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In This Edition

Spring 2013 Volume 18, Number 2

The National Sow Housing Conversion Project: initial pilot and demonstrations 4

Feeding Green to Save Green 5

Interactions between sow temperament and housing system on factors influencing sow longevity..................... 6

Evaluation of a Biotrickling Filtration System for Treatment of Exhaust Air from a Swine Barn.............................. 8

Thirty Five Years of Change............... 10

Personal Profiles 12

Program funding provided by

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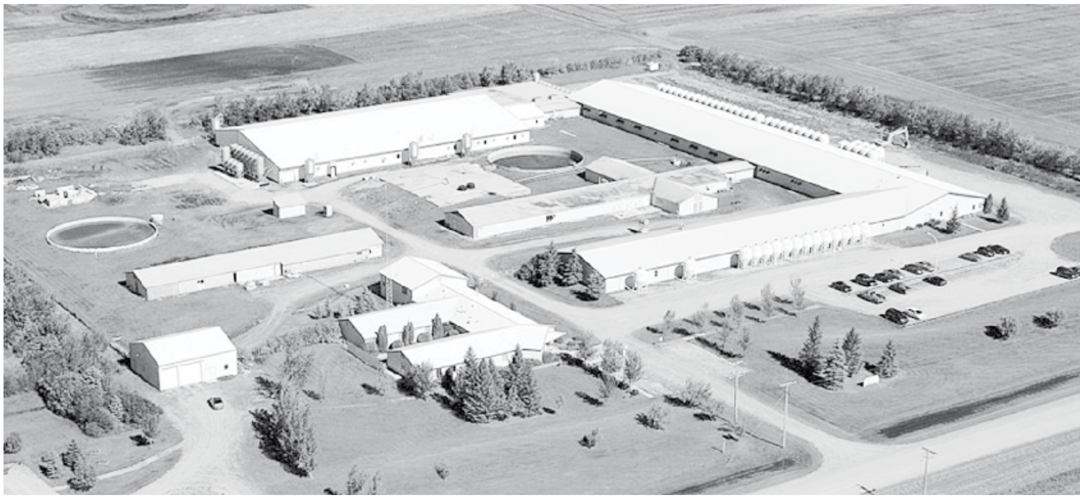
Contract Research Services at Prairie Swine Centre

We Do Research – It's Our Job!



Lee Whittington
B.Sc., MBA, P.Ag.
President/CEO
Prairie Swine Centre

You may already know about the Prairie Swine Centre but are you familiar with all that we do? What unique characteristics and abilities have we lurking in the shadows that you know little about? Let's get reacquainted.

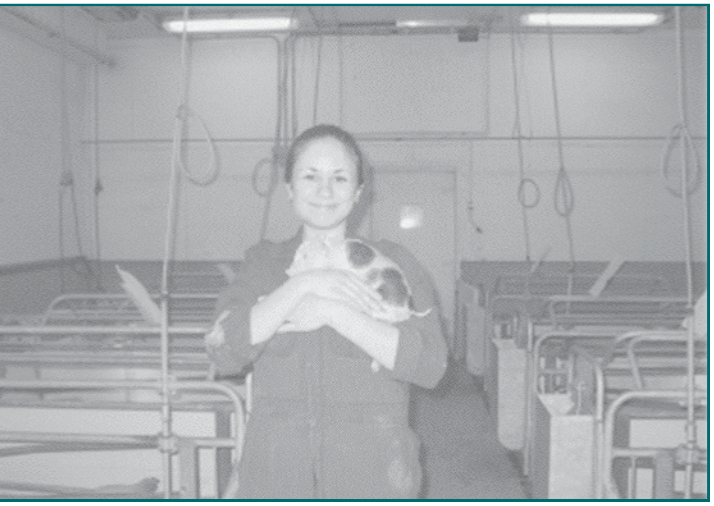
Of course we do research. It is our main objective and raison d'etre but I would like to take the time to remind you about the breadth and scope of our abilities. For starters unlike many research facilities ours is large and follows standard commercial practices. We are a 330 sow farrow to finish operation located just outside of the city of Saskatoon. Our barn functions as a typical North American swine barn with typical production, for example we produce 27 pigs weaned per sow per year. So along with the usual daily challenges of running a hog operation we add on the intricacies of running scientific experiments.

As already mentioned, in comparison to other research facilities, ours is considered quite large. In fact we are the largest publically funded research facility in North America. In general, our research is generally divided into two main categories – public

(Research Services PSC ... continued on page 2)

Publication # 40010021

(Research Services PSC ... continued from page 1)



Highly qualified staff are the key to the success of the Contract Research program.

and private. Publicly funded research refers to research that is carried out to be shared with the public. It is available for anyone to see and usually addresses a topic of concern to many in the industry. The results of these studies are published in many locations from scientific journals to newsletters, in the Prairie Swine Centre annual report and presented at producer meetings. It is often funded by provincial producer groups, universities, Canada Pork International, the Swine Cluster, Agriculture and Agri-food Canada or the provincial governments.

In contrast, private research is confidential, requested by companies to support product registrations, evaluate new technologies or possibly even to perform comparisons. We commonly refer to this as our Contract Research department. Research done for these clients is proprietary and not shared with anyone but the client unless the client desires to share to the information.

Types of research we do

On our staff we have three research scientists, three research assistants, four technical graduate students and a contract research coordinator all dedicated to performing experiments. The three main areas of research that we are most active in are nutrition, engineering and ethology (animal behavior). Dr. Denise Beaulieu heads up our nutrition department. Types of experiments that she most often designs are related to digestibility of feed ingredients, evaluation of nutrients and their interactions along with evaluating nutrient requirements of pigs. Dr. Beaulieu works with ingredients that are grown or are by-products of a processing industry. They may be synthetic or natural, common or exotic. She may be determining levels of inclusion, availability of nutrients, or effect on performance such as growth, feed conversion or milk production.

Dr. Bernardo Predicala manages the Engineering Research Program at PSC. His research focus is to improve air quality inside hog barns by reducing odour and gaseous emissions to the environment. He is also involved in housing development, reducing operating costs such as utilities and creating management systems that optimize pig health, welfare and productivity.

In the area of ethology, Dr. Jennifer Brown's research interests include behaviour, stress physiology, and individual differences (temperament) in pigs, with a focus on humane handling and slaughter methods and the interaction of genetic and environmental factors. Current research projects are examining transport and handling methods and the relationship between temperament and the stress response.

Our contract research clients have access to all the research expertise that we offer at the Prairie Swine Centre. If clients wish to review protocols or discuss experimental design with the research scientists that is easily arranged.

The chart below summarizes our general capabilities.

"The Contract Research program staff are certified in Good Laboratory and Clinical practices that can assist in meeting your organization's needs."

Our Facilities

Redevelopment starting in 1992 and continuous upgrades of the facilities ensures the Centre has modern and functional pork production facilities. Along with standard grow – finish rooms, the nursery rooms were converted to "all in-all out" in 2002, while in 2008 group sow housing was incorporated into the site. As such the Prairie Swine Centre is one of only two research centres in North America to offer this to our customers and clients.

At the Prairie Swine Centre

We can evaluate	We measure responses in
• Additives	• Behavior
• Equipment	• Digestibility
• Ingredients	• Health
• Management	• Metabolism
• Manure	• Welfare
• Pharmaceuticals	• Costs
• Transportation	• Environment
• Vaccines	• Housing
	• Production

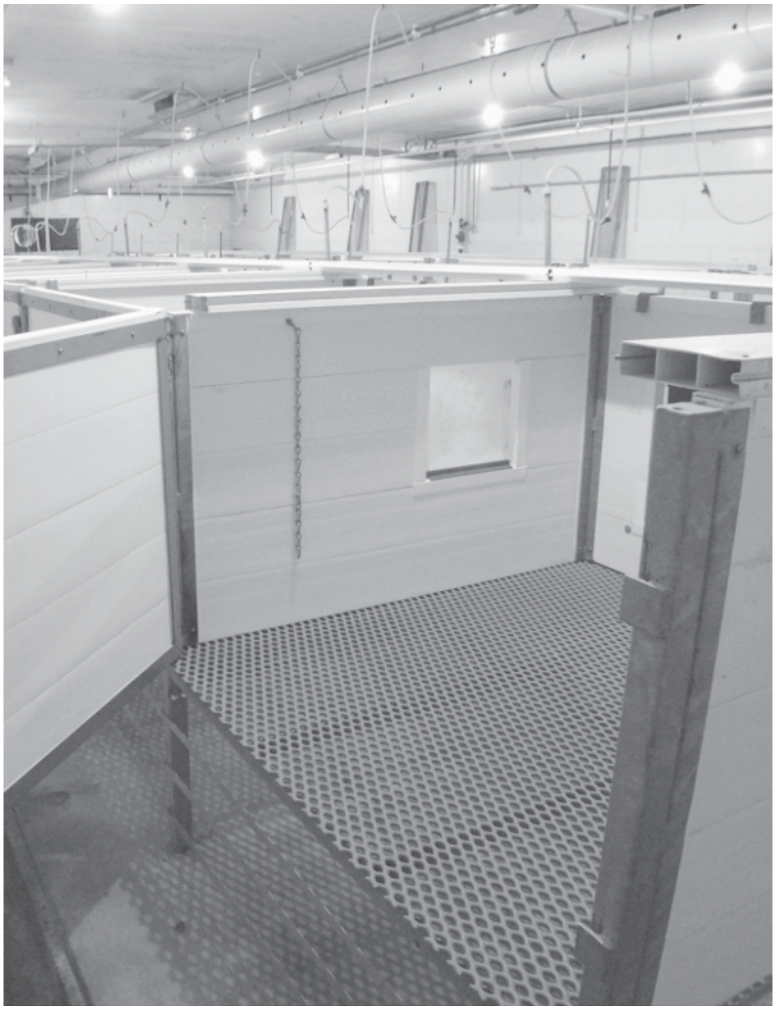
Our Specialized Facilities

Taking advantage of the expertise available to us at the Prairie Swine Centre, specialized areas have been created within our barns. For instance, we have metabolic collection pens designed for the understanding of nutrient use in metabolic processes such as eating, breathing and sleeping. We have a surgery room for the insertion of cannulas or catheters or other veterinary procedures. This fully equipped room is used to prepare animals for a variety of studies, from changes in blood profiles to monitoring the digestion of various feedstuffs. Associated with the surgery room are the Preparation and Recovery rooms. Then there are engineering rooms equipped with extensive environmental recording and monitoring devices for evaluation of air quality and climate control. There also exist laboratories for analyses and metal fabrication capabilities to create new equipment that may be needed.

Experts in Research

Rounding out the research capabilities found at the Prairie Swine Centre are the highly trained staff. Conducting research is a detailed and precise process. The staff are skilled at meticulous collection of data and conscientious maintenance of confidentiality. They are certified in Good Laboratory and Clinical Processes. Close attention is paid to scientific protocol development with support provided by the research scientists. Results dissemination depends on the client, ranging from no dissemination at all to publishing in scientific journals to practical explanations distributed directly to end users. In addition, we are a recognized supplier of data for CFIA, Health Canada, FDA and the European Food Safety Authority (efsa). Talented people produce reliable results.

The Contract Research group can evaluate wide range of products ranging from pharmaceuticals to feed additives.



Metabolic crates provide access to a wide array of digestibility studies

We are experienced and professionally trained in the areas of

- Experimental design
- Data collection
- Statistical analysis
- Regulatory reporting
- Good Clinical Practices/Good Laboratory Practices

In Summary

Our areas of research are broad and varied, a short list would include

Animal health
Animal welfare
Disease evaluation
Engineering
Ethology
Housing
Manure
Nutrition
Occupational Health
Reproduction
Transport

Yet additionally we are delving into the area of using pigs as animal models for human research. Pigs provide a great experimental model to evaluate certain human diseases, nutritional parameters and anatomical structures such as bone density. This is an exciting new area with the potential to generate life changing results.

The Bottom Line

Whether it is to our facilities, our expertise or our capabilities that draw you to the Prairie Swine Centre for research, rest assured that your projects will be handled professionally. We Do Research – It's Our Job!

The National Sow Housing Conversion Project: initial pilot and demonstrations

Jennifer Brown[1], PhD; Yolande Seddon[1], PhD; Laurie Connor[2], PhD; Lee Whittington[1], MBA; Mark Fynn[3], MSc; Qiang Zhang[2], PhD; Murray Elliot[4] .

The use of stall housing for gestating sows has come under criticism for being too restrictive and failing to provide adequately for the welfare of sows. From 1st January 2013, a legislated ban was implemented in the EU, banning the use of sow stalls from 28 days post breeding. In 2007, the largest pork producers in the USA and Canada pledged to transition their sow housing to group systems over the next 10 years. Now, increasing numbers of food retailers, including Tim Hortons, Burger King and McDonalds, have pledged to source pork from producers who have developed plans for conversion to group housing. In addition the supermarket chains Safeway and Costco recently announced plans to develop a stall-free pork supply chain. Consequently, the Canadian pork industry is under increasing pressure to convert existing gestation stall housing for its 1.3 million sows to group systems.

However, there are major concerns within the industry surrounding the conversion from stalls to group housing. The process requires a large capital investment, placing pressure on producers with little room for error. Selecting the 'right' system can be a daunting task because there is relatively little knowledge and experience on the management of sows in group systems within the Canadian industry. A variety of group housing systems are available, and these require more space, different management skills and may require more labour inputs compared to stall housing. Researchers at the Prairie Swine Centre and University of Manitoba have therefore joined together to work with producers on the design of successful barn renovations for group housing. The long term goal of the project is to oversee the construction and implementation of these systems at multiple commercial sites, and to share the information gained from early adopters with other producers.

The Project

The experience of other countries that have already implemented group housing demonstrates that, when done correctly, group sow housing provides sow performance equal to, or exceeding that achieved in stalls. To facilitate and encourage the successful conversion of Canada's sow barns to group housing, the National Sow Housing Conversion Project (NSHCP) was developed to bring together industry and scientific expertise to support Canadian producers through the conversion from stalls to group housing for gestating sows.

Beginning in 2013 an initial project involved two pilot farms in Manitoba and Saskatchewan. The objective of the pilot studies is to work with two commercial producers on the development of barn renovation plans and to initiate the conversion of existing facilities from stalls to group housing. In each barn, detailed documentation of the pre-conversion barn sow performance, management and existing building layout will be gathered. This information will be used to develop sow housing conversion options for each farm, and to allow comparison of management costs and production figures before and after barn conversion. Options for group housing will be developed based on the barn layout and management preferences, with the advice of scientific experts in sow management and engineering, and use of the University of Manitoba's sow housing conversion simulation model.

> "A increasing number of food retailers, including Tim Hortons, Burger King and McDonalds, have pledged to source pork from producers who have developed plans for conversion to group housing."

Following the initial documentation process and development of barn conversion options, the participating producer will select the final barn design and blueprints for the barn conversion will be produced. The conversion work on farms will be documented in detail, including the modifications made to the existing barn, material and labour costs for the renovation, changes to management during and after the renovation process, and the short and long term impacts on sow productivity.

The final part of the pilot project will involve the dissemination of results, documenting the

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experience of these initial demonstration barns for the benefit of other producers. Factsheets on management of sows in group housing, focusing on practical, science-based information will also be prepared. The longer term goal will be to expand the scope of this project on a national scale, with demonstration sites located in each of the major pork producing provinces.

Progress to Date

As of April 1, 2013, two demonstration barns have been selected (one each in Manitoba and Saskatchewan). The pre-conversion documentation of each site will take place in April and May, followed by the development of conversion plans and blueprints.

Funding is being sought to continue this work and expand it to a national level. As the project expands, a National Sow Housing Working Group will be established to coordinate farm selection and documentation of barn renovations across the country. Currently, no funds are available to aid producers with barn renovation costs, however the research team will work with producers to help secure funding to assist with barn conversions.

The Bottom Line

There is substantial pressure for Canadian producers to convert to group sow housing systems. This is a daunting task for many, and due to the cost involved, it is imperative that those who are making the change do so based on sound scientific information to ensure that pork production remains sustainable and sow productivity and welfare are maintained. By assisting producers in the conversion to group housing, the project will help to ensure Canada's role as leading producer and exporter of high quality pork.

The NSHCP will provide a network of support to producers, advising on sow housing conversions and developing information resources to encourage the successful adoption of group housing. By documenting the experiences of a few early adopters, the project can leverage this information to the benefit of other producers. Beginning with these initial pilot projects provides an opportunity to refine the data collection and information dissemination techniques before expanding the project to the national level.

Acknowledgements

The authors acknowledge primary funding support for this project from the Canadian Agricultural Adaption Program (CAAP). Additional funding support is provided by Alberta Pork, Manitoba Pork, Ontario Pork, the Federation of Pork Producers of Quebec (FPPQ) and Sask Pork.

Feeding Green to Save Green

Dr. Eduardo Beltranena
Alberta Agriculture

Pork producers are always looking for new ways in which they can increase their efficiencies through reducing feed costs. Feeding coproducts from the fuel ethanol industry like distillers dried grains with solubles (DDGS) or from the wheat flour industry like millrun can reduce feed cost and spare inclusion of imported soybean meal. But these coproducts have reduced starch content that propels pigs to grow. Calories thus need to come from other sources instead like fat. One high fat feedstuff that can spare calories from starch is green canola seed. It might be available as close as your own farm or the neighbours.

When feeding full-fat canola seed it should be evident that it won't be cw1 canola as the price alone would be prohibitive. Green canola seed is not available year round and the quality varies greatly, but it is an opportunity feedstuff. Generally there isn't much wrong with it, except that was planted late or harvest early and didn't mature entirely. Oil content won't be >45% like regular canola seed, but may range between 20 and 30%. Feeding seed with a high green count may be cost competitive as feedstuffs for pork producers.

Simple questions that need answering is how to process it and what levels to feed that won't compromise pig performance. To look at the potential of feeding green canola seed, a project funded by the Alberta Livestock and Meat Agency (ALMA) led by Malachy Young at Gowans Feed Consulting, Eduardo Beltranena at Alberta Agriculture, and Ruurd Zijlstra at the University of Alberta examined feeding increasing levels (0, 5, 10, or 15%) of green canola seed (90% greens) to 1100 hogs in a commercial scale study. The green seed was ground together with barley and wheat to avoid plugging the hammer mill screen.

Feeding increasing inclusion up to 15% green canola did not reduce daily feed disappearance or weight gain. Feed efficiency was better for controls fed diets without it, but pigs fed 5% green canola were heavier than controls. Days from first to last pig marketed was only higher at the 15% inclusion level. Dressing percent for pigs receiving 15% green canola was lower than control dpigs diets due to greater dietary fibre content. Backfat thickness, loin depth, pork yield and index did no differ across hogs fed greed canola. Feed cost decreased as green canola level increased being lowest at the 15% inclusion.

The Bottom Line

Feeding up to 15% green canola resulted in satisfactory performance and carcass characteristics. Green canola can provide another opportunity to reduce feed cost although it may not be available year round. Producers should look out that the seed hasn't been too overheated as the risk of containing mycotoxins increases. Payback of feeding green canola will be greatest in grower diets when concentrating dietary energy will return producers the most.

Interactions between sow temperament and housing system on factors influencing sow longevity

Yolande Seddon[1], PhD; Jennifer Brown[1], PhD; Fiona Rioja-Lang[1], PhD; Megan Bouvier[1], BSc; Nicolas Devillers[2], PhD; Laurie Connor[3], PhD; Harold Gonyou[1], PhD.

With the move towards group sow housing systems in North America, developing management practices that optimise sow performance and longevity in these systems will be critical to the success and long term profitability of swine operations. A variety of group gestation systems have been developed, each a different level of competition sows must cope with. How well an individual sow copes in each system will depend on the housing type and management, but also on the animal's individual temperament.

Two key temperament characteristics in animals are known as the active/passive and confident/fearful dimensions. Traits related to these characteristics are considered important for influencing how an individual responds to, and copes with, environmental challenges. This study aimed to better understand the effects of the gestation housing environment on sow behaviour, the interactions between housing environment and sow temperament and their influence on sow welfare and longevity. A better understanding of these interactions may help determine optimal management strategies for sows in different group housing systems, and whether the selection of sows based on temperament may be beneficial.

Study design

Studies took place at the University of Manitoba's Glenlea swine research unit, which uses electronic sow feeders (ESF) in two identical 50 sow, farrow to finish barns. One barn houses gestating sows on partially slatted concrete floors, and the other has straw bedded pens, otherwise the two farms are identical in building layout, pen design, sow management and genetics, enabling a controlled comparison of conventional and alternative floor systems. Sow behaviour and productivity were monitored over two gestations. A total of 284 sows were studied, 138 in the unbedded system, 146 in the straw bedded system, and over a range of parities (0-9, average 2.9) representative of the herd demographics. A total of 12 breeding groups were studied (6 per system), with group sizes ranging from 21-30 sows. Sows were transferred to group gestation pens at 35 days gestation (week 7), where they remained until seven days before (week 16).

Measures of sow condition, body injury and lameness were taken over the course of each gestation to determine how each sow was coping in the system. Individual sow body weight, backfat depth and body condition score (BCS) was measured at week 8 of gestation and at week 20. Sows were gait scored from 0 (not lame) to 3 (severely lame) to assess lameness at four time points, (weeks 7, 8 and 16 of gestation, and week 20 at weaning, following breeding). Additionally, at weeks 8 and 16 of gestation, sows were assessed for body injury by examining scratches and lesions on the body.

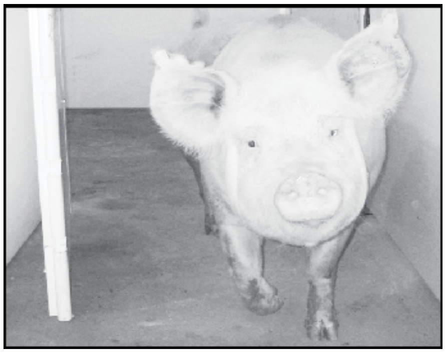

Fig. 1 ~~the~~ (open door test)

Fig. 2 ~~NOT~~ (novel objects tested)

Temperament testing

The temperament of sows was assessed using specially designed test pens at 8 weeks of gestation, using four behavioural tests: 1) the open door test (ODT); 2) the novel object test (NOT); 3) the pig approaching human (PAH); and 4) human approaching pig test (HAP). The tests are described as follows:

ODT: The time taken for pigs to exit a test pen is measured after the door is opened, up to a maximum time of three minutes (Fig. 1).

NOT: The time taken for a pig to contact unfamiliar objects placed in a pen is measured, along with the total frequency and duration of contacts with novel objects (Fig. 2).

PAH: Pigs are placed individually in a test pen. A human enters the pen and stands in a set location, away from the pig, for a maximum of three minutes, the time taken for the pig to make contact with the human, the number of contacts made, and the duration of time the pig spends within one meter of the human is recorded (Fig. 3).

HAP: Pigs are placed individually in a test pen. A human, unfamiliar to the pig enters the pen and approaches the pig slowly. The response of the pig is recorded on a scale of 1-4, (1- fearful, 4 – pig allows human to approach and interacts), (Fig. 4).

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Fig. 3 ~~the~~ PAH test (pig approaching human)

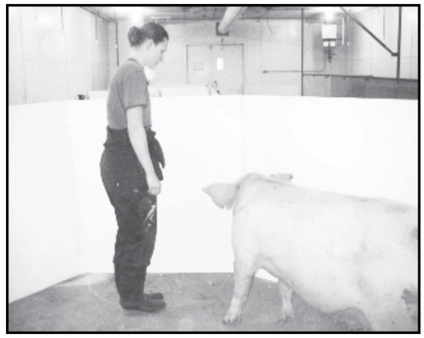

Fig. 4 ~~the~~ HAP (humane approaching pig)

The ODT and NOT are considered indicators of the active-passive dimension of temperament, with active animals being quicker to exit the test pen, and to approach and make contact with unfamiliar objects than passive individuals. The PAH and HAP tests were used to evaluate the confident-fearful dimension, with more fearful individuals taking longer to approach a human in the PAH, or actively avoiding human interaction in the HAP test. This relationship is shown in table 1.

Table 1 Relationship between pig behaviour and temperament

	Behaviour	Response
Test	Active	Passive
ODT	fast	slow
NOT	fast to contact	slow to contact
Test	Calm	Fearful
PAH	fast approach	slow approach
HAP	high score	low score

Results

Sow behaviour

Sows in the concrete and straw bedded housing systems showed significant differences in their behaviour during the ODT, NOT and HAP tests. Overall, sows in the straw bedded system showed more active temperament traits, being faster to exit the home pen in the ODT (P<0.0001), and making contact with objects more frequently in the NOT test (P<0.001), compared to sows housed in the concrete system. Sows housed in the straw bedded system also had a lower HAP score, which could indicate more fearful behaviour, or alternatively these sows were just not interested in the human.

Factor analysis, a data reduction technique, was used to analyse the behavioural responses of sows and compare the sow temperament characteristics between the two housing environments. This analysis indicated that in straw bedded systems, the active/passive temperament dimension was more important (accounted for the greatest amount of variation), while in the concrete system, the confident/fearful dimension was more important.

Sow condition, injury and lameness

Sows housed in the straw bedded system had a significantly higher body injury score throughout gestation than sows in the concrete system (P<0.001). Across both systems, younger sows had higher levels of body injury score than older sows (P<0.001). Sows housed in the straw bedded system had a greater reduction in BSC over lactation, as measured from weeks 20 to 16, than those housed in the unbedded system (P<0.001). Younger sows showed a greater reduction in sow BCS than older sows (P<0.001), over weeks 20 to 16.

Over the course of the study, a greater number of sows became lame in the concrete system than in the straw bedded system (Table 2).

The incidence of lame sows was also positively correlated to the severity of body injury score measured at 8 weeks of gestation in the concrete system (P<0.005), but not in the straw-bedded system.

Relationships between sow temperament and sow longevity

The severity of body injury as measured at 16 weeks of gestation was positively correlated to different temperament dimensions across the two systems. In the concrete system, body injury was related to active/passive traits, with active sows having more injuries (P<0.05), and in the straw-bedded system, body injury was related to confident/fearful traits, with confident sows having higher injury scores (P<0.05).

In the straw-bedded system, but not the concrete system, passive sows had a greater reduction in BCS during lactation (P<0.05) than active sows. There was no relationship between temperament and the incidence of lameness in sows in either of the ESF systems.

Table 2 The incidence of lame and non-lame sows in straw-bedded and concrete part-slatted ESF housing systems over one gestation.

Straw-bedded ESF	Not lame	Lame	Total
Frequency	99	41	140
Percent (%)	35.7	14.8	50.5
Part-slatted ESF	Not lame	Lame	Total
Frequency	78	59	137
Percent (%)	28.2	21.3	49.5
Total (frequency)	177	100	277
Total (%)	63.9	36.1	100

The Bottom Line

Individual sows vary in temperament, and these traits can be successfully determined though simple on-farm behaviour tests. Housing environment has a strong influence on the behavioural responses of sows, and can interact with temperament to influence how well sows cope under different management systems.

In both of the housing systems studied here, temperament traits were correlated to the severity of body injury score. Body injury scores are a measure of aggression between sows, and the results indicate that temperament is thus linked to aggressive behaviour. This finding is in agreement with previous research. However, it is interesting to note that the temperament traits related to injury score differed between the two housing systems, providing further evidence for the importance of the interaction between housing and temperament. Floor type in the two housing systems also had a significant influence on the incidence of lame sows. This demonstrates the importance of floor type in sow longevity, and the value of using alternative floor types that provide greater comfort to sows , such as straw or rubber.

With continued research, our understanding of the interaction between sow temperament and housing system will improve, and specific handling and management protocols for sows under different housing environments could be developed. In addition, genetic selection of sows with more suitable temperament types can become a component of sow replacement schemes, helping to reduce aggression and improve production and longevity in group housing systems.

Acknowledgements

Specific project funding for this work was provided by the Canadian Swine Research and Development Cluster. Strategic funding was provided by Sask Pork and the Manitoba Pork Council.

Evaluation of a Biotrickling Filtration System for Treatment of Exhaust Air from a Swine Barn

Bernardo Predicala[1], Ph.D. Alvin Alvarado[1], M.Sc., Matthieu Girard[2], Ph.D. Martin Belzile[2], M.Sc., Stephane Lemay[2], Ph.D. John Feddes[3], Ph.D.,

Biotrickling filters are considered to be the next development for animal housing since they are easier to manage and are smaller in size compared to other exhaust air filtration technologies. Various configurations of biotrickling filters and bioscrubbers have been studied and showed a very good potential for controlling emissions from pig buildings. A number of operating conditions have been specified for biotrickling filters (Deshusses and Gabriel, 2005). Design values have been suggested for bed height, bed cross-sectional area, packing nominal size, empty bed residence time (EBRT), pressure drop, air temperature, liquid recycle rate, pH of the recycled liquid, and some typical control parameters. However, further work is needed in order to realize the best design that will perform effectively when installed in actual swine production facilities.

The main objective of this study was to develop an air cleaning technology that will reduce the offensiveness of the exhaust air from a swine grower-finisher facility. The specific objective of this study was to evaluate the effectiveness of this air treatment unit (ATU) in a commercial-scale pig facility.

Previous phases were used as basis for the design of a commercial-scale ATU (Figure 1) that was evaluated in this study. Each ATU consists of two vertical walls of plastic porous material with a sprinkler system supplying water from the top of the wall; as water trickles down the wall, the exhaust air is passed across the wall. Because the water is continuously recirculated over the wall, a biofilm forms on the surfaces of the porous wall material, and the combined action of the microorganisms in the biofilm and the wetted filter media results in the cleaning of the exhaust air that passed through the wall.

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[2]*Research and Development Institute for the Agri-Environment*[3] *University of Alberta*

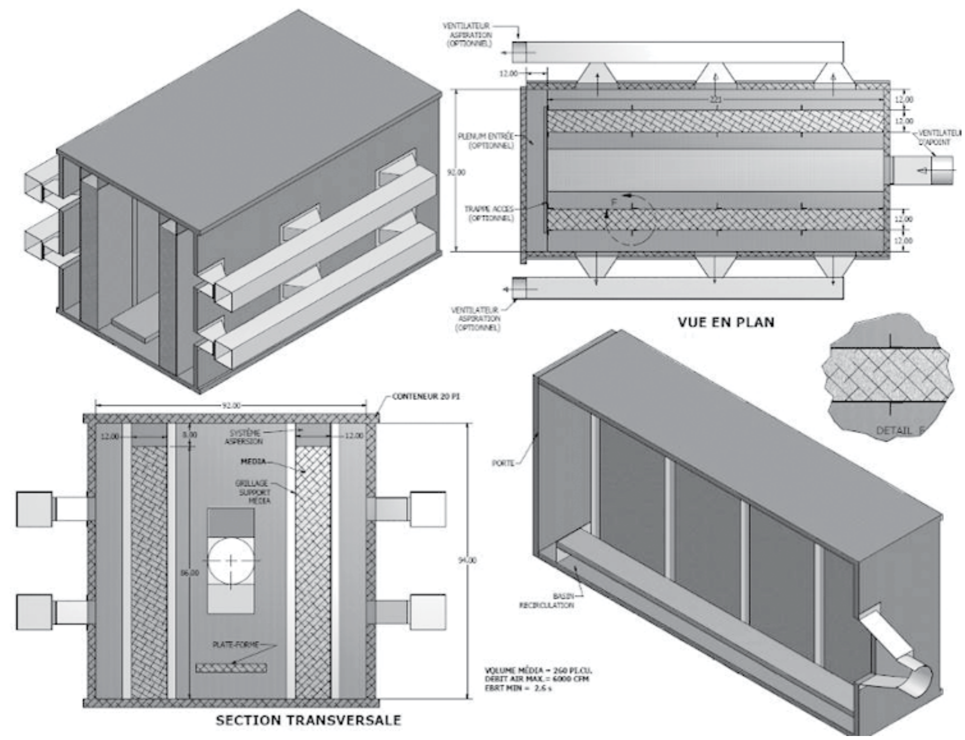

Figure 1. Conceptual diagram of the interior of each air treatment unit.

Animal and room preparation

Three grow-finish rooms at the PSC barn facility were used for this study. Each room had a total floor area of 5.49 x 14.63 m (18 x 48 ft), with six pens of 1.98 x 4.11 m (6.5 x 13.5 ft.) each. Each room was mechanically-ventilated with 3 exhaust fans at one end of the room (outside wall). For this experiment, a total of 60 grower pigs (10 per pen) at starting weight of about 20-25 kg was brought into each room.

Three identical air treatment units (ATUs) were installed outside of the rooms; the exhaust air from each room was ducted to each ATU and passed through the biotrickling filter inside each unit (Figure 2). Monitoring equipment and sensors were installed in the rooms and in each unit to collect data on gas and dust levels, environmental parameters, as well as operational parameters such as airflow rates, water and energy consumption.

The trial ran for 12 weeks. During the trial, the following parameters were monitored:

1. gas (NH3), dust, and odour levels
2. environmental parameters (air temperature, relative humidity, airflow rates)
3. pig performance (average daily gain, health record and mortality rates)
4. operational parameters (water and energy consumption).

Figure 2. Photo of actual set-up showing the plenum enclosing the barn exhaust fans and the duct connecting the plenum to the air treatment unit.

Additionally, on each sampling week, air samples were collected into 10-L Tedlar bags before and after each ATU and sent to an olfactometry laboratory for odour analysis. Furthermore, two total dust samplers were installed in each ATU to assess the impact of the ATUs on dust levels at the exhaust.

Effect on ammonia concentration

Table 1 shows the weekly average NH_3 concentration before (inside the room) and after each air treatment unit. The difference in NH_3 levels before and after the unit was statistically significant ($p<0.0001$) which means that the air filtration unit was able to significantly reduce levels of ammonia in the exhaust airstream before being released to the environment. It was also observed that NH_3 concentration before the treatment units increased significantly ($p<0.0001$) as the trial progressed while the fluctuations of NH_3 at the exhaust of the units were not significant ($p=0.059$). This observation implies that the air filtration units worked effectively even at the start of the trial; however, the reduction in NH_3 levels during the initial part of the trial was not that high because the incoming NH_3 levels were relatively low compared to the latter part of the trial when pigs were nearly market weights and NH_3 levels inside the room tended to be very high, thus, resulting to higher NH_3 removal percentage.

This observation is more evident in Figure 3 when actual levels of ammonia before (initial) and after (final) each ATU and temperature of air passing through the ATU were plotted over a 24-hour period; the data presented in the figure were extracted from week 11 results when ammonia sampling was done continuously for three days. Considering two factors (time and air temperature) that may influence reduction of ammonia, regression analysis revealed a significant relationship ($p=0.0001$) between NH_3 reduction and air temperature but not with time ($p=0.8187$) (i.e., over a 24-hr period). As shown in Figure 3, NH_3 levels at the biotrickling filter exhaust were almost the same over the 24-hr period regardless of the initial NH_3 concentration in the rooms.

Effect on dust and odour concentration

Levels of total dust before and after the air treatment units are shown in Table 1. Significant reduction ($p<0.0001$) in dust levels was observed after the exhaust air had passed through the treatment units. Similar to ammonia, dust levels after the treatment units were not significantly different ($p=0.183$) over the monitored weeks; however, dust levels inside the rooms (before the units) increased significantly ($p<0.0001$) with time. This has resulted to higher dust reduction achieved at the latter part of the trial when pigs were nearing market weights. Maximum dust reduction was about 92%, which was achieved on week 12 while the least reduction was about 65% during week 3.

As shown in Table 1, the impact of the air treatment units on odour concentration was not as readily evident compared to ammonia and dust, though statistically significant reduction ($p=0.017$) in overall odour levels was observed after passing through the treatment units. On average, odour concentration inside the room (before treatment)

(Evaluation of a Biotrickling ... cont'd on page 11)

Table 1. Average weekly concentration of ammonia, total dust, and odour concentration before and after each ATU and the corresponding removal efficiency (RE).

Parameter		Weekly average		
		Before	After	RE (%)
Ammonia, ppm	Mean	27.6	7.6	62.3
	SD	12.4	1.1	17.7
	Min	8.4	6.3	22.0
	Max	48.0	9.6	76.8
Dust, mg/m^3	Mean	0.899	0.177	77.6
	SD	0.410	0.077	8.8
	Min	0.255	0.089	65.2
	Max	1.301	0.266	91.9
Odour, OU/m^3	Mean	815	553	4.4
	SD	419	208	81.1
	Min	241	306	-165.6
	Max	1443	936	75.0

Thirty Five Years of Change

Brian Andries, BSA
Manger - Operations
Prairie Swine Centre

After a Bachelor of Science degree and 2 years of Veterinary Medicine, a summer accident while managing the local golf course lead to a year off, not being able to return to classes after missing the first 4 weeks of the school year. In the fall of 1979, I heard that the University of Saskatchewan was looking for a Stockman to work at the nearly constructed swine facility located near the Goodale farm East of Saskatoon, and so it began.

The Prairie Swine Centre as it was called was conceived in 1973-74 by members of the Agriculture, Western College of Veterinary Medicine, and Agricultural Engineering departments along with the Saskatchewan Hog Marketing Commission in consultation with producers. Stock from purebred producers in Western Canada was utilized to populate the facility. Piglets from c-sectioned sows were raised in isolation units at VIDO, at this time the Veterinary Infectious Disease Organization. When old enough, stock was kept and grown out in the isolation units at WCVM on the north side of the large animal clinic.

It is at VIDO where were I started in October of 1979, doing midnight feedings on new born piglets using milk replacer to keep our Specific Pathogen Free animals alive. The success rate was not that great but we moved out to the Prairie Swine Centre in November of 1979 and with the original 34 sows and 11 boars which were placed in the 50 sow nucleus barn, the only barn finished that fall. Breeding stock were pure York, Landrace and Lacombe. The next summer the manager travelled to Ontario to purchase 34 pure York gilts from an SPF herd in Ottawa. Progeny from these animals then went to fill the 2 other 100 sow barns when construction was completed in the spring of 1980. Normal sow inventory grew to around 280-300 sows which has remained constant over the last 35 years. There was a small finisher barn that housed our replacement stock and some market hogs. We shipped to Mitchell's in Saskatoon at that time but only marketed about 400 animals a year. We sold the majority of our stock through SISCO, Swine Improvement Services Co-operative, as weaner pigs.

The next major change came when Dr. John Patience started as Director of the Centre in 1989. I became Production Manager at this time. Prairie Swine Centre Inc. was established in 1991 as a non-profit corporation with pigs going into the grow-finisher research facility in May of 1992. The facility was built to market 5,500 animals a year and do research in nutrition, behaviour and agricultural engineering. At this time we were weaning about 5,000 animals per year unlike the 7,800 we are now producing. The additional 2,000 pigs produced each year have been managed through a combination:

1. The sale of research animals to supply University of Saskatchewan researchers
2. The use of contract finishers in good years selling nursery pigs

Three all-in-all-out nurseries were built in 1994 and another three 3 in 2004. This replaced the continual flow nurseries and completely eliminated mortalities from Streptococcus Suis. This dropped our nursery mortality to less than 2.5% which remains so until today. In 2008 a new breeding gestation and farrowing barn was built to replace the original sow barns built in 1979.

In 1992 it was decided to change the genetics of the herd to be more representative of the industry. We went with Pig Improvement Canada stock and brought in new lines by doing about 90 c-sections over a number of years. Between 1979 and 2009 we changed genetic lines 4 times with the quickest change in 2004 converting L-15 to L-23 F1 females. At this time we performed hysterectomies on 87 sows over a few months and brought in 478 replacement animals. The last genetic change was to Camborough Plus (L-42) females which were completed in 2009.

A total of 11 full time production staff, including the manager, maintenance, and animal health technician along with 3 people each, working in the 100-sow barns and 2 in the 50-sow barn were hired by the end of 1980. When I became manager in 1989 and we now finished all animals produced on site, we restructured labour bringing the number of full time staff to 8. We were still dealing with 3 separate sows barns at this time. When we built the new breeding gestation barn in 2008 production staff dropped to 4.5 people, including maintenance and management.

Production changes over the years are as follows:

Genetics	Year	Farrowing Rate	# Born/Sow	# Wean/Sow	Avg. Born Sold/Yr	Total
York/Landrace	1988	79.5	18.6	16.4	9.4	4,968
PIC L-C15	1998	91.5	26.0	23.0	10.8	6,225
PIC L-C22	2004	86.2	28.1	24.8	11.3	7,759
PIC L-42	2012	93.0	31.1	26.8	13.0	7,828

One of the things that have stayed fairly consistent over the last 35 years is the health status of the herd. We continue to bring in new genetics but only through c-section and artificial insemination. We currently only have antibiotics in the first stage starter diet for pigs 8-9 weeks of age and other than that no other antibiotics are fed at the facility. Our only sow vaccination program is for parvovirus, leptospirosis, and erysipilus. We are probably one a few facilities that doesn't vaccinate for circo virus and still our grow-finish mortality is less than 3.5%.

In spite of a well developed biosecurity program, we contracted Transmissible Gastro-enteritis in March of 1995 when the virus was

(Thirty Five Years of Change ... cont'd on page 12)

(Evaluation of a Biotrickling ... cont'd from page 9)

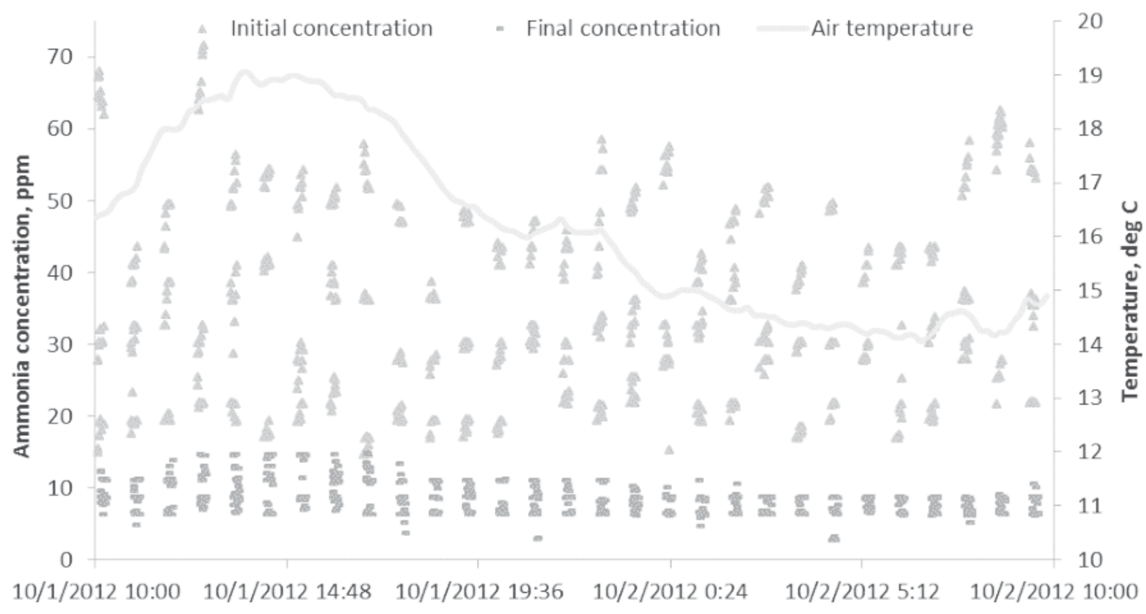

Figure 3. Variation in ammonia and exhaust air temperature over a 24-hr period in week 11.

was about 815 ± 419 OU/m^3 and was reduced to about 553 ± 208 OU/m^3 after the air treatment units. Variations in odour levels after the treatment units were not significant (p=0.119) while odour variations inside the room were significant (p=0.006).

Water consumption

The water consumption associated with the air treatment units are presented in Table 2. On average, the air treatment units consumed about 537.5 ± 113.3 liters of water per day with ATU 1 had the highest (663.0 L/day) while ATU 3 had the least (442.9 L/day). Wide variations in water consumption between ATUs can be attributed to the differences in frequency of replenishing the water in each particular unit, i.e., draining about 2 inches depth of water from the unit and then adding the same volume, to maintain the water electrical conductivity below 7.5 µS. Throughout the trial, the water in ATU 1 was replenished 16 times compared to 11 times for ATU 3; this could be related to NH3 removal because as shown in Table 2, ATU 1 had the highest NH3 removal efficiency while ATU 3 had the least. Draining and then adding water into the ATU was not done every day as it was dependent on the water electrical conductivity readings in each unit; this was required almost every day for some units but for others this was done at two to three days interval.

Table 2. Water consumption associated with each air filtration unit.

Replicate	Average NH3 removal efficiency, %	Water consumed, L/day (Mean ± SD)
ATU 1	72.2	663.0 ± 498.2
ATU 2	65.0	506.6 ± 427.3
ATU 3	49.6	442.9 ± 419.1
Average		537.5 ± 113.3

The Bottom Line

Based on the findings from this trial, the following conclusions can be made:

1. The biotrickling air treatment units installed at the exhaust of swine grow-finish rooms were effective in reducing the levels of ammonia, dust, and odour by about 77%, 92% and 75%, respectively.
2. The biotrickling units were able to reduce the levels of ammonia even at the initial stage of the trial, with the ammonia levels after the filter almost remaining the same throughout the trial. Hence, the percent reduction in ammonia increased as the initial ammonia concentration entering the filter increased.
3. Water consumption tended to increase as the biotrickling units remove more contaminants from the air.

Acknowledgements

This research was supported by the Canadian Swine Research and Development Cluster, Saskatchewan Pork Development Board, and the Research and Development Institute for the Agri-Environment. Strategic funding to PSC research programs are provided by Sask Pork, Alberta Pork, Manitoba Pork Council, and Saskatchewan Ministry of Agriculture.

Personal Profile

Felina Tan

I come from Melaka, Malaysia which is about 180km from the capital city Kuala Lumpur. I came from a non-agricultural background but I have owned a few pets during my childhood, I always had a keen interest in animals. My big break came when I had the opportunity to pursue a Doctor of Veterinary Medicine (DVM) in University Putra Malaysia, the sole university in Malaysia with a vet school. During my university years, I had practical training in various species of animals in different locations in Malaysia and other countries including Thailand and London, UK. During my final year, I decided to pursue my career in the livestock industry after graduation in 2010 as I wanted to have a wider perspective, experience and to meet more people around the world.

I worked with Cargill Animal Nutrition, Malaysia for over a year and a half after graduation as an animal feed formulator majoring in swine and poultry formulations. Apart from complete feed formulations, I also did concentrated premixes for swine. Having met so many more experienced and top-notch nutritionist in the industry, I was inspired to pursue my graduate studies in Animal Nutrition.

I joined Prairie Swine Centre Inc. in April 2012 as a graduate research assistant and at the same time, pursuing my MSc in Animal Science majoring in Nutrition. My research focus is on the effect of dietary calcium and phosphorus balance on sow lameness and longevity. I will be looking into the bone integrity of the sows treated with different levels of calcium and phosphorus according to the industry standard. Analysis will be done on serum and milk calcium and phosphorus, and bone turnover using bone markers assay. Apart from that, I will also be looking into the bone integrity of sows and piglets by measuring their bone density and bone mineral content using the peripheral quantitative computed tomography (pQCT) technique collaborating with the College of Kinesiology.

Coming Events

World Pork Expo
June 5-7, 2013
Des Moines, Iowa

Swine Technology Workshop
October 30, 2013
Red Deer, Alberta

Saskatchewan Pork Industry Symposium
November 19-20, 2013
Saskatoon, Saskatchewan

Banff Pork Seminar
January 21-23, 2014
Banff, Alberta

(Thirty Five Years of ... cont'd from page 10)

brought into the facility likely on a 45 gallon drum of canola oill. The disease started close to the shop area where the canola oil drum was stored and spread from here. Grower animals in rooms adjacent to the shop first became sick with reduced feed intake and diarrhea. The virus made its way room by room through grow-finish and hit farrowing rooms 3 days later. When piglets became sick we were able to do two different tests on intestinal tissue to confirm the diagnosis. Feedback procedures were initiated to expose all sows to the virus. Close to 450 piglets died as a result of the disease, around a 36% pre-wean mortality, with some week's mortality getting close to 75%. Production staff had to remain strong as it was a particularly depressing time for staff to be working in the barns at this time.

In June of 1997 we performed two c-sections on sows at WCVM and brought the piglets out to the facility to put on newly farrowed sows at the Centre. Ten days later we received a call from the facility where the c-section sows came from informing us that they had broke with Porcine Reproductive and Respiratory Syndrome (PRRS). We took blood samples from the c-section piglets and other animals in the room confirmed that we were PRRS's positive. At that time our herd health veterinarian Dr. Charles Rhodes decided not to vaccinate the sows with the modified live vaccine. Infected sows through the facility were moved so that all sows would be infected at the same time. After 3 years of blood tests and at the end removing the last sows with titres we had sero-converted back to being PRRS negative.

Working in the industry has always been challenging. The Swine Centre has given me the opportunity to meet, work with and develop friendships with a large number of people over the last 35 years. There has never been a dull moment and the changes in the facility, the animals, and the research has made this job rewarding.

PRAIRIE SWINE CENTRE

Centred on Swine is a semi-annual newsletter produced by Prairie Swine Centre Inc. (PSCI).

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