks and their drivers may carry pathogens from farm to farm.
- **Mortality removal.** Dead pigs should be removed from a facility as soon as feasible and as required by local or state regulations. Consider the placement of dead-pig bins and the risk posed by rendering trucks, which may have visited other farms. On-farm mortality management can reduce the risk of rendering truck cross-contamination.
- **People.** Farm workers and visitors should be considered as potential sources of pathogens. Appropriate strategies are required to reduce the likelihood that people spread pathogens.

- **New pig arrivals, replacements.** Pigs represent a critical, high-risk source of new infections. The appropriate isolation and acclimation of new breeding stock is appropriate in sow herds.
- **Number of sources of new pigs.** Since each farm has its unique population of pathogens, a change in source represents a potential introduction of new pathogens.
- **Semen deliveries.** Certain pathogens, such as Porcine Reproductive and Respiratory Syndrome virus (PRRSV) can be transmitted through semen. It is imperative that semen comes from a boar stud with a known health status.
- **Neighboring farms.** Aerosol transmission and vectors of certain pathogens in the area should be considered especially when neighboring farms have disease problems.
- **Sharing of equipment with other farms.** Since some pathogens can survive on inanimate objects, producers should realize that the movement of equipment from farm to farm increases the likelihood of pathogen transmission.
- **Failure of staff to follow existing biosecurity protocols.** It is essential that all farm workers adhere to biosecurity protocols, without exception.
- **Pest (rodents, birds, insects, cats, dogs) control.** Various animal species are recognized as carriers of certain pathogens.
- **Sanitation.** Removal of manure and urine from the pig space and washing and disinfection reduce the number of pathogens within a facility.
- **Entry of supplies.** Since some pathogens can survive on inanimate objects, producers should consider the risk of pathogens when supplies are delivered to farms.
- **Mitigation of aerosol transmission of pathogens.** Some pathogens, such as PRRSV, can be transmitted via aerosols. Producers should take measures to limit the likelihood of pathogen transmission via aerosol.

In addition to the aforementioned basic biosecurity principles, it is important to consider limiting some routine, yet high-risk practices on commercial farms. These high-risk practices on farms include:

- Adding new pigs without a quarantine and test.
- Failing to require testing for specific diseases prior to entry.
- Failing to vaccinate for specific diseases prior to addition.
- Allowing pigs to return from fairs, shows, or exhibits without quarantine and testing.
- Allowing other domestic or wild animals to have contact with the pigs, feedstuffs or water sources.
- Failure to prevent disease transfer by pig transportation, human contact, vehicular traffic or equipment used with more than one animal or used at other locations such as buying stations, slaughter plants or off-site farm.
- Being geographically located close to other facilities increases risk, especially near farms with high disease incidence.

Transportation

Pig transportation represents a critical means for pathogen transmission. Nursery farms are considered greater risks of disease spread than sow or finishing sites.[12] Regardless of the production phase, it is important to recognize that animal movement between farms represents a risk for disease spread and numerous shipments per month is a significant biosecurity risk predictor.[13] Furthermore, the slaughter facilities and livestock auction markets likely play a role in various pathogen distributions, such as Porcine Epidemic Diarrhea virus.[14] Producers need to consider proactive measures to limit certain pathogen spread when vehicles return from collection points. The NPB website, *pork.org,* provides information related to biosecurity issues associated with transportation.[15]

Daily observations

Pigs must be observed at least once a day, but more frequently during specific events such as farrowing or recovery from illness. Drinkers and feeders must be monitored to make sure pigs have adequate access to water and feed. An out-of-feed event interferes with growth and development, and creates a stressful event for the pigs. A daily

management regimen allows pigs to develop a routine of their own. Producers must pay close attention to all environmental factors that will influence the pig health and viability. Daily neutral or positive interaction of caretakers with pigs elicits many positive outcomes for the well-being of pigs.[16, 17, 18] Caretakers are encouraged to consider these practices.

It is imperative that attention to sick and injured pigs must take place without delay, and as soon as possible, remove and properly dispose of any that die. In all production systems, there should be a space appropriate for segregating sick and injured animals from the general population. Greater details on sick pig identification and management are provided in the Managing sick and injured animals section of this handbook.

Daily animal care should also be arranged during weekends and holidays, unexpected employee absences because of illness or similar contingency and other emergencies. All workers should be qualified to perform assigned duties. A procedure should be established for providing emergency animal health care after hours, on weekends and on holidays.

Managing sick and injured animals

Caretakers should develop and utilize refined daily observations so that they can recognize early stages of sickness, illness and injury so that prompt action is taken or advice is sought. It is recommended that pig caretakers may either use the current location or provide an additional location for sick, ill or injured animals. The location must provide feed and water consistent with the pig's daily needs, and may provide environmental resources such as a mat or heating or cooling equipment that support treatment and recovery. As with all other pigs, they must be observed daily.

Caretakers must have a method for tracking animals that are undergoing treatment. Treated animals may be tracked individually or as a group and identification may be temporary (e.g. paint stick) or permanent (e.g. ear tag; refer to the *Health monitoring, vaccination and treatment* section of this handbook).

A pig is considered non-ambulatory if it cannot get up or if it can stand with support, but is unable to bear weight on two of its legs. If the decision has been made to move a non-ambulatory pig, movement should occur with consideration for both the pig well-being and caretaker safety. Dragging of conscious non-ambulatory animals by any part of their body is not acceptable, except in the rare case where a non-ambulatory animal must be moved from a life-threatening situation. At times, an animal may become non-ambulatory and needs to be euthanized, but is positioned in a way that performing the euthanasia method is not safe for the caretaker. The caretaker may need to reposition the pig to perform the euthanasia method safely and effectively. Repositioning does not include dragging and relocating the non-ambulatory animal in the current pen or another location within the facility.

Handling methods for moving non-ambulatory pigs should include equipment appropriate for the size, age and condition of the animal. Caretakers must not purposefully move ambulatory pigs over the top of non-ambulatory pigs except in the rare cases when ambulatory pigs must be moved to access the non-ambulatory pigs. Once the pig has been relocated, the pig must be provided feed and water consistent with the pigs daily needs and should be given time to recover. If unable to recover, euthanasia should be considered.

If the decision has been made to move a severely lame pig (pig is non-weight bearing on the affected limb when either standing or walking), movement should occur at the pig's own pace, given proper care and time to recover. If unable to recover, euthanasia should be considered and caretaker safety must be considered throughout the entire process. Prods must not be used on an animal that has been identified as non-ambulatory or used more than twice on ambulatory pigs that refuse to move.

> The position of the National Pork Board is that any pig that is unable to walk or that is ill and will not recover should be euthanized on the farm and not transported to market channels. When the likelihood of recovery is low, even with treatment, the pig should be euthanized. When the likelihood of recovery is high, the pig should be housed in a location where competition for feed and water is reduced and where the pig can be monitored and treated regularly.

Emergency and safety

In case of an emergency, quick communication is important. Names and telephone numbers of the producer, veterinarian, equipment suppliers and the fire and police departments should be posted near telephones, the entrance gate and/or outside of the buildings. Suitable alarm systems should be available to warn of power failures and/or temperature changes. Producers and employees should be provided hands-on training in emergency procedures. The person in charge of the farm should review plans for all types of emergencies that may be encountered.

A well-documented emergency action plan (EAP) can be a valuable tool to reduce the impact of an emergency on the operation. A thorough analysis and description of the site, careful planning for each possible emergency scenario and ongoing maintenance and training before an emergency are all critical steps to handle an emergency effectively. The operation should have an up-to-date written EAP that will provide guidance to persons not familiar with the operation or are distraught due to the emergency. The plan should include driving directions to the farm, a facility map, descriptions of all operations, and plans addressing critical system failures (power, water, ventilation, and building damage/collapse), contingency plans for alternative mortality disposal under normal and catastrophic loss conditions and steps to mitigate uncontrolled manure releases including releases from any off-site transfer of manure. It is recommended that copies of structural design drawings and specifications, including re-designs, additions or reductions, for the facility be maintained on-site.

Operations should have manual procedures in place or facilities must be equipped to provide some automated intervention to prevent the death of animals in the event there is a mechanical ventilation failure. For example, a back-up generator, automatic or manual drop curtains, back-up heat sources, or some provision for natural ventilation may be appropriate depending upon the building's ventilation type.

Alarm systems and emergency backup equipment such as generators, curtain drops, and override fans should be checked at least twice a year to insure they are properly operating. It is a good practice to document when these systems are checked along with any needed repairs.

All live animal farms have routine death loss and farm management plans for carcass disposal. It is possible for numerous situations or events to cause massive deaths in a very short time period. These events may include fire, storm effects or disease. This mortality level usually exceeds the farm's dead animal disposal plan. Plans should include who to call and where to seek help if catastrophic events occur.

Poor responses to emergencies can lead to personal injuries, economic losses, negative public reaction, and increased scrutiny by regulatory officials. Producers should manage the system with storm warnings as part of the plan.

1. Catastrophic death is most likely to be caused by natural acts. Past events have been due to tornados, hurricanes and floods.
2. Smoke and fire may cause tragic losses on a single farm site, but will usually not affect large numbers of farms.
3. Disease outbreaks may cause much greater than normal mortality.

The National Pork Board offers resources for emergency planning and EAP development.[19, 20, 21] Thorough training for every employee or person involved with the operation is an essential part of emergency planning and should be implemented as soon as the customized plan has been completed. An EAP should be created for each individual site. After completion, each site should have a copy available in the event of an emergency. This information should be shared with all employees to ensure best execution of the EAP. This plan should include:

- The location of shutoffs for water, gas, and electric systems.
- Address for the site and directions to the site.
- The names and telephone numbers of emergency response agencies.
- The names and telephone numbers of the farm's emergency response team.
- The facility layout and spill control measures drawn out on a diagram.
- Pre-approved mortality disposal options for catastrophic incidents.
- Contact list of neighboring property owners that may be affected.
- List of equipment on site for emergency use, including location.
- List of heavy equipment owners who have agreed to assist in an emergency.

PRODUCTION PRACTICES AND ANIMAL HUSBANDRY

Housing systems and space allowance

Breeding and gestation

Pregnant sows can be kept in a variety of housing systems. Sow housing and management systems should:

- Provide every animal access to appropriate feed and water;
- Promote good air quality and allow proper sanitation;
- Protect sows from environmental extremes;
- Reduce exposure to hazards or conditions that result in injuries, pain, distress, fear or disease;
- Facilitate the observation of individual sows to assess their well-being;
- Provide sows with adequate quality and quantity of space that allows sows to assume normal postures and express normal patterns of behavior.

There are advantages and disadvantages to any sow-housing system. Therefore, for each system the benefits and harms to the animals should be considered by weighing scientific evidence, veterinary professional judgement, and caretaker management abilities. For example, while gestation-stall systems minimize aggression and injury, reduce competition, and allow individual feeding and nutritional management, this system restricts movement and exercise, ability to perform foraging behaviors, and limits social interactions. Group-housing systems are less restrictive, but could lead to increased lameness and undesirable social behaviors, such as aggression and competition for resources (e.g., feed, water, space to lie down).

Appropriate and ongoing training for people handling and working with breeding and pregnant animals is critical to ensure that they are able to provide and promote good well-being within the management system being used.[22]

Pig Tethering

Pig tethering for gestating and lactating sows is not recommended.[23, 24]

Individual Housing and Space Allowance

Variation in pig size within a herd may result in some animals having more body space within a stall than others do. A minimum of 90% of the sows should have adequate body space when assessing space allowance for gestating sows. If sows are identified as not having adequate quality and quantity of space to meet her body size, action should be taken to account for this space restriction. Stall size for breeding animals should be considered adequate when:

- Full lateral recumbency can be achieved without the head having to rest on a raised feeder and the rear quarters coming in contact with the back of the stall at the same time.
- Back-to- back, udder-to-udder and back-to-udder contact is acceptable as long as contact does not lead to injury.
- Animals are able to stand up without having to touch the bars on top of the stall.

It is critical that pregnant gilts and sows are kept in stalls that are appropriate to the size of the individual animals. Conventional gestation stalls may not be wide enough for larger sows to lie laterally, especially towards the end of gestation.[25, 26, 27]

Group Housing and Space Allowance
Breeding animals need adequate space to access areas for lying, feeding, drinking and elimination of urine and feces. Pen design should take into consideration the need for animals to avoid/escape aggressive interactions. Space requirements can also be influenced by feeding method, group size, flooring type, pen design, management practices and other factors. Consideration of these items will aid in minimizing negative social interactions and promoting positive social interactions.

Adequate group space must meet the following criteria:

- Be able to lie down fully on its side (full lateral recumbency) without having to lie on another pig and be able to stand back up
- Minimize the risk of injury

The greatest well-being concerns associated with managing sows in group-pens has to do with minimizing the level of aggression (especially early on), injuries and stress for several days post-mixing as well as subordinate sows being underfed due to competition at feeding.[28] All of these factors can also be influenced by feeding method, floor-space allowance, group size, genetics, and management procedures—just to name a few.[29] Moreover, some group-housing systems require more highly skilled and attentive caretakers to manage group-penned sows successfully.

How and when to group sows – Mixing of breeding animals should be conducted in a way to minimize aggression, injury and reproductive failure. Factors to take into account include stage of production/gestation, grouping system (dynamic vs. static), feed system, parity and group size. Caretakers can minimize aggression by segregating or culling of overly aggressive animals and/or overly timid animals. Grouping animals by size and/or parity is a suggested management tool for minimizing aggression.

The most vulnerable time for pregnancy is the first 35 days post-breeding. If mixing must occur during this time, early reproductive physiology of the breeding animals and breeding procedures of the farm must be considered to minimize reproductive losses.

Feeding system options – Feeding systems should minimize aggression and competition for resources and help maintain appropriate body condition. Some factors to take into account include stage of production, grouping system (dynamic vs. static), pen design, genetics, feed ration, parity and group size. Employee safety and accessibility should also be taken into consideration.

Close observation and professional judgement in modern facilities may allow higher stocking densities without interfering with the pig's welfare. Production practices, such as group size, type and amount of feeder space, type and amount of waterers, ventilation equipment and rate, and type of floors (partial vs. total slats), have an effect on suggested stocking densities. Research is ongoing to study space requirements for different production systems, including breeding and gestating animals. Additional research needs to be done in order to develop scientifically based swine space guidelines that will address measures of animal welfare and be economically sustainable.

Nursing sows with piglets

Sow Space
Many indoor farrowing systems are available for producers to implement on farms. These systems differ in their ability to optimize the performance, health, and well-being of sows and piglets. In general, individual farrowing stalls tend to improve piglet well-being through decreased mortality but limit the sow's freedom. In loose-farrowing systems, freedom of movement and ability to express nesting behaviors are afforded to the sow but piglet well-being may be compromised due to increased piglet mortality. Producers need to select a system they can manage effectively and that optimizes the competing needs of sows and piglets and considers caretaker safety.

Regardless of the farrowing system selected, equipment and flooring design should provide for comfort, safety, and hygiene of sows and piglets. The system should be properly maintained to prevent injuries to sows and piglets. Farrowing systems should provide adequate space for sows to make postural adjustments easily.

Farrowing systems must provide unobstructed access to feed and water for the sow. Feeding and watering systems should be checked daily to ensure they are operating properly.

Individual farrowing stalls should provide adequate space for sows. Adequate space is defined as:

- The sow can easily lie down fully on its side (full lateral recumbency) and easily stand up.
- The sow must be able to lie down fully on its side (full lateral recumbency) without the head having to rest on a raised feeder and the rear quarters coming in contact with the back of the stall at the same time.

Loose-farrowing systems should provide adequate space for sows to easily lie down fully on their side and easily stand up. In addition, loose-farrowing systems need to provide adequate space for sows to turn around easily with minimal risk to piglets.

Piglet Space
In every farrowing system, there needs to be an area(s) that accommodate unique needs of piglets (creep area). This area should have the following characteristics:

- Provide thermal comfort for piglets,
- Provide ample floor space so all piglets can lie down without having to lie on other piglets,
- Provides protection for piglets from sow(s) (i.e. prevents crushing of piglets), and
- Ensures unrestricted access to the udder for all piglets so that appropriate nursing behaviors can be expressed.[30]

Feed (creep feed) should be provided to piglets that are weaned at 28 days of age or older. Some producers may observe benefits in piglet performance, survival and well-being if supplemental water is available to piglets in the creep area. Consumption of creep feed could be enhanced if supplemental water is provided for piglets in the creep area.

Boars

Stall size and feeding system requirements established for breeding and gestating sows are applicable to mature boars. Adequate quality and quantity of space should be provided to allow boars to meet space requirements based on body size.

Fighting will occur when mature boars unfamiliar with one another are penned together. Individual housing of mature boars limits aggressive interactions. Boars living in small groups should be of similar size and it is highly desirable that they be reared together before puberty. Newly purchased young boars, if housed together on arrival, can often be kept as a group.

Weaned (Nursery) pigs & grow/finish pigs

Pens should be designed to accommodate growth up to a point when all or part of the group of pigs in the pen are removed. Each pig must be able to easily lie down fully on its side (full lateral recumbency) without having to lie on another pig and without the head having to rest on a raised feeder. Table 1 contains the suggested space allowances for the average weight of pigs in a pen.

An alternative method for calculating floor space allowance is the use of an equation based on the allometric relationship between body weight and space requirements.

$$A(m^2) = k \times BW^{0.667}$$

Table 1. Floor Area Recommended for Growing Pigs in Indoor Housing on Partial or Total Slats

Stage of Production	Square Feet
12 - 30 lbs	1.7-2.5 ft^2/pig
30 - 60 lbs	2.5-4 ft^2/pig
60 - 100 lbs	4-6 ft^2/pig
100 - 150 lbs	6 ft^2/pig
150 - 275 lbs	7 ft^2/pig
275 lbs to market	8 ft^2/pig

Table adapted from MWPS (1983)[31] Chapters 1, 2 and 3; Fritschen and Muehling (1981)[32]

Floor space allowance is expressed using a k-value, which, when multiplied by a pig's body weight (kg)$^{0.667}$, gives the floor surface area in m^2.[33, 34] The k-value can range from 0.030 to 0.039 when calculating pig space. The optimal k-value may change according to temperature, type of flooring and group size.

Close observation and professional judgment in modern facilities may allow higher stocking densities without interfering with the pigs' well-being. Production practices, such as group size, type and amount of waterers and feeder space, ventilation equipment and rate, and type of floors (partial versus total slats), have an effect on suggested stocking densities. Research is ongoing to study space requirements for different production systems. Additional research needs to be done to develop scientifically based pig space guidelines that will address measures of animal well-being and be economically sustainable.

Outdoor housing considerations

Shelter Availability, Design and Thermal Comfort
Natural or manmade shelter must be provided to protect pigs from the elements. The farrowing / lactation environment should support low pre-weaning mortality.[35, 36, 37] The size of the shelter should be large enough for all pigs in the group to lie down at the same time. The microenvironment should reflect an effective environmental temperature appropriate for the age of pig. Refer to Table 7 in the Thermal Control section for recommended temperature limits.

Space Allowance
Critical factors that determine space for pigs housed outdoors should include, at a minimum, bedding, soil type, vegetation types and density, season, rainfall, supplemental feeding levels, vegetative palatability, vegetative trampling and rooting, and producer preference, slope of land, waterways, and human and pig health and safety. Minimum space allowances for outdoor pigs are with the idea of maintaining ground cover over time but dependent on specific factors listed above. Providing vegetative ground cover (forests, crops, forage, etc.) should support healthier pig production compared to dirt systems. Table 2 provides recommendations for minimum space allowances for outdoor pigs.

Table 2. Summary of space recommendations for outdoor pigs.

	Animals per Acre		
Reference	**Lactating Sows**	**Gestating Sows/Boars**	**Growing Pigs**
Carrier and Ashbrook, 1918[38]	0.3-0.5	--	--
Fritschen and Muehling, 1987[32]	7	10	50-100
Wheaton and Rea, 1993[39]	6-8	8-12	10-30
Rachuonyo et al., 2002[40]	3-14	3-14	--
Range of all recommendations	0.3-14	3-14	10-100

Use of Nose Rings
Nose rings are painful and only slow down rooting behavior. Therefore, it is recommended that producers should limit the use of nose rings and carefully consider the animals' well-being relative to the environmental benefits before use.[41]

Mixing pigs

Mixing and regrouping of different pigs should be avoided as much as possible due to an increase in fighting and a decrease in production gains that follows such practices. Increasing group size decreases the amount of fighting at mixing, as does increased space allowance to allow escape. Sorting by size into pens may increase the amount of fighting. The addition of individual pigs to an unfamiliar group should be avoided where possible. The populations in "hospital pens" should be smaller to maintain the ability to segregate classes of pigs.[42, 43, 44]

Breeding and genetics

A balanced genetic selection approach should include economically important traits along with well-being traits. Examples of well-being traits could include aggression, maternal behavior, feeding behavior and heat stress tolerance.

Pigs that are dangerous to humans and other animals should be removed from the herd and aggression should be selected against when choosing genetics. Sows that experience severe/frequent aggressive encounters may experience acute stress and, if unresolved, chronic stress may result in negative consequences for immunity, disease and productivity, which may or may not be of genetic origin.[45]

Breeding records should be maintained to assist in identifying genetic sources of undesirable traits. This information will assist genetic suppliers with identifying individuals and genetic lines that have deleterious genetic defects that should be removed from the population.

Weaning Age

The appropriate weaning age for an indoor farrowing system is driven by many factors including, but not limited to, the ability of pigs to thrive after weaning, health status of pigs, sow body condition, disease challenges present in the herd and management abilities of caretakers. Producers commonly wean pigs at ages ranging from 14 to 35 days.

Producers must ensure appropriate nutrition, environmental control and management oversight are in place to protect well-being of weaned pigs realizing that needs of a young pig can be very different than those of an older pig.[46]

Producers should closely monitor sow body condition to ensure acceptable standards are maintained. Lactation length and sow body condition influence subsequent reproductive performance.

Pain Management

The following standard agricultural practices if conducted should be performed prior to weaning (with exception noted below) in order to allow piglets to be returned to their mother where they can achieve maternal-neonatal interaction including nursing, which has been demonstrated to reduce stress. If standard agricultural practices must be conducted post-weaning, they should be performed with the use of anesthetic or analgesic in accordance with American Association of Swine Veterinarians (AASV) guidelines.

Castration

Castration is performed to reduce aggressive nature, boar taint and unintended breeding. Surgical castration should be performed after colostrum intake and sufficiently prior to weaning to allow adequate time for wound healing. Clean, sharp equipment must be used to minimize pain and risk of infection. A scalpel blade is a common tool utilized. There are few pharmaceutical options available for pain mitigation that are practical, legal and improve piglet outcomes. However, when such options do exist or become available, they should be considered for pain mitigation. Therefore, surgical castration without pain mitigation is currently a viable option. Alternative methods to surgical castration include immunological castration, sexed semen and genetic selection against boar taint. At this time, there is an FDA-approved product available for immunological castration. Sexed semen has limited availability from one genetic source, and gene editing is an emerging technology not currently available for industry application. If surgical castration must be done post-weaning, it should be done with the use of anesthetic or analgesic in accordance with AASV guidelines.

Identification

Identification is important from the standpoint of quality assurance and traceability and can be required throughout the lifetime of the pig. Pigs should be identified on an as-needed basis. When permanent identification (i.e. ear notching) is needed, it should be performed prior to weaning to allow adequate time for wound healing using clean, sharp equipment to minimize pain and risk of infection. Other common identification techniques include tagging and tattooing and may occur at any age. There is insufficient data at this time to make recommendations on pain mitigation for identification.

Tail docking

Tail docking is performed to reduce injury, pain, and infection associated with tail biting and reduce the need for treatment. Tail docking should be performed sufficiently prior to weaning to allow adequate time for wound healing. Clean, sharp equipment must be used to minimize pain and risk of infection. Common tools include side cutters, scalpel blade and electrocautery. There is insufficient data at this time to make recommendations on pain mitigation for tail docking.

Tail biting is multifactorial. As such, prevention and treatment options should address management and environmental issues.

Teeth clipping

Teeth clipping is a management tool performed when necessary. Teeth clipping should be performed as soon as the need is recognized based on conditions of littermates and sow's underline. Clean, sharp equipment must be used to minimize pain and risk of infection. Common tools include teeth clippers or grinders. There is insufficient data at this time to make recommendations on pain mitigation for teeth clipping.

Tusk trimming

Tusk trimming must be performed under the direct or indirect supervision of a veterinarian. Clean, sharp equipment must be used to minimize pain and risk of infection. Common tools include embryotomy wire and cutters. The veterinarian is responsible for developing recommendations for analgesic and/or anesthetic protocols as well as technique to be used for the procedure. An age recommendation for tusk trimming is not appropriate given the tusks continue to grow as the pig ages.

Other on-farm surgery

Any surgery requiring the opening of the thorax or abdomen is considered major. On-farm major surgery must be performed under the direct or indirect supervision of a veterinarian. The veterinarian is responsible for developing recommendations for analgesic and/or anesthetic protocols to be used for the particular surgery.

3

FEED AND WATER

Nutritional needs

Animals should be fed to at least meet their minimum nutrient requirements for growth and/or maintenance of good body condition. Body condition scores are useful to assess the adequacy of the nutrition program. Body condition scoring has been adopted from the industry standard that is based on a 1 (emaciated) to 5 (obese) scale as shown in Table 3. Any animals with a body condition score less than 2 should receive immediate attention to improve their body condition.

Table 3. Pig body condition scoring[47]

Image					
Score	1	2	3	4	5
Condition	Emaciated	Thin	Ideal	Fat	Obese
Detection of Ribs, Back Bone, "H" Bones and Pin Bones	Obvious/ Visible	Easily detected with pressure	Barely felt with firm pressure	None	None

Taken from "Assessing Sow Body Condition" by R.D.Coffey, G.R. Parker, and K.M. Laurent (ASC-158; 1999)

The feed provided should meet the nutritional requirements of the animals as appropriate for their age and phase of production without deficiency or toxicity. Detailed requirements are available from the NRC and recommendations from the National Swine Nutrition Guide.[48, 49] Dietary fiber may be used to improve satiety when pigs are limit fed.

Water needs

Water should be evaluated for livestock suitability, especially with new water sources. Because surface water is open for potential contamination, it may require additional or more frequent testing. Water consumption for each phase of production can be found in Table 4.

Table 4. Average water usage of pigs.[50, 51]

Class of Pig	Liters/pig/day	Gal./pig/day	Flow Rate (cups/min)
Nursery pigs (up to 60 lbs BW)*	2-5	0.5-1.3	1-2
Grower Pigs (60-100 lbs BW)*	5-12	1.5-3	2-4
Finishing Pigs (100-250 lbs BW)*	7-12	1.8-3	2-4
Non-pregnant gilts	12	3	4
Pregnant sows	12-25	3-6	4
Lactating sows	10-45	2.5-12	4
Boars	12-20	3-5	4

*Water consumption and requirement is directly related to feed intake and environmental temperature. Water wastage is highly variable, dependent on water device, and in some instances, much higher than water consumption. For this chart, water usage = consumption + wastage *Water needs are approximately 2.5-3.0 L/kg or 0.3 gal/lb of feed consumed for nursery, grower and finishing pigs.*

Feeding and watering practices

Pigs must be provided with feed and water at least once per day to meet their daily requirements. For pigs fed with automatic feed and water systems, normal management should include daily verification that pigs have access to feed and water.

Feeders and waterers should be in good state of repair and positioned to allow for unobstructed feed and water delivery without causing injury to the pigs. Although dependent on group size, diet type, and feeder design, in general, an ad libitum feeder for growing pigs can feed up to 12 pigs per space for dry feeders and up to 20 pigs per space for wet-dry feeders. Table 5 provides recommendation for feeding space widths for growing pigs.

Table 5. Recommended width of a feeding space for growing pigs.[52]

Pig Weight, lbs	Width, inches
50	7.4
100	9.3
150	10.6
200	11.7
250	12.6
300	13.4
350	14.1

Calculated as 110% of the shoulder width of the pig from the equation (width, cm = 6.1 x BW, $kg^{0.33}$) from Petherick JC. A note on allometric relationships in Large White × Landrace pigs. Anim. Prod. 1983; 36:497.

4

ENVIRONMENTAL MANAGEMENT

Thermal control

Table 6 gives the critical limits and preferred temperature ranges for pigs in various stages of production. Upper and lower critical temperatures define the pig's thermal comfort zone. Within the thermal comfort zone, there is an optimal range of temperatures in which the pig does not have to use heat-conserving or heat-dissipating mechanisms (such as shivering, huddling or panting) to conserve or dissipate body heat. Keeping pigs above or below their critical temperature cannot only negatively influence thermal comfort, but also feed intake, growth, feed efficiency and health.

Table 6. Recommended temperature limits for pigs.[53, 54]

Stage of Production	Lower Critical Limit (°F)	Upper Critical Limit (°F)	Optimum Range for Health and Production (°F)
10 – 30 lbs	60	95	80 – 90
30 – 75 lbs	40	95	65 – 80
75 – 150 lbs	25	95	60 – 75
150 lbs – market weight	5	95	50 – 75
Gestating sows	5	90	60 – 75
Lactating sows and litters	50 for sow	90 for sow	60 – 80 for sows; 90 – 95 for piglets
Boars	5	90	60 – 75

Regardless of whether pigs are kept indoors or outdoors, it may be necessary to provide supplemental heating or cooling for pigs when temperatures are outside the pigs' critical temperatures. Examples of supplemental heating include using heat lamps or brooders for zone heating, gas or electric heaters or bedding. Examples of supplemental cooling can include misters, evaporative cooling cells, fans, drip coolers, shelters, shade trees or wallows.

Caretakers should learn to identify signs of heat-stress. These include:

- Increased rates of respiration or panting (See Table 7)
- Increases in body and skin temperatures
- Increased body contact with cooler surfaces
- Spreading out
- Reduced feed intake
- Decreased activity
- Increased water consumption
- Increased splashing and wallowing
- Discoloration of the skin color (also known as "blotchy" or "splotchy" skin)

Table 7. Normal respiration rates for pigs[55]

Stage of Production	Respiration Rate (number of breaths/minute)
Pre-Nursery	50 – 60
Nursery	25 – 40
Growing	30 – 40
Finishing	25 – 35
Gestating Sows	13 – 18
Lactating Sows	15 – 22*
Boars	13 – 18

**Respiration rates will increase beginning 24 hours prior to farrowing and should return to normal levels by 24 hours post-farrowing.*

In the event of extreme heat, strategies caretakers can consider to mitigate heat stress include:

- Reduce the stocking density and increase the floor space per pig to take advantage of pigs releasing heat through their skin.
- Use of water sprinklers, foggers, or drip coolers to provide effective supplemental evaporative cooling, allowing time to dry between wetting cycles.
- Increase air movement over pigs.
  - Air exchange in mechanically ventilated buildings should be increased.
  - Use stir fans in naturally ventilated barns.
  - The use of an evaporative cooling pad can cool the air that enters a building and is most effective in hot, dry climates.
- Formulate diets to be more nutrient dense during hot seasons so that nutrient needs are met and reduced feed consumption does not affect pig health and performance.
  - Add supplemental fat to the diet.
  - Increase the concentration of other nutrients.
  - Reduce the crude protein content by using synthetic amino acids.
  - Add water to dry feed.
  - Use of liquid feed systems.
  - When free choice access to feed is not provided, the ration should be supplied during the coolest periods of the day (early morning, late afternoon or at night).
- Provide pigs with access to fresh, quality water.
  - Waterers should be adjusted and functioning properly, with enough waterers available to allow adequate access (pigs can drink up to 6 times more water when heat stressed).
  - Increased water intake may lead to increased urination and loss of important minerals. Dietary adjustments may help replace mineral losses and restore electrolyte and metabolism balance.
- Provide shade for pigs housed outdoors.

Barn fan and evaporative cooling pad.

Caretakers should learn to identify signs of cold-stress. These include:

- Increased huddling with pen mates,
- Shivering,
- Reduced contact with the floors by tucking the tail and/or feet beneath the body,
- Increased feed intake,
- Seeking shelter in the warmest, least drafty area in the pen, and
- Altering dunging and sleeping habits, and lying down in warm excrement.

In the event of extreme cold, strategies caretakers can consider to mitigate cold stress include:

- Keep pigs dry at all times.
- House several pigs together during times of cold weather to take advantage of huddling behaviors.
- Provide plentiful dry bedding for facilities that utilize bedding. Be sure to add new dry bedding frequently.
- Eliminate air drafts.
  - Ventilate at the recommended level.
  - Repair holes in walls, ceilings and curtains.
  - Replace broken windows.
  - Use solid pen dividers or barriers.

- Keep inlets properly adjusted.
- Never leave doors or windows open.
- Use hovers, or a box structure, in farrowing crates or nursery pens to capture heat and reduce drafts.
- For outdoor housing systems, provide huts or covered kennels.
- Cover or insulate unneeded fans.

- Add insulation to walls, ceilings and curtains.
- Provide supplemental heat.
  - Gas or electric heaters (space or overhead heaters)
  - Electric heat lamps or gas brooders for zone heating
  - Electrically heated floor mats
  - Heating pipes placed in the floor of the pen

Air quality

Adequate ventilation must be provided to prevent the buildup of gases, particulate matter, and airborne microorganisms to levels that are harmful to pigs. Caretakers should evaluate the environment at the pig and barn level to make sure temperatures and air quality are correct for the phase of production. Table 8 explains the health effects various gases can have on pigs.

Ammonia
Ammonia is a common air contaminate that can directly affect the well-being of the pig through irritation of the respiratory tract. Average ammonia concentrations should not exceed 25 ppm. Make sure ventilation systems are working properly to reduce pig exposure to ammonia gas.

Table 8. Health effects of pigs exposed to gases in pig operations

Gas	Health effects in pigs
Ammonia	Irritation, puberty delays, compromised sense of smell, increased risk for respiratory disease, reduced performance
Hydrogen Sulfide	Nervousness/fearful, loss of appetite, shortness of breath, death
Carbon Dioxide	Decreased performance, increased respiratory disease, increased rate of breathing and discomfort, asphyxiation and death
Carbon Monoxide	Increase in numbers of small litters, unthrifty pigs, and low weaning weights; increased abortions and stillbirths, death
Methane	Explosion/highly flammable resulting in injury and death

Hydrogen Sulfide
Hydrogen sulfide concentrations are typically very low (approximately < 2 ppm), but during manure agitation and pumping of liquid manure, concentrations can reach dangerous concentrations (200-1,500 ppm) and can be lethal.

Carbon Dioxide
Carbon dioxide is produced from respiration, burning of fossil fuels and manure decomposition.[56, 57] Although an unusual circumstance, CO_2 concentrations can rise quickly if ventilation systems fail completely. High concentrations can induce loss of sensitivity, consciousness, breathlessness, and ultimately death.[58] Carbon dioxide concentrations can also climb to levels that may potentially induce heat stress and kill hogs if ventilation systems fail completely, which is a greater concern during periods of warm weather.[58]

Carbon Monoxide
Carbon monoxide can come from improperly functioning or poorly ventilated heating units and generators, or insufficient ventilation when gas-powered high-pressure sprayers are used indoors. Winter is a dangerous period for the accumulation of CO because buildings are typically closed and ventilation rates are reduced to minimize heat loss. Gas brooders that are improperly maintained can produce CO at a level of concern.

Methane
Methane is a product of manure decomposition in manure pits. With proper ventilation, it is normally at low levels. The major safety hazards of methane occur when levels are high enough to become explosive or highly flammable.

High concentrations of methane can be trapped in the manure foam of deep-pit manure systems. When foam bubbles are disturbed or broken (such as during pit agitation or pumping), the methane gas trapped in foam bubbles is released at explosive concentrations (50,000 – 200,000 ppm). If there is an ignition source (e.g. light switch, electric motor and heater pilot light) near explosive concentrations of methane, an explosion or flash fire could occur. Explosions happen most frequently in a barn that has had no ventilation during an empty period and then an ignition source is introduced.

Particulate Matter (PM)
Several studies have determined that PM concentrations are markedly greater during the winter season than in the summer, when ventilation rates are decreased to minimize heat loss, as when using deep-based litter systems compared to slat flooring.

Pig exposure to high concentrations of PM has been linked to: (1) an overload of the respiratory tract and impaired ability of pigs to appropriately respond to respiratory infections, (2) PM can contain bacteria, fungus and viruses that are disease-causing and put pigs at higher risk for pneumonia and other respiratory illnesses, and (3) PM also carries non-infectious bacterial components that cause inflammation in the airways of pigs.

Airborne Microorganisms
Factors leading to increased concentrations of airborne microorganisms include:

- Cold seasons when ventilation rates are lowest.
- When deep-bedded litter systems or non-slatted floors are used.
- Malfunctioning ventilation systems, defective air inlets and outlets, and poorly selected location of air inlets and outlets with respect to airborne microorganism exposure.
- High animal density.
- A lack of routine and proper sanitation strategies including not removing wastewater from non-slatted flooring or irregular or infrequent cleaning of densely stocked units.

Ventilation systems and requirements

Fans, inlets and controls need to be compatible and function together to achieve the two major ventilation functions of air exchange and air distribution. Recommended ventilation rates are provided in Table 9 and Table 10.

Good air distribution is necessary to eliminate dead spots and limit unwanted drafts. The design, location and adjustment of the air inlets can control the distribution and mixing of air. Inlet design and management are the keys to uniform distribution,

Table 9. Recommended ventilation rates[59, 60]

Stage of Production	Body Weight (lbs)	Cold Weather Rate (cfm*/animal)	Mild Weather Rate (cfm*/animal)	Hot Weather Rate (cfm*/animal)
Sow and litter	400	20	80	500
Nursery pigs	12-30 30-75	2 3	10 15	25 35
Finishing pigs	75-150 150-250	7 10	24 35	75 120

*cfm = cubic feet per minute

How to determine the minimum ventilation rate:
# of animals x cold weather rate (cfm/animal from Table 10) = _____ cfm

How to determine the maximum ventilation rate:
# of animals x hot weather rate (cfm/animal from Table 10) = _____ cfm

Table 10. Recommended mechanical ventilation rates for sows, gilts and boars.[61]

Animal Type	Body Weight (lbs)	Cold Weather (cfm*/animal)	Mild Weather (cfm*/animal)	Hot Weather	
				Uncooled Air with Spray Cooling (cfm*/animal)	Evaporative Cooled Air (cfm*/animal)
Gilts	250-350	12	40	150	90
Sows & boars	350-450	14	50	300	180
	> 450	16	65	500	300

*cfm = cubic feet per minute

complete mixing and providing acceptable uniform air quality throughout the room. It is important to ensure that attic and pre-warming hallway inlets allow adequate airflow to meet room inlet needs. Air inlet capacity must match the overall fan capacity because static pressure (difference in air pressure from inside a building to the outside of a building) can increase in rooms or buildings with insufficient or inadequate air inlet capacities, ultimately resulting in reduced overall fan performance.[62] Table 11 provides guidelines on fan capacity. It is best to use the actual rates for capacity when selecting fans rather than using assumed values due to wide variations in fans.

Table 11. Fan capacity guidelines based on performance test results on agricultural ventilation fans conducted by the University of Illinois Bioenvironmental and Structural Systems (BESS) Laboratory.[a]

Fan Blade Diameter	Certified air flow (cfm) at 0.05" static pressure[b] (power supply: 1 phase 230V, 60 Hz)			Certified air flow (cfm) at 0.10" static pressure[b] (power supply: 1 phase 230V, 60 Hz)		
	Lowest[c]	Highest[d]	Average[e]	Lowest	Highest	Average
9"	970	1090	1050	930	1070	1020
12"	1530	2340	1805	1450	2260	1718
14"	1990	2610	2320	1900	2480	2218
16"	2190	3740	2906	2050	3580	2765
18"	3090	4500	3907	3000	4310	3725
20"	2930	5370	4171	2630	5190	3971
24"	4450	7680	6274	4090	7270	5893
25"	4820	7820	6586	4340	7420	6250
30"	6720	7010	6860	6160	6530	6393
36"	7630	16420	11479	6940	15700	10639
48"	16500	28400	22759	14600	26800	21326
50"	17300	29800	24376	15700	28600	22868
51"	22900	33300	27595	21300	31900	25919
52"	20800	31100	27104	18400	31000	25794
53"	20800	30100	25261	17900	28400	23433
54"	19400	33400	27720	18500	32100	26562
55"	23400	36200	28387	20600	34400	36479
57"	24610	33280	29576	22040	31480	27554
60"	28400	34600	31440	28400	34600	31000
61"	24600	32400	28783	21600	29900	25833

[a]When purchasing fans, look for the AMCA, BESS or other reliable testing label to assure valid ratings. Make sure that louvers, shutters, and other restrictions are included when selecting fans for the required ventilation rate in pig buildings. Air flow can substantially vary between manufacturers; thus, the air flow rating should be checked with manufacturer data sheet. [b]Data prepared as of April 7, 2015. [c]Fan with lowest cfm value. [d]Fan with highest cfm value. [e]Average of all fans evaluated within same size.

Unwanted openings or inlets will affect air distribution patterns and cause drafts in pens. Strategies to address unwanted inlets include:

- Seal pit access openings and drains, and make sure all doors and windows fit tightly.
- Tightly seal all fans that do not operate during cold weather.
- Curtain leakage is a major problem and if curtains are not tight or they have small cracks, air enters from curtain versus ceiling inlets and air distribution is a problem. To minimize curtain leakage, curtains should have no sags or gaps, have a 2- to 3-inch overlap at the top plate, all holes repaired, ropes in place and tight, and end pockets repaired. Additional insulation may be added during the winter between the curtain and bird netting to further help maintain room temperatures. Care needs to be taken to insure that curtains are still able to drop in the event of an emergency power outage.

Lighting

Lighting plays a significant role in good husbandry, as it is important for workers to be able to carry out all their normal duties effectively and safely.[64] Table 12 provides recommended light intensities for each phase of production.

Table 12. Recommended light intensity levels for pig housing

Housing Type	Fluorescent Lighting (watts/ft^2)	Incandescent Lighting (watts/ft^2)	Light Levels (lux)
Farrowing	0.6	2.4	50 – 100
Nursery	0.4	1.6	50
Growing-Finishing	0.2	0.8	50
Breeding	0.6	2.4	>100
Gestation	0.6	2.4	>50

Table adapted from Swine Care Practices (1997)[63] and ASABE(2015).[64]

Noise

Caretakers should avoid startling pigs with sudden and/or unnecessary loud noise. The noise level of machinery and equipment should be minimized. When moving or handling pigs, they should be moved at their normal walking pace while minimizing excessive loud noise or yelling that may frighten or excite pigs.

Manure management and sanitation

Pigs are clean animals and keep their area for defecation and urination separate from the lying area, provided their living facility has the correct floor space, floor layout, air inlets, air distribution method, air flow pattern, relative humidity and ambient temperature.

All alleyways within pig production rooms should be routinely cleaned to avoid excessive manure accumulation. In addition, corridors between and within buildings should be routinely cleaned.

All buildings operated with an all-in-all-out procedure should be routinely cleaned and disinfected between groups. If possible, buildings operated with a continuous flow should be scheduled whereby sections can be cleaned.

If the volume of slurry in the manure pit becomes too high, it can reduce the headspace and restrict air flow through the pit fans. The volume of manure-slurry should be routinely measured and recorded to help ensure the manure pit being too full is not effecting air quality. Table 13 provides estimates of typical manure characteristics as excreted by pigs. A stick or a laser can be used to measure the depth of manure by determining the free-board between the manure surface and the top of the slats.

Because some highly contagious viruses stay viable in stored manure for an extended time, producers should avoid bringing stored manure into the area where a new group of pigs can be infected with the contagious disease.

All buildings with a deep-pit manure storage method should be monitored for foaming and a method implemented to reduce the foam.

Guidelines should be developed for pumping manure from deep pits to reduce the risk of spreading disease, death of pigs and caretakers due to hydrogen sulfide, and barn explosions and fires due to methane. Table 14 provides guidelines for developing a farm-specific procedure for mixing and pumping manure from a deep pit.

Table 13. Estimated typical manure (feces and urine) characteristics as excreted by pigs.

Stage of Production	Total Solids[a]	Volatile Solids	Total Manure Produced[b]		Assumed Finishing Time Period (days)
	Lbs/finished pig		Lbs/finished pig	Ft^3/finished pig	
Nursery pigs, 27.5 lbs[c]	10	8.7	87	1.4	36
Grow-finish pigs, 154 lbs[d]	120	99	1,200	20	120
	Lbs/day/pig		Lbs/day/pig	Ft^3/day/pig	
Gestating sow, 440 lbs	1.1	0.99	11	0.18	
Lactating sow, 423 lbs	2.5	2.3	25	0.41	
Boar, 440 lbs	0.84	0.75	8.4	0.13	

Table adapted from ASABE (2014)[65]

[a] Total solids includes feces and urine.

[b] Total manure is calculated from total solids and manure moisture content.

[c] Value is calculated as: (In weight of 11 lbs + Out weight of 44 lb)/2 = 27.5 lbs

[d] Value is calculated as: (In weight of 44 lbs + Out weight of 264 lb)/2 = 154 lbs

Table 14. Guidelines for development of a farm-specific procedure for mixing and pumping manure from a deep pit.[66]

The greatest manure-related hazard exists almost immediately after vigorous agitation of manure begins due to manure-related gases, but the danger may continue even when there is full ventilation. The following guidelines help avoid unnecessary risks.
• Prior to agitation or pumping, turn off electrical power to any non-ventilation equipment (e.g., feeding system) and extinguish any pilot lights or other ignition sources in the building (e.g., power washer). The provision of no supplemental heat may be problematic when there are no animals in the building or there are only small animals in the building that require warmer indoor temperatures. Thus, pumping manure with these restrictions may require pumping during warmer days or warmer part of the day.
• Remove all workers from buildings before beginning manure agitation. Never enter a building or allow workers to remain in buildings or manure storage areas when agitating manure.
• Place warning signs at all entrances to buildings and manure-storage areas where manure agitation is taking place so people will not enter.
• Remove all animals from buildings before beginning manure agitation, if possible.
• If removing animals is not possible, begin agitating manure slowly and gradually increase pump speed while observing animals from outside the building. If signs of animal stress are noted, immediately discontinue agitating the manure.
• Prior to starting the agitation process of stored manure, be sure a sufficient amount of time has been spent (e.g. 30 minutes) ventilating the facility to ensure adequate air movement and air exchange has occurred.
• For mechanically ventilated buildings, provide the maximum mechanical ventilation for the weather conditions and weight of the pigs that prevent chilling of pigs. Fans should be in operation prior to beginning and throughout agitation of manure.
• For naturally ventilated buildings, agitate manure only with all side curtains and building openings fully open and when there is a brisk breeze.
• Tarp the pump outs to avoid drafts/air from entering manure pit in wrong areas.
• When pumping pits that are close to full, pump without agitation until manure is two feet below the bottom of the floor slats to allow pit fans to perform properly during agitation.
• When agitating manure, keep the jet of pressurized manure below the liquid surface. Do not allow it to strike walls or columns in the pit. Stop agitating when the manure level does not allow agitation below the surface.
• Do not enter the building until complete ventilation of the building has occurred – at least 30 minutes while maintaining full ventilation – or unless wearing a properly fitting self-contained breathing unit that you are trained to use.
• Never enter a building or manure storage to rescue a distressed animal or person without wearing a properly fitting self-contained breathing unit that you are trained to use.
• Never enter a manure storage pit or tank unless it is absolutely necessary, and then only if it is well-ventilated and you are wearing a properly fitting self-contained breathing unit that you are trained to use, wearing a properly fitted harness and lifeline and having at least two other people to rescue you in the event of a problem.
• For manure-storage access points, at or below ground level, install covers or grates in such a way that people or pigs cannot fall into the manure pit/storage.

Flooring and bedding management

Flooring

Regardless of the phase of production, the flooring used in pens, alleys and load-out area should be evaluated for factors that contribute to a poor quality floor, e.g., slipperiness, roughness, broken slats, sharp edges of slats, holes in slats and solid floors, and exposure of floor aggregates due to wear. Regular maintenance along with repairing problems that are identified will help to prevent injuries that may be caused from problems with slats or flooring. All pigs need access to a dry and clean area to lie down.

If shoulder ulcers on sows are a problem at time of weaning, the following factors that can contribute to shoulder ulcers should be investigated: thin body condition, sow weight loss at weaning, large litter combined with low feed intake, parity, lameness, summertime, previous occurrence, duration of contact with floor, side rails of farrowing crate and genetics. Shoulder ulcers should be effectively treated to promote healing (e.g., use of ointments, spray medications, nutrition or rubber mats).

Although the exact cause of lameness can be difficult to diagnose on the farm, lame animals should be evaluated for claw lesions, joint problems, skin lesions, fractures and arthritis. Routinely recording the frequency of identified claw lesions, swollen joints, shoulder lesions, and various types of injuries helps determine whether improvement is being accomplished. Severely lame animals (non-weight bearing on the affected limb when either standing or walking)[67] must be placed in an area that provides a dry laying area, free from excessive manure accumulation, and provides sufficient traction to support mobility. Feed and water should be provided in a manner that meets the pig's daily requirements.

Bedding

Bedding should be provided when pigs are housed in facilities without a heat source in geographic locations where ambient temperature within the building can be cold.

All pigs need a dry area for lying and resting, especially during cold weather. Bedding provides the pigs with an insulation value. The bedded area should be kept dry, especially during cold weather. If bedding is used, it must be dry enough not to transfer moisture, mud or manure onto the body of the animal. Deep mud or muck with no dry place to lie is unacceptable.

Some types of bedding that can be used are oat straw, wheat straw, sawdust, soy hulls, ground corncobs and cornstalks. The type of bedding does influence the absorption capacity of the bedding.

Enrichment

Environmental enrichment can include social, occupational, physical, sensory and nutritional amenities. Social enrichment can be achieved by grouping pigs. Occupational enrichment includes allowing and promoting physical exercise, foraging, exploration and social interaction. For sustained occupational enrichment, the best materials are complex, changeable, destructible, and ingestible. [68, 69, 70] Physical enrichment can be achieved by changing the complexity of the pig's enclosure or adding objects, substrate, or permanent structures such as visual barriers. Sensory enrichment can be achieved by stimulating the pigs' olfactory, visual and auditory senses. Nutritional enrichment can be achieved by presenting varied or novel feed types or changing feed delivery methodology such as providing ingestible foraging substrates.[71] Some types of enrichment can address several of these categories simultaneously. Environmental enrichment must be practical to employ, must not cause harm to the pig and must not compromise food safety.

Facilities and equipment

The physical condition of all pens, floors, and alleyways should be appropriate for the phase of production. All pens, floors, and alleyways should be kept in a good state of repair whereby they do not cause injury to animals due to sharp protruding objects, broken slats, slippery floors or excessively rough floors.

Waterer.

All feeders and feed systems must be in a good state of repair to allow unobstructed feed delivery to the pigs and not cause injury to the pigs.

All drinking devices must be in a good state of repair to allow appropriate water delivery to the pigs and not cause injury to the pigs.

The entire ventilation system (fan blades, fan belts, fan motors, air inlets, air distribution method and shutters) must be kept clean and in good state of repair to

provide an environment for good health and productivity of the pigs.

The electrical system, heating system, gas lines and structural components of the building should be kept in good state of repair to provide a safe environment for the pigs and caretakers.

Example maintenance checklists for inspecting indoor and outdoor aspects of the facility can be found in Appendix 1.

A rodent (especially rats and mice) control program should be implemented and maintained to prevent rats and mice from destroying insulation, eating feed and transmitting diseases to pigs. A bird control program should be implemented to prevent birds from entering buildings, eating feed and spreading diseases to pigs.

Rodent trap.

5 EUTHANASIA

On-farm euthanasia plans

Sites must have a written euthanasia plan. Producers should work with their herd veterinarian to outline a plan covering primary and backup methods for each stage of production in the operation. The written plan must comply with the current American Association of Swine Veterinarians (AASV) guidelines for euthanasia. The plan must be readily accessible to all caretakers in the facility.

Decision-making around timely euthanasia

When a pig becomes ill, injured, or otherwise disadvantaged, the initial decision for action may include treatment or euthanasia. In some cases, euthanasia may be the best option for the well-being of the pig. While not all individuals may be responsible for conducting euthanasia, everyone should take action to ensure a timely response. It is important that the decision to euthanize be made in a timely manner to minimize the pig's pain or distress.

Timely euthanasia is required for:

- Animals that have no prospect for improvement or not responding to care and treatment after two days of intensive care must be humanely euthanized unless otherwise recommended by a veterinarian. The caretaker's past experiences with similar conditions should be used to make informed decisions about the likelihood of recovery.
- Severely injured or non-ambulatory pigs with the inability to recover are euthanized immediately.
- An animal is considered non-ambulatory if it cannot get up or if it can stand with support but is unable to bear weight on two of its legs.
- Any animal that is non-ambulatory with a body condition score of 1 must be euthanized immediately.
- Pigs with hernias that are perforated must be euthanized. Pigs with hernias that are ulcerated and necrotic must be euthanized. Pigs with large hernias that touch the ground while standing and cause difficulty walking and are ulcerated must be euthanized.
- Any pig with an untreated prolapse that has become necrotic must be euthanized. Uterine prolapses must be euthanized immediately.

Methods of euthanasia

Euthanasia is the process whereby the pig is rendered insensible, with minimal pain and distress, until death. For the euthanasia process or method to be considered humane, it must be quick, effective and reliable. Key elements for determining if a method is humane include:

- Minimal pain and distress to the pig during administration
- Rapid loss of consciousness
- Death is achieved quickly and consistently

Certain methods of euthanasia are more appropriate than others for pigs of certain sizes or weights. Table 15 lists various methods of euthanasia in pigs and the size of pigs for which they are most appropriate. Specific details on how to apply each method listed can be found in the AASV's euthanasia guidelines.[72]

Table 15. Euthanasia methods appropriate to pigs of different sizes (weights)

Method	Approved for…
Carbon dioxide (CO_2)	All ages, but may not be practical for pigs over 70 lbs
Gunshot	Nursery pigs or older
Non-penetrating captive bolt	Pigs less than 70 lbs*
Penetrating captive bolt	Pigs greater than 12 lbs
Electrocution, head-to-heart	Pigs over 3 days of age
Electrocution, head-only	Pigs over 3 days of age with a secondary step
Veterinarian-administered anesthetic overdose	All ages, but may not be practical
Manual blunt force trauma	Pigs up to 12 lbs

**Refer to page 9 of* On-Farm Euthanasia of Swine – Recommendations for the Producer *AASV 2016 to determine appropriate force and weight range combinations.*

Confirmation of death

Regardless of the method used, it is important to be able to recognize ineffective stunning if it occurs. It also is important to confirm the death of the pig.

Confirming Insensibility

Insensibility should be checked within 30 seconds after the method is performed and should be monitored and maintained until death. Ineffective stunning and euthanasia can be recognized by the presence of one or more of the following signs:

- Rhythmic breathing
- Constricted pupils
- Attempts to raise the head (righting reflex)
- Vocalization
- Palpebral reflex (run finger along the eyelash and if the pig blinks or moves its eye, the pig is sensible)
- Response to a painful stimulus (such as a nose prick with a needle)

Confirming Death

The pig should be confirmed dead before it is moved for disposal. Multiple vital signs listed below should be checked within 3 minutes after the euthanasia method has been performed:

- No breathing
- No heartbeat
- No movement or muscle tone
- No response to painful stimulus (such as a nose pinch or prick with a needle)
- No vocalization
- No corneal reflex (the eye blinks when an object touches the cornea)

If the pig shows any of these signs, a secondary step or a backup euthanasia method should be used immediately.

6

TRANSPORTATION

Pre-transport planning

Proper preparation is critical when loading and unloading. A loading and unloading plan that clearly defines the roles and responsibilities of each individual handler. Understanding roles and following through with the team plan makes moving animals easier and helps reduce confusion and the potential for animal and/or handler stress during the handling process.

Communication between the transporter and the loading and unloading locations is essential. All loads should be scheduled regardless of the type or size of pigs. The goal of everyone involved in scheduling transportation is to minimize the amount of time pigs must be on a trailer. If a delay occurs, this change in the timeline needs to be communicated to all involved in the transport process, including the people at the origination and destination points. Animal well-being is best managed when arrival times are as close as possible to what is scheduled. The scheduled arrival time needs to be considered when scheduling the loading time.

Fitness for transport

The position of the National Pork Board is that if any pig is unable to walk, is ill, or significantly injured it should not be transported to market channels. Where the likelihood of recovery is low, even with treatment, the pig should be humanely euthanized. Any pig that becomes fatigued should be moved to a resting area in an appropriate manner. A fatigued pig is defined as having temporarily lost the ability to walk but has a reasonable expectation to recover full locomotion with rest. A resting area helps enable recovery by minimizing competition for feed and water and provides the opportunity for monitoring.

All pigs that are scheduled for transport should be evaluated for fitness to travel by a handler. If a pig is found to be unfit, it should not be loaded. Instead, the pig should be segregated for treatment or humane euthanasia.

The following list provides some examples of animals that are unfit to be transported, including, but not limited to:[73]

- Those that are sick, injured, weak, disabled or fatigued
- Those that are unable to stand unaided and bear weight on each leg
- Those that are blind in both eyes
- Those that cannot be moved without causing them additional suffering
- Newborns with an unhealed navel
- Pregnant animals which would be in the final 10 percent of the gestational period (final 11 days of gestation) at the planned time of unloading (They may be transported if special conditions are provided and additional attention is given during transport)
- Females traveling without young or who have given birth within the past 48 hours
- Those whose body condition would result in poor well-being because of the expected climatic conditions

Handling during loading or unloading

Pigs should be moved at their normal walking pace. Aggressive handling must be avoided as it can lead to injured or stressed pigs. Aggressive handling includes things such as:

- Over or improper use of electric prods
- Excessive loud noises and yelling
- Moving pigs too fast
- Moving too many pigs per group
- Overcrowding pigs in chutes, ramps and alleyways
- Rough physical contact

Willful acts of neglect or abuse are unacceptable. Each state has laws that address animal cruelty, and therefore willful acts of abuse can be punishable by law.

Willful acts of abuse or neglect are defined as acts outside of normally accepted production practices that intentionally cause pain and suffering including, but not limited to:

- Intentionally applying prods to sensitive parts of the animal such as the eyes, ears, nose, genitals or rectum. Excessive prod use could qualify as a willful act of abuse.
- Malicious hitting/beating of an animal. This includes forcefully striking an animal with closed fist, foot, handling equipment (e.g. sorting board, rattle paddle, etc.), or other hard/solid objects that can cause pain, bruising or injury.
- Driving pigs off high ledges, platforms or steps while moving, loading or unloading (animals are falling to the ground).
- Dragging of conscious animals by any part of their body except in the rare case where a non-ambulatory animal must be moved from a life threatening situation. Non-ambulatory pigs may be moved by using a drag mat.
- Purposefully dropping or throwing animals.
- Causing physical damage to the snout or tusks of a boar as a means to reduce aggression (this excludes nose ringing and tusk trimming).
- Failure to provide food, water and care that results in significant harm or death to animals. This includes the intentional failure to provide food, water or care that falls outside of normal husbandry practices and would reasonably be considered neglect.

Animal handling equipment that aids in sorting and moving pigs in a safe, humane and efficient manner should be available to be used during animal handling. Animal handling equipment must be in good working order and not broken or have any sharp edges. Pipes, sharp or pointed objects or other items that would cause injury or unnecessary pain to the animal shall not be used when moving pigs.

Handling Piglets and Nursery Pigs

Pigs can be moved either by herding or by picking them up and moving them by hand or with a cart. Pigs should be picked up by holding them under their rib cage or by grabbing a rear leg, above the hock, and then gently setting the piglets into a cart, alleyway or pen. Before releasing a pig to the ground the pig must have a point of contact with the ground or floor before the handler lets go (i.e. a front leg). Pigs may squirm and wriggle when picked up so care should be used so that they are not dropped. Pigs must not be tossed, thrown or picked up by their ears or tail.

When being held for an extended period, pigs should be held under the rib cage next to the handler's body or by both rear legs using two hands. Pigs should be moved in groups large enough to be efficient for the production system but small enough to be safe for the pigs and the handler(s). Electric prods must not be used on suckling or weaned piglets. Electric prods must not be used to move nursery pigs out of pens.

Handling Finisher Pigs
Groups of finished pigs should be small enough so that the handler can apply handling interventions to the pigs not moving. Group size should be appropriate for the smallest point in the path of movement. For example, finished pigs should be moved in groups of three to five in barns with 2- to 3-foot alleys.[74] Electric prods must not be used to move market pigs out of pens.

Handling Breeding Stock
Groups of breeding stock should be small enough so that the handler can maintain control of all pigs in the group so handling interventions can be applied to the pigs not moving. Electric prods must not be used to move sows or boars out of pens. **Breeding stock (sows, gilts and boars) are the largest and most powerful swine a handler will work with and handlers should use extra caution when moving these animals. A sorting board should be used when moving a large animal. The handler should not use his or her body alone. If the animal appears aggressive or agitated, it may be safer for the handler to move out of the way than to risk potential injury.**

Transport Loading Density Recommendations
Overcrowding pigs on a trailer is never a viable option when transporting animals. Signs of overcrowding may include piling, excessive squealing or panting. Gates should be able to close without having to force the pigs into the space. Once a gate is closed, watch to see if the pigs have room to stand without climbing on top of each other. Listen for pigs that are squealing due to being stepped on or crowded. If overcrowding is suspected, reduce the number of head per compartment. Pigs in overcrowded conditions will quickly overheat and begin panting and open-mouth breathing and may become injured, fatigued or even die.

Generally, loading density should be such that pigs can lie down and stand up, in their normal position. On short trips, pigs may prefer to stand. Pigs need space to lie down on longer trips. If there is not enough room, pigs may compete for floor space generating heat, noise and stress. The trailer should have compartments with gates or dividers with working latches to limit the number of pigs in each given area. Weather conditions and animal size should be considered when determining the number of animals to load.

Table 16 provides transport loading density recommendations per pig under normal weather conditions. See section 6.5 for further information on hot or cold weather extremes. Transport losses are minimized at these recommendations but optimal loading density is dependent upon temperature, trailer design, compartment size, etc. Changes in loading density need to be made to accommodate the weight of the pig or weather conditions. Research has shown that providing too much floor space during transport can also increase transport losses.

Table 16. Recommended transport loading densities.*[75]

Average Weight (lbs)	Square Feet Per Head
12	0.65
50	1.53
100	2.32
150	2.95
250	4.26
275	4.57
300	4.79
350	5.48
400	6.39
450	7.00
500	7.69
550	8.39

**When weather conditions become extreme, additional space must be provided. Refer to Section 6.5 of the Swine Care Handbook for additional adjustments during extreme hot or cold conditions.*

Loading/unloading facilities

Facilities should be properly designed and constructed, and in good repair, with functional equipment in place before loading or unloading pigs. Designs that provide consistency of width from alleyway to the truck are ideal because the hourglass effect of a smaller doorway or chute is eliminated. This section provides recommendations for facility designs that facilitate easy pig movement. However, there may be other configurations that are also effective, but may require different handling skills to prevent animals from balking, jamming or becoming stressed.

Lighting
Lighting should be routinely checked in all movement areas. Areas that switch from light to dark discourage movement. Pigs move best into well-lit areas.[76, 77] Likewise areas that have strong shadows or light shining into the eyes of the pig also discourage movement. Recent chute design research has shown that an industrial LED rope lighting system provides a soft continuous light source that minimizes shadowing.[78]

Alleyways and Doorways
When building a new finishing barn, the width of the alleyway is an important design component for animal handling. Alleyways should be 3-feet wide to accommodate moving three to five finishing pigs of current market weight (~280 lbs.). This will allow two pigs to walk side by side without jamming, thereby reducing stress and speeding up the movement of pigs. Doorways should be at least the same width as the alleyway and the door should open completely to eliminate pinch points. Avoid thresholds on the floor of the doorway to reduce balking.

Ramps and Chutes
The design of the loading ramp or chute has a significant effect on pig well-being. Goals of loading chute design should be to facilitate easy pig movement, reduce incidence of slips and falls, and avoid injury and stress to the pig. The correct angle of incline on ramps is very important to promote successful pig movement.

As a general guideline, ramps should be 20 degrees or less. Research has shown that ramp angles over 20 degrees cause an increase in balking and backing up behavior of pigs, an increase in physical interventions by the handler, and increased unloading times.[79] Lower angled ramps, such as 10-13 degrees, are much easier for pigs to use. The following are critical to proper ramp and chute design:

- Concrete ramps should have stair steps and nonslip surfaces to provide traction and help avoid slipping. It is recommended that the stair steps should have a 2.5-inch rise and a 10-inch tread
- Ramps for market and adult pigs should have cleats spaced 8 inches apart
- Ramps for piglets and nursery pigs should have cleats spaced 3 inches apart
- Ramps should have a flat dock at the top for pigs to step onto when they exit the truck and before they enter the ramp
- A pig views a 90-degree turn as a dead end and may stop or try to turn around. Ramps should be straight with no 90-degree turns. If a straight ramp is unachievable, curves are preferred over sharp turns and angles to facilitate pig movement.
- Chute width should match or be slightly smaller than the trailer entry width, which is normally 36 inches. The width should be less than 36 inches but greater than 32 inches.
- Covered chute (aluminum or other material).
- Cushioned bumper dock system to eliminate gaps from the barn to the chute or the chute to the trailer.
- Using concrete or an epoxy coated material to mimic the feel of concrete as the flooring material of the chute.

Chutes should be kept in a good state of repair. Sharp, protruding or otherwise injurious items should be removed or repaired. Broken or missing cleats should be repaired or replaced. Moving parts such as cables, pulleys and hinges should be inspected regularly and maintained as necessary. Ramps and chutes should be kept free of trash, debris and other potential distractions. Chutes should have adequate lighting to aid in the movement of pigs. An industrial rope lighting system installed inside the chute will provide a soft continuous light source that minimizes shadowing. However, inexperienced and/or aggressive handling will nullify the benefit of any proper chute design.

Transport Trailer
Trailers should be kept in good repair and should be kept clean. The trailer should have non-slip solid flooring to prevent the animals from slipping and falling. All gating and doors should open and close freely and must be able to be secured shut and not have gaps where pigs can get their head or legs stuck or fall out of the truck. Internal ramps should function properly and extend all the way to the floor. There should be no sharp or protruding objects in the trailer that may injure the pigs. Ensure drain plugs are securely in place prior to loading pigs onto the trailer. Trailer interiors should be equipped with sufficient lighting if loading or unloading trailers in the dark. Trailer ramp angles should be 20 degrees or less to help with pig movement in the trailer.

If the trailer has a misting system on board, the equipment should be kept in good working order, especially in the warm and hot temperatures. Plugs or panels must be available for use during colder temperatures to help regulate the internal trailer temperature. Sudden or unexpected fluctuations in temperatures can be managed easier with weather panels than with plugs.

Trailer set-up

Handlers and transporters are responsible for understanding the effects of weather on pigs undergoing transport and how to protect pigs during weather extremes. Transporters should check weather conditions along their transport route and make ventilation adjustments before pigs are loaded on to the trailer.

Cold Weather

Freezing temperatures and wind chills are very dangerous to the safety of pigs. Cold temperatures are amplified by wind speed. In cold temperatures, overcrowded pigs that cannot seek the protection of bedding from wind and low temperatures are potentially subject to frostbite. Frostbite can result from wind, but it may also occur from being pressed against the side of the trailer. Newly weaned piglets and nursery pigs are especially susceptible to cold temperature extremes.

The following measures are precautions to be taken to help ensure the well-being and safety of pigs being transported during cold weather extremes:

- Make sure trailer is completely dry after washing.
- Use proper bedding and boarding based on the weather conditions.
- Use panels at pig level to protect pigs from crosswinds.
- Block or plug a portion of the ventilation holes/slots at pig level.
- Keep pigs dry.
- Load fewer pigs per load.
- If you have to stop during extreme cold weather, monitor trailer conditions and adjust trailer boarding to ventilate the trailer to prevent condensation buildup.
- Provide extra bedding. Bedding should be clean and dry before pigs are loaded

Table 17 provides recommended truck set-up procedures for finished pigs during temperature extremes. These are based on two research projects conducted in the Midwest, but may not be appropriate for every geographical location.[80, 81] These projects were done using two-deck trailers. Trailers with more than two decks may require additional bedding.

Table 17. Recommended truck setup procedures for market pigs based on air temperatures.

Estimated Air Temperature	Bedding* (minimum recommended bags/trailer)	Side-Slats (percent closed)
<10° F	Heavy (6 bags)	90 - 95%
11-20° F	Heavy (4-6 bags)	75 - 90%
21 – 30° F	Heavy (4-6 bags)	50 - 75%
31 – 40° F	Medium (3-4 bags)	50 - 75%
41 – 50° F	Medium (3-4 bags)	25 - 50%
51 – 60° F	Medium (3-4 bags)	0 - 25%
61 – 90° F	Medium (3-4 bags)	0%
> 90° F	Light (1-2 bags)	0%

**Bedding refers to a 50-pound bale of wood shavings.*

As with finished or adult pigs, any wean pig transport must be well-planned and take into account such aspects as preparation and age of the pigs, choosing the best route and vehicle type, assuring adequate vehicle design and maintenance, and the changing weather conditions during transport. Every effort should be made to avoid transport at extreme hot or cold temperatures and drivers must provide sufficient protection in winter. The suggested minimum guidelines for market pigs may also serve as a basis for boarding and bedding requirements for weaned pigs, with the understanding that this will vary greatly depending on the age and size of the pigs, the trailer design, the length of the transport and stocking density of the trailer.

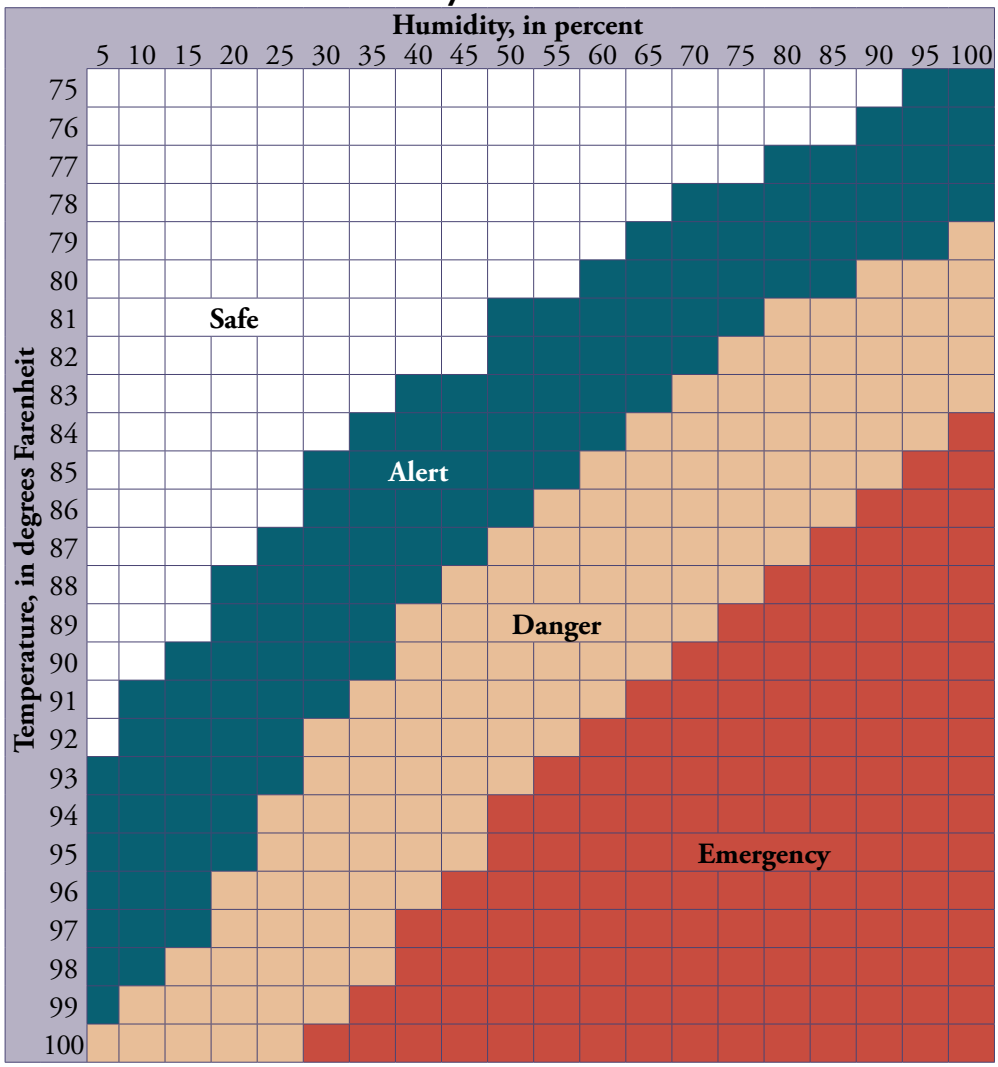
Bedding can serve multiple purposes. In cold temperatures, the bedding material prevents the pig from coming into direct contact with the metal. Therefore, the floor should be covered at the time of loading so the pigs do not come into contact with the floor. Bedding also helps with moisture control and footing for pigs and the handler. The volume of bedding needed will be dependent on the distance of transport. Professional judgment of the driver and transport staff and knowledge of the local conditions may allow for using different bedding levels than recommended here. Use of excessive bedding during warm or hot weather may cause increased pig losses.

Hot Weather

Hot weather and high humidity can be deadly to pigs due to their lack of functional sweat glands.

Refer to the livestock weather safety index (Table 18) prior to loading. The weather safety index provides a guide to help reduce heat stress of livestock. Hazard to the pig increases when both temperature and humidity increase. When conditions are in the "alert zone," transporters need to be careful to keep livestock cool. When conditions get into the danger and emergency zone, try to shift loading schedules to avoid the hottest part of the day.

Table 18. Livestock Hot Weather Safety Index



The following measures are special precautions to be taken during the danger and emergency scenarios as outlined above. These will help keep pigs cool and to help ensure the well-being and safety of pigs transported during hot weather conditions:

- Open nose vents.
- Unplug ventilation holes/slots.
- Adjust loading density of pigs in the truck by loading fewer pigs per load. For example, provide 300-pound pigs with 5.0 square feet.
- Schedule transportation early in the morning or at night.
- Be prepared to adjust to rapid temperature fluctuations such as the first warm day(s) of spring.
- Do not bed pigs with straw in hot weather.
- Load and unload promptly to avoid heat buildup.

Wetting pigs during transport can be an effective cooling method for high temperatures. The following are guidelines for wetting pigs during hot weather conditions:

- If the temperature is over 80° F (27° C), wet the pigs for 5-10 minutes during or after loading.81, 82 Be careful of over wetting to prevent excess humidity buildup or runoff.
- Use a large droplet spray, not a fine mist.
- Large amounts of cold water applied to an overheated pig (open-mouth, panting, with blotchy skin) may shock or kill it.

- If possible, you may need to wet pigs while waiting at the plant. Trailers will have better air flow if trucks do not park side by side.
- For wetting to work, animals should be made damp and then allowed to dry. The wetting process should be monitored to prevent excess humidity buildup.
- Air movement is needed for evaporative cooling to work. Trucks should be in motion or have access to fans or crosswinds.
- Allowing time for evaporation of the water will remove body heat from the animal.
- Pigs should not be wet again until evaporation has occurred.
- Continual wetting with no time for evaporation can increase heat stress by creating a sauna effect.

It is the transporter's responsibility to protect pigs during all weather conditions. It may become necessary for transporters to adjust trailer ventilation during the journey due to changing weather conditions. This may be true for long journeys across geographical regions or for spring and fall days that have wide temperature variations. Journeys spanning multiple regions may involve weather condition planning. Sideboards or plugs should be added or removed accordingly to prevent the pigs becoming too hot or cold.

Feedback for continuous improvement

There should be some sort of feedback mechanism between the origin and destination locations to communicate outcomes of the transportation process. Examples of outcomes that may be useful to communicate for each load of pigs transported include the number of transport losses, condemned pigs, fatigued pigs, injured pigs, etc. This information should also be shared with the transporter. This type of feedback can be helpful for animal handlers to monitor any changes that may occur and to continuously improve their animal handling skills.

GLOSSARY OF TERMS

Acclimation: Adaptation to changes in the environment.

Aggression: Overt, often harmful, social interaction, which may include biting, hitting or pushing.

All-in-all-out procedures (AIAO): All pigs within a room or building are moved into or out of the facility at the same time and the area is cleaned and disinfected.

Ambient temperature: The temperature of the surrounding environment that a pig is exposed to.

Ammonia (NH_3): A gas that is produced from the mixture of urine and feces, which can cause harmful health effects in pigs and people when exposed to high concentrations in the air.

Analgesic: An agent that alleviates pain without loss of consciousness.

Anesthetic: An agent that induces loss of feeling or sensation, especially the loss of pain sensation. Used during surgery or a painful procedure (e.g. castration). Examples include lidocaine (local anesthetic), isoflurane (general anesthetic).

Anthelmintic: A type of medication used to eliminate parasitic worms; a dewormer.

Backup curtain drop: The method used to automatically drop a sidewall curtain when an electrical power system fails.

Backup generator: A generator (fixed or portable) used to provide electricity when the normal electrical power source fails.

Bedding: The material used for pigs to lie in (e.g., oat straw, wheat straw, corn stalks).

Breeding animal: A pig that has reached sexual maturity otherwise referred to as a sow or boar.

Boar: An uncastrated male pig. Sexually mature males intended for use in breeding over the weight of 300 lbs (135kg).

Boar taint: Unpleasant taste and smell that results from an accumulation of androstenone and skatole in the fat of uncastrated male pigs; it is detected when cooking meat from these pigs.

Carbon dioxide (CO_2): A colorless, odorless, non-flammable gas that is produced from respiration, burning of fossil fuels, and manure decomposition.

Carbon monoxide (CO): An odorless, colorless, and toxic gas that can occur from improperly functioning or poorly ventilated heating units and generators, or insufficient ventilation when gas-powered high-pressure sprayers are used indoors. This gas can be immediately dangerous to the life and health of both pigs and people.

Caretaker: A person who undertakes the immediate day-to-day care and oversight of the pig.

Castration: A process which renders a male infertile which may be achieved by various methods depending on the species, including surgical removal of the testes, immune suppression of hormones, or cutting off blood circulation to the testes. (Only surgical or immuno-suppressive methods may be used for pigs.)

Cubic feet per minute (CFM): A measure of volumetric air flow rates.

Cold stress: A pig is cold stressed when it must increase heat production to keep warm. Many factors affect when a pig is cold stressed (e.g., body weight, feed intake, age, insulation of the building, and floor type).

Continuous flow: The barn contains animals of many different stages of development that are housed in close proximity to one another and the facilities are never empty.

Deleterious genetic defect: A genetically inherited problem caused by one or more abnormalities in the genome that causes harm or death to the pig.

Direct veterinary supervision: A licensed veterinarian is readily available on the premises where the patient is being treated and has assumed responsibility for the veterinary care given to the patient by a person working under his or her direction.

Dirt systems: A type of production that confines pigs outdoors for more than 45 days per year without (70%) groundcover. Dirt systems may have mud during wet weather and make it difficult to control parasites, disease and pig thermal comfort.

Dragging: To move a pig along the ground or floor by pulling it.

Effective environmental temperature: The temperature pigs experience including all modes of heat flux.

Electrocautery: Cauterization of tissue by means of an instrument heated by an electric current.

Euthanasia: Greek word meaning "good death." The process whereby the pig is rendered insensible, with minimal pain and distress, until death.

Genetic selection: Intentional breeding for specific traits.

Heat stress: Pigs become heat stressed when the ambient temperature at which evaporative heat loss increases markedly. The major component for increased heat loss in pigs is through increases in breathing rate, because pigs do not sweat.

Husbandry: The scientific control and management of raising animals for food.

Hydrogen sulfide (H_2S): A poisonous, acidic gas that can kill in a matter of seconds. It is an extremely dangerous gas that is colorless, flammable, has a "rotten egg" smell, and collects in enclosed, poorly ventilated areas such as manure storage tanks and pits.

Illness: Deviation from normal health. Changes can be seen in the pigs' behavior, physiology or performance. Also referred to as sickness.

Immunological castration: A method of castration that is reversible and non-painful. Accomplished by immunizing against sex hormones, with the effect of moderating aggressive behaviors in males, minimizing development of secondary sex characteristics and inhibiting fertility. Antibodies are delivered via an intramuscular injection given twice during the production phase.

Indirect veterinary supervision: A licensed veterinarian need not be on the premises; has given either written or oral instructions for treatment of the patient; is readily available by telephone or other forms of immediate communication; and has assumed responsibility for veterinary care given to the patient by a person working under his or her direction.

Inlet: A ventilation component that controls the volume and direction of fresh air entering a building.

Injury: Damage to the body that result in a pig not expressing full health.

Isolation: Separating a pig or group of pigs from others for the purpose of quarantine or treatment.

Manure pit: A concrete structure that contains the waste products generated in the building (e.g., manure, urine, wasted drinking water, water used to wash and clean building).

Methane (CH_4): A colorless, odorless flammable gas that is produced during the decomposition of manure.

Microenvironment: The environmental condition (e.g. temperature, wetness, drafts, etc.) that an individual pig feels, which may be different from the environmental conditions of the surrounding area (e.g. pen, barn).

Non-ambulatory: A pig that cannot get up or if it can stand with support, but is unable to bear weight on two of its legs.

Nose ring: A ring made of metal designed to be placed through the nasal septum of the pig.

Nutritional enrichment: Maybe achieved by giving varied and/or novel food types or changing food delivery methodology.

Occupational enrichment: May be achieved by allowing movement or interaction.

Pain: An aversive sensory experience associated with actual or potential tissue damage resulting from a procedure or a by-product from disease or injury that changes the animal's physiology and behavior.

Pain mitigation: Alleviating pain, usually through medication (see "Analgesic" and "Anesthetic").

Particulate matter (PM): Refers to solids or liquids suspended in air (airborne particles). Also known as dust, and can become suspended in the air through use of machinery, air ventilation, and movement of animals and workers.

Pathogen: A disease-causing agent of an infectious nature, such as a bacterium or virus.

Physical enrichment: May be achieved by adding objects, substrate or permanent structures.

Postural adjustment space: The space required for animals to change from one position to another (e.g. moving from full lateral recumbency to sternal lying or sternal lying to standing).

Parts per million (ppm): A way of expressing very dilute concentrations of substances. PPM is the number of parts out of a total number of one million.

Producer: Refers to everyone involved in the pork operation on the farm, including the operation management and caretakers.

Quarantine: A period of time during which a pig or pigs are kept away from others to prevent a disease from spreading.

Rooting: Behavior of pig whereby they use their noses to dig in the ground or in any available material.

Satiety: The feeling or condition of being full after eating feed.

Sedative: An agent that calms nervousness, irritability and excitement by depressing the central nervous system.

Sensory enrichment: May be achieved by stimulating the pigs' olfactory, visual and auditory senses.

Severely injured: Major trauma that has the potential to cause prolonged pain and disability or death. An example is a pig that is non-weight bearing on an affected limb when either standing or walking.

Shroud: A plastic or metal housing allowing fan blades to rotate inside and all the air flow passes through the structure to prevent air from recirculating.

Shutter: A series of hinged panels in a frame that is placed either inside or outside of the fan opening to prevent air from either entering or exiting the opening. A synonym is louver.

Sickness: Deviation from normal health. Changes can be seen in the pigs' behavior, physiology or performance. Also referred to as illness.

Slat: A flooring surface that allows manure and urine to fall through the floor; thus, providing a cleaner surface for the pigs. Slats are most commonly made of plastic or concrete material.

Social enrichment: May be achieved by allowing pigs the ability to smell, see and hear other pigs.

Soffit: The underside of an overhanging eave that has an opening that allows air to enter the building's attic.

Stage of production: The stages of producing pork include breeding (boars, sows and gilts), gestation (sows and gilts), farrowing (sows/gilts and baby piglets), nursery (weaned piglets to 75 lb body weight), growing (pigs weighing 75 to 150 lb), finishing (pigs weighing 150 to market weight), and wean-to-finish (weaning to market weight).

Stocking density: The amount of floor space provided per pig in the nursery, growing and finishing stages of production.

Tail biting: An abnormal behavior that is characterized by one pig's dental manipulation of another pig's tail.

Tail docking: The practice of removing the latter part of a pig's tail to prevent tail biting.

Tethering: A method of restraining pigs whereby a neck or girth collar is attached to a short length of chain, which is in turn fixed to the floor or the front of a pen.

Transporter: Refers to those individuals responsible for the movement and transport of pigs.

Treatment: The act or manner of care for an ill or injured pig. Treatment can include administration of drugs, placing a pig in a hospital pen, or enhanced observation for improvement.

Unrestricted udder access: Ensuring that all piglets in a litter can easily access the sow's udder at the same time for nursing regardless of whether the sow lies on her right side or left side. Equipment design and pen/stall configuration should not impede piglets' access to the udder at any nursing bout.

Ventilation controller: An electrical device that controls the operation of the heating and ventilation system.

Veterinary-Client-Patient Relationship (VCPR): A relationship that exists between a client and a veterinarian where the veterinarian has assumed the responsibility for making medical judgments regarding the health of the animals, has sufficient knowledge of the animals, and is readily available for follow-up consultations.

Zone heating: The provision of supplemental heat in a specific area of a pen (e.g. an area specifically for baby piglets or a specific area for recently weaned pigs).

APPENDIX

Example maintenance checklists for inspecting indoor and outdoor aspects of the facility.

Generic example of outdoor aspects that need to be evaluated for maintenance to improve animal well-being.

Ventilation fans	**Y/N**
All manure pit fans are plugged into the electrical socket and working.	
All manure pit fans blades are clean and in good working condition.	
All manure pit fan shutters (louvers) are clean and in good working condition.	
All manure pit fan shrouds are clean and in good condition.	
All manure pit fan guards are in place and in good condition.	
All manure pit fan covers correctly fit the opening and cracks are sealed.	
All building fans not used during winter months have fan covers properly installed; and, all fan covers do not have air leaks.	
All building fans have hoods without holes in the side of the hood.	
All building fans have fan blade guards in place and in good condition.	
Soffit vents	**Y/N**
All soffit air inlet vents are clean and free of obstructions that restrict air flow.	
All soffit air inlet vent covers are free from large holes that allow entry of birds.	
All soffit air inlet vent covers are designed to allow continuous flow of an appropriate volume of air to enter the attic area, e.g., ¾" x ¾" to 1" x 1" screening to prevent clogging and choking air supply.	
During spring, summer and fall, all soffit vents are open to allow adequate air flow into the attic area.	
Sidewall curtains	**Y/N**
Both ends of all sidewall curtains correctly fit to prevent air leaks.	
All sidewall curtains are free of holes.	
All curtains are straight and level from end-to-end.	
All curtain cables are in good condition.	
All curtain cables correctly match the size of the pulley.	
All cables and pulleys are correctly aligned.	
Evaporative cooling system	**Y/N**
All sensors are correctly working.	
No evaporative cool cells are clogged with algae and debris from the sump.	
All evaporative cool cells are free from dry spots.	
All sumps are covered and the filters are changed regularly.	
No holes in the water distribution pipe are clogged.	
The proper amount of water is bled-off to reduce mineral deposits from collecting on the pad and limiting water flow.	
During winter months, the cooling system is correctly winterized.	
Rodent control	**Y/N**
There are no signs of rodent damage or burrows.	
There is an adequate quantity of rock in the rodent-proof perimeter surrounding building.	
All bait stations are correctly placed and managed.	

Miscellaneous	Y/N
There are no tall grasses or obstructions that prevent adequate air flow, especially with curtain-sided buildings.	
All walkways connecting buildings prevent injury to animals.	
All external doors fit tightly to prevent entry of rodents, birds and air.	
If the backup generator is located outdoors, the emergency generator has been verified to function correctly.	
Comments:	

Generic example of indoor aspects that need to be evaluated for maintenance to improve animal well-being

Facility evaluated:

☐ Breeding-gestation ☐ Farrowing ☐ Nursery ☐ Growing-finishing ☐ Wean-to-finish

Floor surface:	Y/N
There are no floors too slick to cause feet and leg problems.	
There are no floors too rough to cause feet and leg problems.	
No bolts placed in the floor or attached to slats cause injury.	
There are no bolts without a nut that could cause injuries.	
There are no broken slats that could cause injuries to pigs.	
There are no holes in the solid concrete floors that could injure pigs.	
There are no sharp edges between slats and solid concrete portion of floor.	
Pen partitions:	**Y/N**
There are no broken rods or pipes extending into pen that could injure pigs.	
There are no bolts extending into pen or gestation crate that could injure pigs.	
There are no bottom rods or pipes too high off surface of floor that could injure pigs.	
There are no broken pen partitions between farrowing crates.	
Water system:	**Y/N**
All watering devices (nipples, cups, water bowl) have an adequate rate of water flow for age of animal.	
There are no water lines leaking.	
Feeding system:	**Y/N**
All feed drop boxes and/or feed drop tubes are correctly working.	
All automated lactation feeders are correctly working.	
All feed delivery augers are correctly working.	
All feed bulk bins are in good working condition.	
Heating system:	**Y/N**
All heating systems are correctly working.	
All pilot lights are correctly working.	
All temperature data loggers are correctly working.	
All high/low thermometers are correctly working.	
All room temperature sensors are correctly working.	
Cooling system:	**Y/N**
There are no dry spots or holes in evaporative cooling pads.	
All controls are working correctly.	
All temperature sensors are working correctly.	

All temperature sensors are correctly located within the building.	
All water supply lines to drippers and sprinklers are correctly working.	
All drippers and sprinklers are correctly working.	
Comments:	

Generic example of indoor aspects that need to be evaluated for maintenance of ventilation system.

Alarm and backup systems	**Y/N**
All backup thermostats are correctly working when activated.	
All backup fan systems are correctly working when activated.	
All emergency curtain drops are correctly working when activated.	
The in-line/automatic start generator is correctly working when activated.	
The ventilation system failure alarm is correctly working when activated.	
Shutters	**Y/N**
All fan shutters (louvers) are clean and unbroken.	
All fan shutters are correctly working (completely open and close).	
All shutters are lubricated with graphite.	
All shutters prevent back drafting.	
Air inlets	**Y/N**
All ceiling inlet louvers are clean.	
All ceiling inlet louvers are correctly working and prevent back drafting.	
All sidewall curtains are correctly working when engaged for movement.	
All sidewall curtain controllers are correctly working when engaged.	
Ventilation fans:	**Y/N**
All stir fans are correctly located and working.	
All fan blades are clean and in good condition.	
All fan blade guards are in place and in good condition.	
All belts are in good condition on belt driven fans.	
Belt tension is adequate on belt-driven fans.	
Depending on design of fan, bearings are greased.	

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