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Gestation sow housing and its implications on health

K. Stalder[1], A. K. Johsnon[1], L. Karriker[2] and J. McKean[2]
Department of Animal Science and VDPAM, Iowa State University, Ames, IA, 50011

1. Global perspective on the gestation sow housing issue

In 1991, the European Union enacted legislation which prohibited the use of gestation stalls for sows except for the first four weeks of gestation. This law stated that no new gestation stalls could be placed in service after 2003 and existing stalls would be prohibited after 2013 (Animal Rights International Website, 2007; EU Commission Website). In 1997, the EU Commission's Scientific Veterinary Committee (SVC) was asked to examine the well-being of pigs raised under intensive practices and make recommendations based on their conclusions. Among the recommendations given by the committee is recommendation #73 which states that "no individual pen should be used which does not allow the sow to turn around easily" (Jensen et al., 1997). Following this report, laws similar to the one in the EU banning the use of gestation stalls have been enacted in Denmark, Sweden, Finland and the Netherlands, note; various dates of enforcement range from 2002 -2014 (Animal Rights International Website, 2007).

2. Background to the gestation sow housing issue in the US

2.1 Dialogue and impact from the market

The U.S. the pork industry, like other animal commodity groups, is being challenged and is under scrutiny from groups and individuals outside of the production sector. These challenges come from groups with demands that range from disagreement with raising animals for food production (PETA, 2003) to groups who oppose specific production practices or housing systems (AWI, 2003; HSUS, 2003). In the mid 1990's the People for the Ethical Treatment of Animals (PETA) began actively targeting food service companies under a variety of slogans "McCruelty", "Murder King" and ""Death in the Box" to highlight a few. McDonalds and Burger King formed their own Animal Welfare Committees to formulate animal welfare guidelines for their suppliers. In 2000, McDonalds published their welfare guidelines and in 2001 Burger King followed suit. Although they later retracted the letter, in late 2001, Applebee's sent out a detailed letter to their suppliers insisting that they only purchase meat from sources that:

1. Begin a process to phase out . . . farms that continuously confine sows….
2. Immediately euthanize any animals at the slaughterhouse which are overheated or in severe pain
3. Continuously improve the minimum living conditions of animals…..
4. Not accept any product from suppliers that mutilates animals for convenience

In 2001 the National Council of Chain Restaurants (NCCR) and the Food Marketing Institute (FMI) formed an alliance to address these animal well-being challenges for their respective members. FMI and NCCR formed an animal welfare program to review published producer guidelines and to create a process (Animal Welfare Audit Program [AWAP]) where third party auditing could be conducted to assure animals are raised, handled, transported and harvested for

food consumption under controlled, animal welfare guidelines (FMI, 2003). The FMI-NCCR Animal Advisory Group had the following objectives when reviewing producer guidelines:

a. Conducting the initial review and commenting on industry guidelines or standards;
b. Revising and recommending acceptance of the animal welfare standards applied by AWAP;
c. Reviewing AWAP audit questions and weighting factors;
d. Maintaining an understanding of the current state-of-the-art practices in animal welfare; and
e. Hearing and judging appeals of AWAP audit findings.

The Pork Checkoff's animal care guidelines were updated and made accessible to FMI-NCCR (NPB, 2003). In June 2002 FMI-NCCR released their first report on producer guidelines. FMI-NCCR endorsed the sow performance guidelines as printed in the Swine Care Handbook and the following statement was presented.

"*One of the most challenging issues the pork industry faces is confinement of gestating sows. Current pork industry guidelines include several enhancements regarding sow stalls but our experts have challenged the industry to go further. As a short term measure the FMI and NCCR support enhanced pork industry guidelines regarding individual housing systems, including*:

1. The pregnant sow should be able to lie down on her side without her teats extending into the adjacent stall.
2. Her head should not have to rest on a raised feeder.
3. Her rear quarters should not come into contact with the back of the stall.
4. The pregnant sow should be able to stand up unimpeded."

For the full report please visit http://www.fmi.org/animal welfare/

Subsequent to this review the Pork Checkoff's Animal Welfare Committee amended the industry performance guideline to say a sow in gestation housing should be able to:
1. Lie down without the head having to rest on a raised feeder;
2. Lie down without the rear quarters having to be in contact with the back of the stall; and
3. Easily lie down in full lateral recumbancy and stand back up.

In 2003, the industry rolled out its first version of a swine well-being program, the Swine Welfare Assurance Program^{SM} or SWAP^{SM}. Three sections of SWAP assessed swine welfare. The first was to evaluate records, which assessed herd health and nutrition and caretaker training. The second was animal observations, which assessed regularity of animal observation, body condition score, euthanasia, and handling and movement. The third part of the assessment was to look at the facilities, which evaluated facility conditions emergency support and continuing assessment and education (Johnson et al., 2003). SWAP was a good first attempt, but after conversing with packers and the customers it was felt that an educational and assessment program did not *a priori* assure swine well-being at the production level. Subsequently, the swine industry has worked closely with all players in the pork production chain to meet mutual goals. These efforts have resulted in the new PQA Plus^{TM} program, which will be available to all

US pork producer June 2007. This program rolls the concepts and practices PQA Level III and SWAP into an integrated program subsumed within 10 Good Production Practices. Good Production Practice 10 titled "*Provide proper swine care to improve swine well-being*" will be assessed at the production site level. In addition third party audits will be used to assure program effectiveness over the next few years, and to assure the final customer that swine well-being is being taken seriously by producers and is integrated into day to day practices (NPB, 2007).

2.2 Legislative actions

In 2002, Florida voters passed legislation which prohibits the use of individual gestation stalls. Arizona voters followed suit in 2006, marking the first two states in the U.S. to enact legislation against this form of sow housing. It should be pointed out that advocates of removing the gestation stalls started their efforts in states that had very few pork producers to begin with. This allowed the legislation to more easily pass as the industry was not of sufficient size to mount a large opposition at the grass roots level. In early 2007, the largest pork production company in the U.S., Smithfield Foods, announced its intentions to phase out gestation stalls in the next 10 years (Kaufman, 2007). Days later, Maple Leaf foods, the largest pork production companies in Canada (#7 in the U.S.) made a similar announcement (Meyer and Steiner, 2007).

Pressure resultant from this chain of events will likely lead to the conversion of gestation stalls into pen gestation in the majority of North American pork farms. As such, it is vital that practitioners and producers be prepared for challenges pen gestation creates and develop strategies to deal with these issues.

Therefore, the aim of this paper will be to discuss the following areas that relate to sow housing gestation:

- Sow behavior and aggression – a normal part of pig biology!
- Injuries and recommendations for prevention,
- Reproduction and production challenges with recommendations for management,
- Labor challenges with recommendations for management,
- Pen / facility designs and
- Feeding systems.

3. Sow behavior and aggression – a normal part of pig biology!

3.1 Natural social organization of the domestic pig

Aggression is a major challenge when group-housing pigs. Pigs will fight when mixed and when competing for access to resources. The main function of aggression appears to be to settle intra-group disputes and to deter rapid intrusions into the group. Persistent aggression can decrease an individual pig's well-being in terms of increased stress hormone concentrations (Otten et al., 1999), increased heart rates (Marchant et al., 1995), increased injuries (O'Connell et al., 2003a) and restricted access to resources (O'Connell et al., 2003b). Aggression can also increase costs, by slowing growth, increasing sow culling due to injuries and decreasing sow productivity (Mendl,1995), especially if aggression occurs at the time of embryonic attachment.

3.2 How long do sows fight?

As previously noted some U.S. states are dictating how gestating sows will be housed. However, without adequate management of aggression, group housing can severely impact the

well-being of subordinate sows (Mendl, 1995), especially when groups consist of multiple parity individuals. Although aggression at mixing is unavoidable, it is usually intense only over the first few hours as social hierarchies are being established (Pritchard, 1996). Aggression levels should decrease quickly over the first few hours post-mixing, reaching basal levels within 1-2 days (Pritchard, 1996). In addition, Pritchard notes that the duration of fights have been reported to last 491 seconds (s) for weaned pigs, 118 s and 98 s for growing pigs (McGlone 1985, Arey and Franklin, 1995) and between 1 – 180 s for sows (Mount and Seabrook, 1993). Not every interaction with an unfamiliar animal results in a fight which suggest that hierarchy of the animals is an important consideration. A good detailed ethogram for aggressive interactions of nursery-age pigs during mixing has been compiled by McGlone (1985) and a similar ethogram is available for sows already in stable groups (Jensen, 1982).

4. Injuries and recommendations for prevention

The three major physical injury concerns for the sow while housed in a group system are vulva biting, body lesions from fighting and claw lesions.

4.1 Vulva bites

Vulva bites occur when a sow approaches another sow from behind and uses her incisors to bite the vulva, resulting in a deep cut, partial removal, or complete amputation of the vulva. These wounds can bleed severely, are highly susceptible to infection and may attract further biting from other sows (van Putten and van de Burgwal, 1990). A prevalence of 15.2% vulva lesions in group housing compared to 0% in stalls was identified in a study by Gjein and Larssen in 1995. In a 1998 study, which involved mailing surveys to producers in England, Rizvi et al. found that sows had an increased risk of vulva biting when housed in groups (risk ratio of 3.8, $p<0.01$), when they were fed with electronic sow feeders (risk ratio of 1.9, $p<0.01$), when they were fed once daily (risk ratio 2.1, $p<0.01$), when there were 11-38 sows per water drinker (risk ratio of 16.0, $p<0.01$), and when the water delivery system was automatic (risk ratio of 2.0, $p<0.02$).

4.2 Body lesions

Body lesions, like vulva biting, are associated with aggression between pen mates in group housing systems. In a study by Anil et al., (2003), it was found that injury rates were higher for pigs in group housing systems, especially in younger animals. In a 1995 study by Gjen and Larssen, (1995) the prevalence of body lesions was found to be 13.1% in group housed sows and 4% in individually housed sows. In a study by Anil et al in 2002, sows housed in stalls were more likely to have injuries associated with increased size during gestation while animals housed in groups were more likely to have injuries associated with competition for resources and from mixing.

4.3 Claw lesions

Typical claw lesions include the following: side wall lesions, heel lesions, overgrown heels, cracks in the white line, and cracks in the junction of the heel and toe, and toe cracks. In a 1995 study by Gjen and Larssen, the relative risk of claw lesion was 1.5 to 2.1 greater in group housed vs. individually housed sows. The authors theorized that the type of floor and the free movement of the sows are the two main factors associated with claw injuries. Walking or

running on slats can cause claw injuries and movement increases in group housed sows. Claw lesions involving the plantar part of the foot can also occur when concrete with no bedding is used for flooring.

4.4 Measures to reduce aggression in group gestation sow housing

4.4a Feeding systems

The major sources of aggression in sow groups are the introduction of individual or groups to a strange environment and the competition for feed. To minimize recurring aggression animals can be maintained in smaller static groups as opposed to dynamic groups. In dynamic group systems, large numbers are kept together and remixed routinely as weaned sows enter the population and late-term sows leave to enter the farrowing system. Proper management of these groups is required to minimize fighting upon introduction. In order to minimize competition for feed, it would be ideal for each sow to have an individual area in which to eat safe from aggressive or hungry animals, and free of bulling. Proper layout of the facility is also necessary to flow animals such that while waiting for feed, animals do not injure each other. A case report by van Putten and van de Burgwal in 1990 introduced strategies for reducing aggression in group housed sows. In the described system, newly weaned sows were introduced in groups into a large area with barriers that allowed escape for 24 hours (to allow establishment of a social hierarchy). After this time, new sows are kept apart for 10 days and taught how to operate the feeding system. Following this, sows are placed in a restricted area within the larger roaming gestation area and fed on the floor for 24 hours. After 24 hours, the division between the new group of sows and the rest of the group was removed. It was noted that within the larger group of sows, a "group" hierarchy was established, i.e. groups introduced earlier were socially superior to new groups. It was observed that when attacked a sow attempted to return to the original acclimation area for safety. Also, groups defended their original acclimation area. In addition, two distinct meals of chopped corn silage were fed on the floor in additional to allowing each sow to enter the electronic feeding station once (to reduce aggression associated with entrance to the feeding system). Arey and Edwards (1998) suggests that to decrease injuries associated with aggression; pens should provide a non-slip floor and barriers which allow for escape/avoidance of dominant animals. More importantly, producers should be present at mixing to ensure that certain individuals are not the recipient of excessive aggression.

4.4b *Chemical intervention*

A number of management techniques have been applied on farm, with varying success in reducing aggression of sows mixed post-weaning. Among those showing short-term benefits are time of day, chemical intervention and boar presence. There is evidence to suggest that if sows are mixed after sunset, aggressive interactions are decreased over the short-term (90 minutes post-mixing) but by the next morning, and aggression levels are the same as if pigs are mixed during daylight (Barnett et al., 1994, 1996). Similar effects have been found using anti-aggression (amperozide – Symoens and van den Brande, 1969; Barnett et al., 1993, 1996) and sedative (azaperone) medications. With both of these compounds, aggression appears to be reduced while the effects of the drug last, but once the effects have worn off, aggression rebounds to that seen with untreated animals. With boar presence, it was found that aggressive interactions, skin damage and flight distance were all reduced by at least 28 % over a 28-h post-mixing period by the presence of a boar (Docking et al., 2001). However, Séguin et al., (2006)

when comparing boars in the pen versus no boar concluded that the presence of a boar was minimally effective at reducing fighting and scratches during the post mixing period, and sows showed a greater stress response on the presence of a boar.

4.4c Social intervention

For longer-term solutions to reduce aggression at mixing, influencing the early social experience of the sows may be effective. Mixing as piglets prior to weaning has been shown to benefit social skills in the longer term. Socialized piglets are able to form stable dominance hierarchies during future encounters with unfamiliar pigs quicker than piglets mixed after weaning (D'Eath, 2005). Early socialization increases consistency of behavior during social encounters (D'Eath, 2005). In the absence of early socialization, the amount of aggression at mixing can be reduced by practicing repeated mixing, pre-mixing or pre-exposure. With repeated mixing, gilts that are re-mixed three or four times post-weaning subsequently show reduced aggression when mixed at 5 months of age, compared to pigs mixed just once or twice (van Putten and Buré, 1997). With dynamic systems, pre-mixing is commonly practiced, whereby, rather than introducing several individual sows into a large group at once, the individual sows are grouped first, and then mixed as a sub-group into the large group. This practice strengthens sub-group behavior and reduces aggression between new and resident sows (Durrell et al., 2002).

5. Reproduction and production challenges with recommendations for management

Reproductive factors along with health status and longevity have traditionally been used as major criteria to evaluate sow well-being (Reeves, 2001). Wean-to-estrus interval, pigs/litter, conception rate, farrowing rate, and pigs/sow/year are all measurements used when assessing reproductive performance. Reproductive performance has been shown to be commonly affected when group housing systems are used (Reeves, 2001). The enhancement of reproductive performance was one of the main reasons that U.S. pork producers adopted the use of individual gestation stalls in the late 1970s and 1980s. In order to maintain high production, and thus well-being, practitioners must assist producers in dealing with the challenges group housing poses. Reproductive performance challenges that the practitioners and producers of tomorrow will face when managing group-housed sows consist of several issues that aren't faced with individual stall production, largely centered around the mixing of sows and the feeding systems utilized. Mixing sows leads to aggressive behavior and an increased tendency to fight. This behavior, during the time of fetal implantation, has been shown to decrease litter size and increase pregnancy loss. Additionally, vulva injuries are frequently reported when group mixing occurs. Competition for feed can lead to uneven body conditions which can have an impact on group reproductive performance. Prior to gestation stalls were being adopted many advisors recommended smaller group size assisted the management of body condition. Reaching the smallest practical group size was one of the reasons individual stalls were so widely adapted in the U.S. pork industry. Any group feeding strategy should be critically assessed to assure it provides sows with the ration that suits their metabolic needs and decreases competition during feeding periods.

6. Labor challenges with recommendations for management

Many labor challenges in the area of reproduction are also presented when group housing is used. Increased total labor, along with more highly trained labor, must be utilized to provide daily heat detection, manage a successful breeding program, perform timely and accurate

pregnancy confirmation, and accurately assess individual sow body condition scores. During the whole process of gestation, the management of group dynamics (additions/ and subtractions from the group) must be carefully accomplished to accommodate the maximization of reproductive performance. Several studies have been conducted in order to examine the reproductive performance effects of different housing systems. The majority of the studies that report significant differences find the discouraging results occur in the group housing systems where mixing occurs between breeding an post-implantation. Although a well managed and highly trained staff is more likely to achieve good reproduction numbers, some drop-offs in production should be expected when transitioning from individual to group housed systems due to the inherent learning process as a new system is being adopted.

Weaning-to estrus interval has been shown to be as much as 0.7-1.1 days less in sows housed in individual stalls when compared to those housed in groups. Farrowing rates have been shown to be lower in group housed sows in some studies (Peltoniemi, 1999) while one study (Schmidt, 1985) actually found a higher farrowing rate for group housed sows. Research looking at the mixing of sows found that changing group dynamics around the time of implantation resulted in pregnancy loss represented by 20% of sows returning to estrus (compared to 10%) and a reduced litter size (0.2 pigs per litter) (Bokma, 1990). Another study found a greater decrease in litter size (2.3 pig difference), when sow mixing was performed around the time of implantation. A field trial looking at reproductive and performance data from 4 group housed farms and 3 individually housed farms found that the group housed sow farms had significantly fewer pigs/litter, less sows bred within 10 days of weaning, and a higher return to estrus (leading to a higher culling rate for this reason). It is likely that the differences in animal husbandry and management system confound much of the research in the literature. Proper management of sows in group housing is a challenge that must be overcome in order to eliminate poor reproductive performance. Following the recommendations put forth in the feeding management and pen management sections of this resource will reduce production losses associated with uneven body condition scores and aggressive interactions during early pregnancy.

Farber (2003). summarized 14 articles comparing the farrowing rate of individual vs. group housed systems. The findings demonstrate that in 10 of 14 studies (71.4%) individual stalls provided equal or better farrowing rates when compared with inside group housing systems. The largest difference was a 31.2% variance in farrowing rates. Factors such as proper training, good pen-management, and body condition assessment will all likely minimize discrepancies seen between group and individually housed sow reproductive performance.

Managing groups of sows is an important aspect to the success of group housing systems. It is important to provide for each sow's needs in the pen while recognizing well-being concerns that arise within each pen. Minimizing aggression/competition, reducing exposure to hazards resulting in pain, injury, and distress, providing each sow with adequate feed and water daily, observing individual sow factors, and allowing sows to express normal behavior are all ideal goals associated with the use of group housing systems.(Reeves, 2001). In order to accomplish these goals, many factors must be addressed. Stock-persons should be properly trained, pen design and feeding system utilization must be addressed, group formation and dynamics must suit the system and animal needs, pre-mixing of sows should be performed.

Performance on sow farms is determined by several factors, one of the most important factors is the stockpeople working on the farm. The husbandry skill level of these employees is even more important in systems utilizing group housing. As facilities are converted to group housing, stockpeople who have only worked in individual stall housing units must learn new

observational skills and acceptable parameters to be successful. Three important skills have been suggested by several that are critical to attain early: 1) The ability to identify sows that are unable to compete in the group so they can be given appropriate care, 2) Taking the appropriate action to maximize the well-being of sows that are unable to compete, 3) Appropriate handling techniques for sorting individual animals from a group to eliminate stress and potential injury.

7. Pen / facility designs

7.1 Static vs. dynamic groups

The make-up of sow groups in a unit varies by pork operation. Total number of sows in a herd, pen size, and frequency of farrowing all factor into group dynamics within an operation. Breeding groups generally consist of weaned sows bred on first estrus, repeat breeders, and replacement gilts. Animals may be familiar with one another within a group but not between groups. Social management must be accomplished in order to minimize the negative effects of aggression associated with mixing and regrouping. Frequency of regrouping, sorting, and group size are all factors that play a role in social management.(Gonyou, 2002).

Static groups are formed once (usually all in the same productive phase) and then no additional animals are added to the group. This grouping system is the best at eliminating re-grouping stress, but limits production flexibility. It has generally been suggested that sows be housed in static groups for the first 4 weeks after breeding in order to minimize production losses associated with stress (Levis, 2004; Gonyou, 2002). Dynamic groups are formed by adding and removing animals on a regular basis, so that groups consist of sows in different phases of gestation. Dynamic grouping of sows allows for efficient utilization of space and equipment. Often dynamic grouping must be used in order to increase group size because of sorting or because not enough animals were bred in a particular group. In many systems where electronic feeding systems are used, groups of 50 or more sows are common. Many units do not breed this many sows at a given time, so these groups are usually dynamic.

The well-being of sows in both large dynamic and small static groups has been shown to be negatively affected by lower social ranking (O'Connell et al., 2003a). In any system where sows are housed in a group, a pecking order or hierarchy is formed. Lower ranking sows find it harder to compete. These sows exhibit decreased production and must be managed well. Kranendonk (2007). found that lower ranking sows gained significantly less weight during gestation, their offspring moved, vocalized, and weighed significantly less at weaning, and had significantly less lean meat at slaughter. Pedersen found that lower ranking sows demonstrated significantly less sexual motivation during boar exposure leading to impaired estrus detection and mating.

Gilts are often only half the size of some of the older parity sows within a herd. Because of this, gilts tend to be near the bottom in the pecking order resulting in more fighting injuries such as scratching and scarring (Gonyou, 2002). For this reason it is recommended that where possible gestating gilts should be housed separately from sows of older parities. When mixing sows together in dynamic groups, the goal is to minimize stress and physical injury as the social hierarchy is formed (Levis, 2004). High levels of aggression are generally perpetrated by the resident sows against the newly added animals. Although much remains to be learned about achieving the best results during group formation, some research has shown possible options. O'Connell et al., (2003a, b) found that when new sows were mixed with each other prior to adding new animals to resident sows, aggression between subgroup members and resident sows

appeared to be reduced. This effect was observed with a replacement rate 10%, but not with a 20% or higher rate. Additional research has found that the presence of a boar in a mixing pen can reduce skin lesions and aggression level. Better options may present themselves as more methods are tested, or experiences refined and codified within management systems.

As mentioned before, one of the goals for training employees is to recognize animals that are non-competitive and sows that have been injured. Injured sows should be treated appropriately as discussed in the injury section of this resource. Non-competitive sows should be supplemented with additional feed by hand if body condition wanes. Additionally, if an injury or failure to compete interferes with that sow's ability to make positive improvement in the group pen, then the animal should be sorted from the group and placed in a designated pen. These non-compete / sick / injury pens allow for sows to recover from their ailment without the negative stresses applied by the regular group setting. However, great care should be exercised when the single animals become healthy enough for re-introduction into a group. Sows in this situation should be assessed for culling if the problem is severe enough or likely to reoccur.

As existing facilities are retro-fitted to adjust to group housing configurations, a decreased number of sows will be able to be housed by current facilities. Producers will have two choices: 1) Decrease their sow inventory, or 2) Utilize additional structures to house sows. New facilities can be built incorporating systems where group housing technology has been advanced via research, such as the T-Pen system. Additionally, more generalized structures such as facilities set up similar to the retro-fitted barns or hoop barn systems may be used.

7.2 System designs to reduce aggression

A number of different system design and management methods have been used to reduce aggression: some that have an effect over the longer term, some that have an effect over the short term, and some that have no effect. In terms of system design, pen shape can affect aggression in the short-term. For example, circular pens cause higher levels of aggression (Weigand et al., 1994) than square or rectangular pens. A solid barrier within the pen reduces the total number of aggressive interactions over a 12-h post-mixing period in sows and has longer-term benefits in weaners (Olesen et al., 1996) and sows (Broom et al., 1995).

In dynamic systems, where sub-groups are mixed into a resident group, dividing the pen into distinct lying bays, with one assigned to each sub-group on introduction, may have long-term advantages in reducing aggression by giving each sub-group its own "territory" (Bünger and Kallweit, 1994). Edwards (1992), provided a sketch for a specialized mixing area which allows the possibilities for avoidance of or escape from aggression with minimum injury. One possibility noted by these authors was to provide a large area for escape and avoidance of aggressors. Total space requirement in such situations has not been scientifically defined, and experiments with animals in unbedded pens have given conflicting results. When sows were mixed after weaning in groups of three or nine in standard pen of 22.8 m^2 / sows (27.36 ft^2 / sow) those in the smaller groups with more space, avoided or withdrew from agnostic encounters more frequently and showed less severe aggression. However, in controlled experiments with gilts reducing space allowance from 3.4 m^2 to 1.4 m^2 reduced the incidence of aggression in the first 90 minutes after mixing although it had no effect on overall damage score after three days (Barnett et al., 1993).

The total space requirement needed to establish dominance without problems is therefore likely to depend upon a number of factors (Edwards 1992). The absolute distances needed for avoidance or escape can, at times, be large. Edwards et al., (1986) noted that although 75 % of

encounters resulted in chase distances of less than 2.5 m (8.25 ft.) some sows were chased up to 20 m (66 ft.). From published reports a mixing pen should have the following design elements:

1. A straw bedded pen providing a good foot hold for sows when fighting and fleeing
2. An absence pf protruding objects or rigid edges on which a sow could damage herself
3. An absence of confined areas on which a sow could be cornered and unable to escape from an aggressor
4. Adequate space for sows to turn around and for two sows to pass side by side unhindered in all places
5. The presence of a visual barrier allowing sows to isolate themselves from more aggressive animals

There is little evidence for an optimum group size at which fighting and aggression are minimized between sows. The expectation is that the number of fights will increase with the number of hierarchy positions to settle, although commercial experience has suggested that aggression is reduced when sows are mixed into larger groups.

8 Conclusions

The gestation sow housing debate is no longer being fought in the scientific arena but rather in the ethical realm. Many individual groups are directing the outcome of the gestation stall and the move towards gestation pens. Science will become critically important to tackle potential well-being and health issues for the individual gilt and sow housed in a form of penned gestation. Varied results from numerous trials suggest that sow well-being and health are multifactorial and influenced by factors other than housing. Excellent stockmanship is critical for real-time assessment of sow health and well being so that appropriate action can be taken to correct deficiencies. No housing system independent of stockmanship can accomplish high health or well-being.

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