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Saskatchewan Agriculture, Food and Rural Revitalization

Greenhouse Gas Emissions from Swine Production Systems

Claude Laguë, P.Eng., Ph.D., University of Saskatchewan / Prairie Swine Centre Inc. Sask Pork Chair in Environmental Engineering for the Pork Industry

The Climate Change and Greenhouse Gas Issues

There is a general agreement in the scientific community to the effect that the increased atmospheric concentrations of what is referred to as greenhouse gases (GHG) are mainly responsible for the global warming trend that the Earth has been experiencing since the beginning of the Industrial Age. Atmospheric GHG allow the sun's electromagnetic radiation to warm the Earth's surface and atmosphere and also prevent some of that heat to escape into outer space. Without GHG, the Earth's average surface temperature would be about –20°C rather than the actual 15°C that allows life to exist and thrive on our planet. The three most important GHG are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). On a molecular basis, 1 kg of CH_4 has the same impact on the warming of the atmosphere as 21 kg of CO_2; in the case of N_2O, it takes 310 kg of CO_2 to obtain the same warming impact caused by 1 kg of N_2O gas. The lifetimes of these three gases once emitted into the atmosphere are approximately 100, 12 and 120 years for CO_2, CH_4 and N_2O respectively. Without any action to reduce world GHG emissions, it is currently estimated that the Earth's average surface temperature could increase by 1 to 3.5°C over the next century. Corresponding average temperature rises for Canada are expected to range from 1 to 2°C in the Atlantic and Pacific coastal regions; 2 to 3°C in the heartland of the country; 3 to 4°C in the Southern Prairies, around Hudson Bay and in most of the Northwest Territories and from 4 to even 10°C in some parts of the Arctic regions by the middle of the twenty-first century.

Figure 1. Gas collection and sampling system used to measure GHG emissions from manure storage facilities.

Impacts of Swine Production Activities

It is estimated that agricultural activities are responsible for about 10% of the total GHG emissions caused by human activities in Canada and that just under 50% of those emissions originate from livestock production. However, the relative contributions of the different livestock sectors have not been precisely established yet.

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Publication # 40010021

Incubation time but not cooling rate affects storage of extended boar semen at 5°C.

M. J. Pettitt, PhD and E. Beltranena, IAZ PhD, Prairie Swine Centre Inc., Saskatoon, Canada.

Large geographical distances often exist between production units and their source of boar semen, or between commercial boar studs and their customers. This makes shipping time lengthy which exposes the extended boar semen to temperature challenges that vary with season. Boar sperm are extremely sensitive to chilling below 15°C, thus extended boar semen is usually stored at a temperature of 17-18°C. As this temperature is difficult to maintain, especially during transport, fluctuations in temperature during shipping or storage that affect the quality of the extended semen can often go unnoticed. Storing extended boar semen at 5°C would allow for the transport of semen using readily available cooling units.

A study to determine the effects of cooling method and incubation time on boar semen extended in three different extenders and stored at 5°C was carried out at PSC Elstow Research Farm Inc. with the objective of determining the effects of stepwise cooling combined with different final incubation times at 17°C on the ability to store extended boar semen at 5°C.

Eighteen fresh ejaculates from 7 boars were split and 8 insemination doses (2 billion sperm, 70 mL each) were extended in each of three commercial extenders (Ext A, B and C) at 35°C. Within extender, each dose was then subjected to one of 8 cooling rate by incubation time treatment combinations.

Stepwise cooling consisted of placing the 35°C extended semen into consecutive water baths at 32, 29, 25, 22, 19 and 17°C, changing the extended semen from one bath to the next every 30 min. For direct cooling, the semen doses were placed directly into a 17°C storage cabinet. Final storage temperature was either 17 or 5°C. The effects of the cooling rate by incubation time treatment combinations were determined by measuring the following sperm characteristics on the extended semen samples for 6 consecutive days: total motility (percentage of sperm moving), progressive motility (percentage of sperm moving in a forward fashion), viability(percentage of living sperm) and normal morphology (percentage of sperm with normal structure).

Table 1

Treatment	Cooling Rate	Incubation	Final Storage Temperature
1	Stepwise 35 - 17°C	None	17°C
2	Stepwise 35 - 17°C	None	5°C
3	Stepwise 35 - 17°C	4 hr @ 17°C	5°C
4	Stepwise 35 - 17°C	24 hr @ 17°C	5°C
5	Direct 35 - 17°C	None	17°C
6	Direct 35 - 17°C	None	5°C
7	Direct 35 - 17°C	4 hr @ 17°C	5°C
8	Direct 35 - 17°C	24 hr @ 17°C	5°C

Results

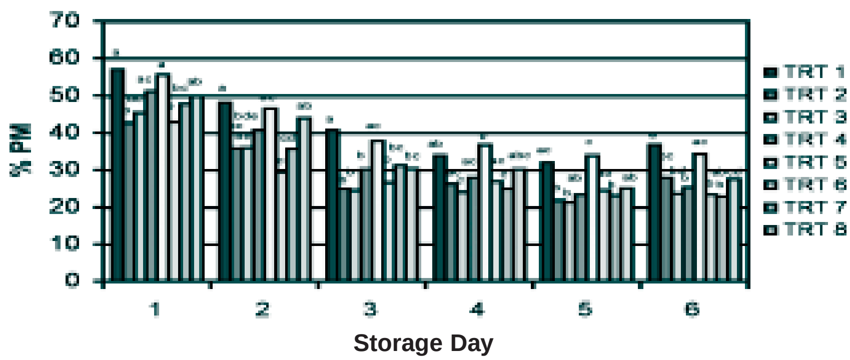
Progressive motilities in the 8 cooling rate/ incubation time treatments were typically the greatest in sperm stored at 17°C (Figure 1; Treatments 1 and 5) followed by sperm incubated at 17°C for 24 hr prior to storage at 5°C (Treatments 4 and 8). Cooling rate (direct or stepwise) did not affect these results.

Total motility on day 1 was greater when sperm were stored at 17°C or incubated for 24 h at 17°C prior to storage at 5°C (Figure 2; Treatments 1, 5, 4 and 8) than when sperm were stored at 5°C or incubated for 4 h at 17°C prior to storage at 5°C (Treatments 2, 6, 3 and 7).

By day 2, total motilities were greatest for sperm stored at 17°C (Treatments 1 and 5), followed by sperm incubated for 24 hr at 17°C prior to storage at 5°C (Treatments 4 and 8),

Continued on page 3

Figure 1 **Progressive Sperm Moblity**



ab Treatments with different letters indicate statistical difference

Figure 2 **Total Sperm Motility**

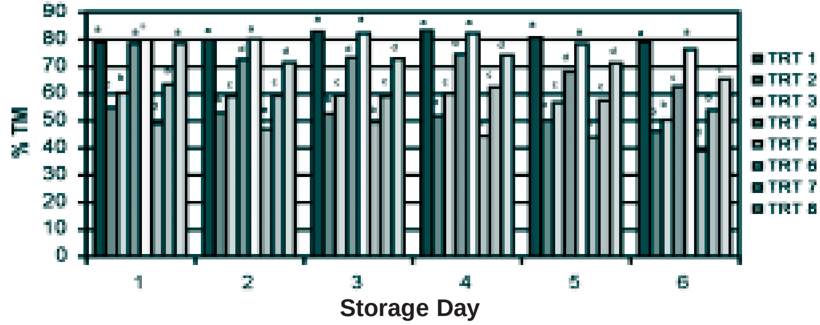


Figure 3 **Viability in Extender A**

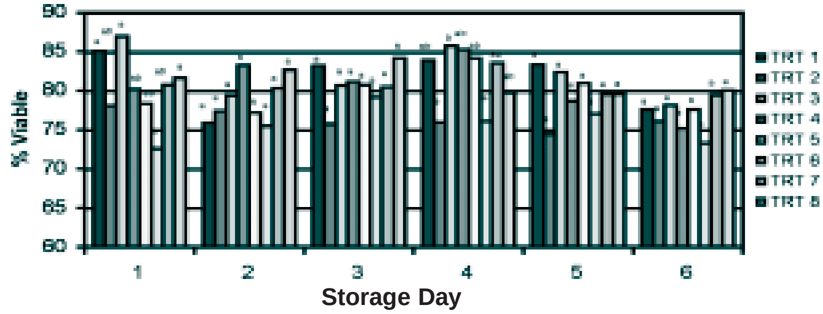


Figure 4 **Viability in Extender B**

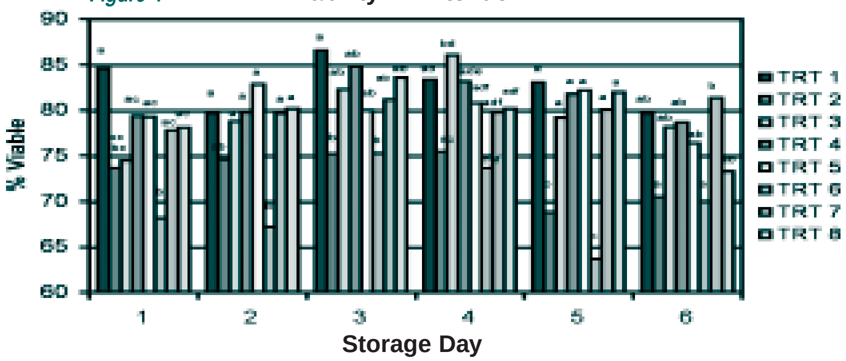


Figure 5 **Viability in Extender C**

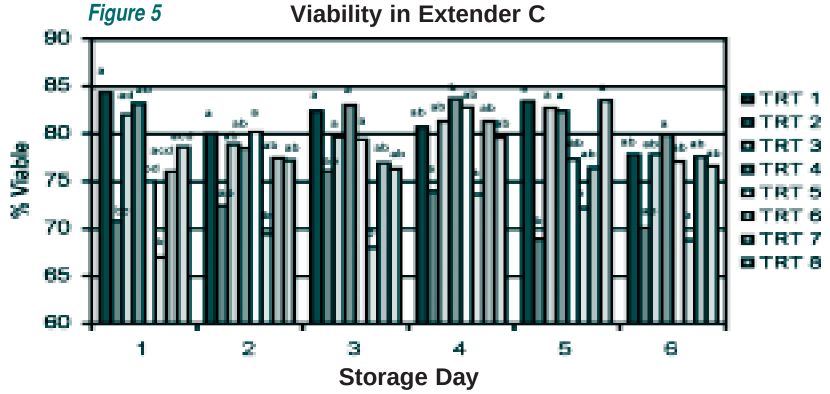
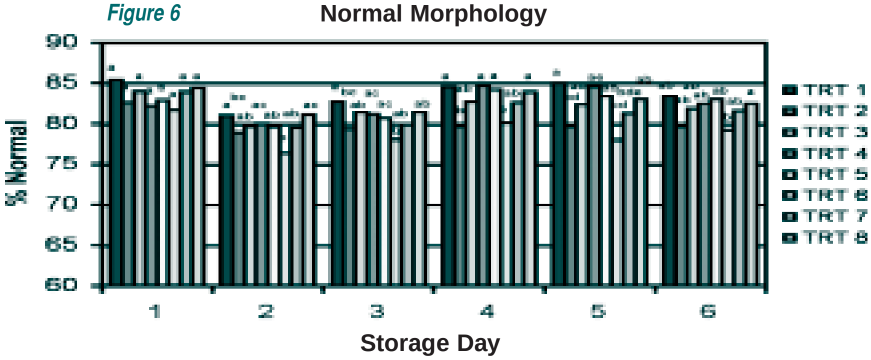


Figure 6 **Normal Morphology**



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which in turn were followed by sperm incubated for 4 h at 17°C prior to storage at 5°C (Treatments 3 and 7). Sperm stored at 5°C (Treatments 2 and 6) had the lowest values for total motility and this pattern continued on through to day 6.

When stored at 5°C without prior incubation at 17°C, total motility values were generally greater for sperm that had been cooled stepwise compared to those cooled directly.

Total motility values were superior when sperm were stored at 17°C. Acceptable total motility was possible, however, when sperm were stored at 5°C but depended on a 24 h incubation period at 17°C, regardless of cooling rate.

Viability results differed among the three extenders. In Extender A, viability was greater on day 1 for sperm cooled stepwise or direct and stored at 17°C (Figure 3; Treatments 1 and 5), or cooled stepwise and incubated for 4 or 24 hr at 17°C prior to storage at 5°C (Treatments 2 and 3), or directly cooled and incubated for 24 hr at 17°C prior to storage at 5°C (Treatment 8), versus sperm directly cooled and stored at 5°C (Treatment 6). By day 2 there were essentially no differences.

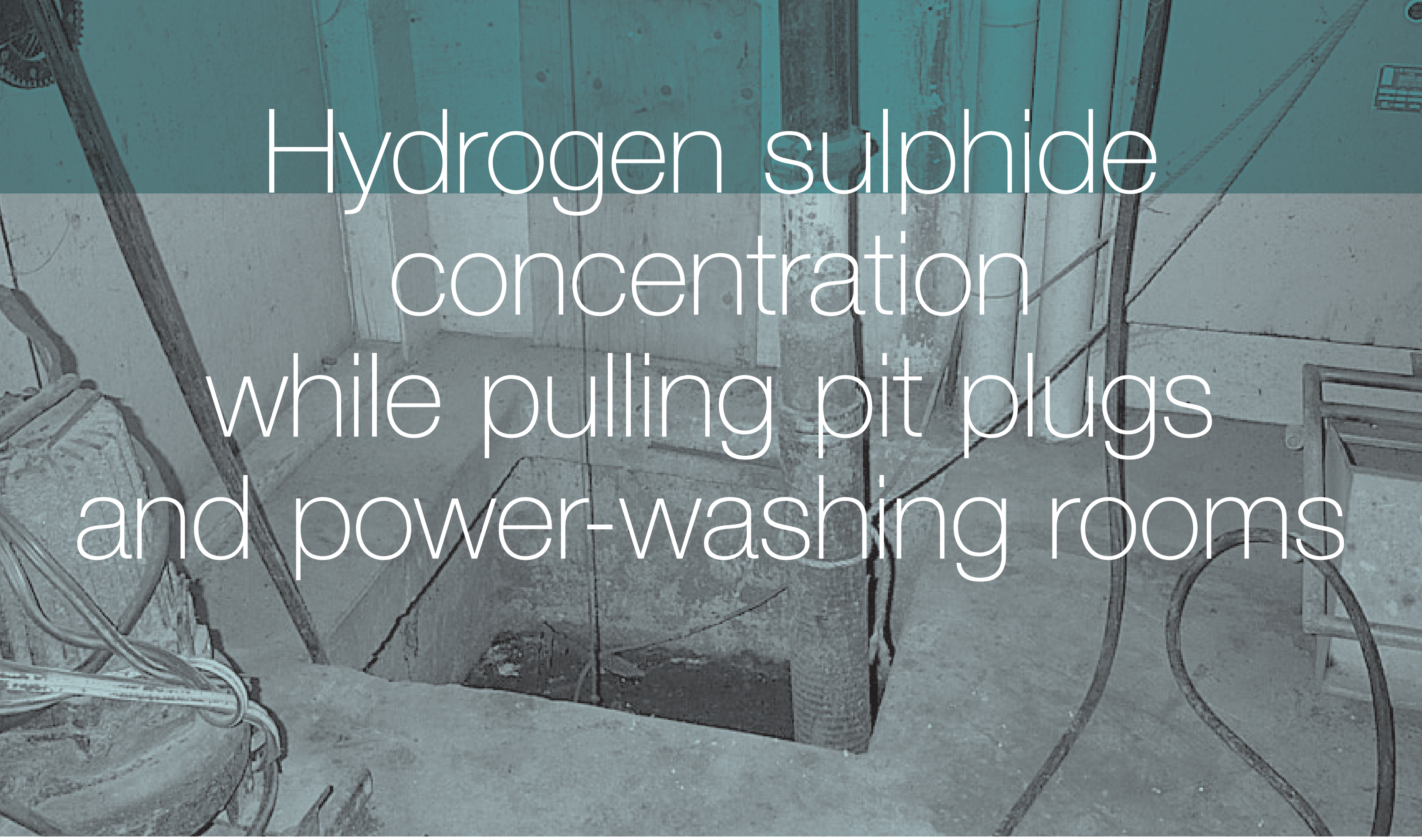
Viability in Extenders B and C was variable (Figures 4 and 5), with sperm stepwise or directly cooled and stored at 5°C without incubation (Treatments 2 and 6) usually yielding values among the lowest. Cooling rate (direct or stepwise) did not affect viability in any of the three extenders.

Normal morphology values generally did not differ among treatments, except for sperm cooled stepwise or directly and stored at 5°C (Figure 6; Treatments 2 and 6), which decreased versus the remaining treatments over time. Cooling rate (direct or stepwise) did not affect normal morphology.

The Bottom Line

These results indicate that extended boar semen can be stored at 5°C with acceptable values of sperm progressive motility, total motility, viability and morphology over time. Achieving these acceptable values at a storage temperature of 5°C depends upon incubating the sperm at 17°C for at least 24 hours prior to storing at 5°C. Success is dependent upon incubation time and not a direct or stepwise cooling rate. However, it is important to note that these are laboratory results and that an insemination trial is required to confirm these laboratory findings prior to implementation in the field.

Funding from Saskatchewan Agriculture, Food and Rural Revitalization and Agriculture Development Fund is gratefully acknowledged.



Hydrogen sulphide concentration while pulling pit plugs and power-washing rooms

L. Chénard, MSC PEng,
S.P. Lemay, PhD, PEng and
C. Laguë, PhD, PEng

Hydrogen sulphide (H_2S) is a life threatening gas produced by the anaerobic degradation of liquid manure. As most swine barns are equipped with gutters that accumulate manure for a period of time, H_2S can be released while performing common tasks that involve manure flow or mixing. In most cases, exposure may not result in death but short and long term effects can have impacts on the health and well being of the person exposed.

Saskatchewan Labour regulates H_2S exposure in the Occupational Health and Safety Regulation and stipulates that in no time a person should be exposed to an average of 10 ppm of H_2S for a period of 8-h (TWA: 8 hour time weighted average exposure limit) and an average of 15 ppm for a period of 15-min (STEL: 15-min time weighted average contamination limit). Saskatchewan Labour does not have a defined ceiling value for H_2S, but defines the level of H_2S immediately dangerous to life or health (IDLH) at 100 ppm, a level at which no body should even be exposed to.

Recent events in Saskatchewan led us to believe that barn workers may be exposed to high H_2S concentrations while pulling pit plugs and power-washing rooms and monitoring was performed to evaluate this hypothesis. Six swine production sites were assessed to determine levels of H_2S exposure while workers performed specific manure management tasks in gestation, farrowing, nursery and grower-finisher rooms. The room concentration and distribution of H_2S were measured when the shallow manure pits were emptied, and the concentration of H_2S was measured when workers were power washing rooms. For plug pulling events, the H_2S concentration was measured at 1 m from the floor and within a 1 m radius of the plug. Hydrogen sulphide concentration while power washing was recorded approximately at worker chest level.

Results from four barns monitored in this study indicate that plug pulling generated high concentrations of H_2S, where in some cases, the maximum recorded reached 1,000 ppm (Table 1). All of the farms used in this study had plug pulling events that could present health and safety risks to workers and exceeded limits defined by the Occupational and Safety Regulations of Saskatchewan.

The H_2S released when a plug was pulled did not follow a predictable pattern. Figure 1 shows typical variations of H_2S concentrations as the plugs were being pulled (time 0:00) and put back in place in a grower-finisher room and a gestation room. In the grower-finisher room, the maximum value was reached within less than 4 min after the plug had been pulled. In the gestation room, the concentration increased and went through a number of intermediate peaks before reaching the maximum. In most cases, the concentration decreased rapidly after the plug was put back in place. Overall, intermediate peaks reaching high values were also observed and the actual concentration pattern could not be predicted.

While most of the highest concentrations were generally recorded at the plug or sewer hole, sometimes it was recorded elsewhere in the room (Figure 2). No predictable distribution pattern was observed for a specific location where the peak would be reached. This means that a worker pulling the plug and walking away from it may not be in a safer position if staying in the room, and the same comment applies to a bystander.

Power washing generated lower H_2S

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Table 1 Overall maximum H_2S concentrations obtained during the plug pulling events performed in the four farms and the number of events where the concentration obtained exceeded IDLH.

Barn section	Maximum H_2S concentration (ppm)[number of events with concentration higher than IDLH / total number of plug pulling events monitored]			
	Farm number			
	1	2	3	4
Farrowing	810 [7/7]	610 [5/8]	75 [0/8]	123 [1/8]
Gestation	1000* [6/7]	1000* [6/9]	79 [0/8]	66 [0/8]
Grow-Finish	202 [2/4]	494 [3/8]	452 [2/8]	61 [0/8]
Nursery	1000* [1/3]	280 [2/9]	69 [0/8]	51 [0/8]

* Maximum concentration that could be read by the H_2S sensor.

concentrations than plug pulling. As power washing generally takes time, the STEL, in some cases, was reached some time after the task started and was exceeded for a long period of time, which in some of the monitored events was more than 30 min.

Workers need to be trained on H_2S risks to know what to expect from exposure and how to react if H_2S is present. Time response in cases of high H_2S exposure is critical for the worker that has been exposed. Access to H_2S monitors is important and self-contained breathing apparatus should be available for situations where day to day or emergency tasks have to be performed in high H_2S concentrations. Standard operating procedures should be developed at each site to define how to perform routine tasks involving H_2S as well as how to react in case of emergency. As an example, a barn worker can safely pull a plug using two H_2S monitors. The person wears one monitor and the second monitor is installed within the plug vicinity in the room. While sufficient ventilation is provided in the room, the plug is pulled and the person leaves the room rapidly. The worker comes back into the room to quickly put the plug back in place only when both monitors indicate H_2S concentrations lower than 15 ppm.

Further research is needed to improve building design and manure management systems, and to develop practical engineering controls for preventing the H_2S exposure in swine buildings. Before engineering controls can be implemented, site-specific procedures should be developed to ensure worker safety and compliance to the safety standards.

The Bottom Line

Swine barn workers may be exposed to H_2S concentrations that exceed acceptable limits when pulling pit plugs and power-washing rooms.

Locations of peak H_2S concentrations when pulling pit plugs vary within the room.

Monitors should be provided to all swine barn workers as pockets of H_2S may be present in areas other than where the plug is pulled (ex: transfer pit room, plug popping situations).

Training and standard operating procedures are needed so swine barn workers can learn how to deal with routine operations that can generate H_2S emissions and emergency situations where high H_2S concentrations may be present.

Figure 1 Hydrogen sulphide concentration during plug pulling events performed in a grow-finish room and a gestation room during the summer and winter period, respectively.

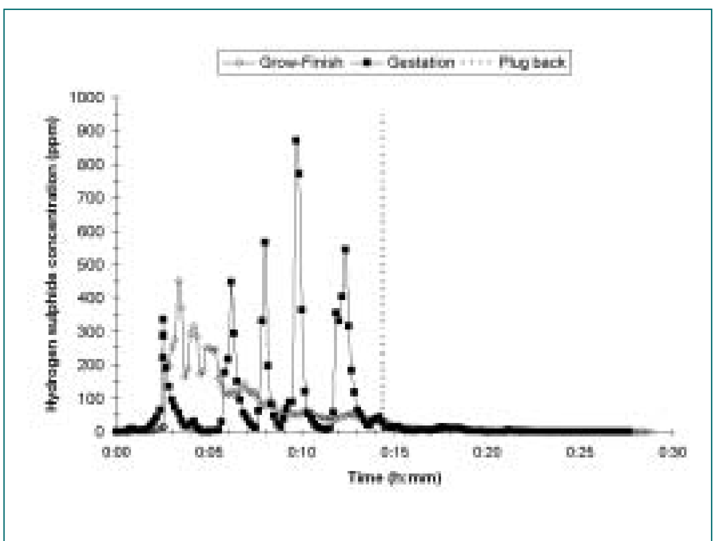
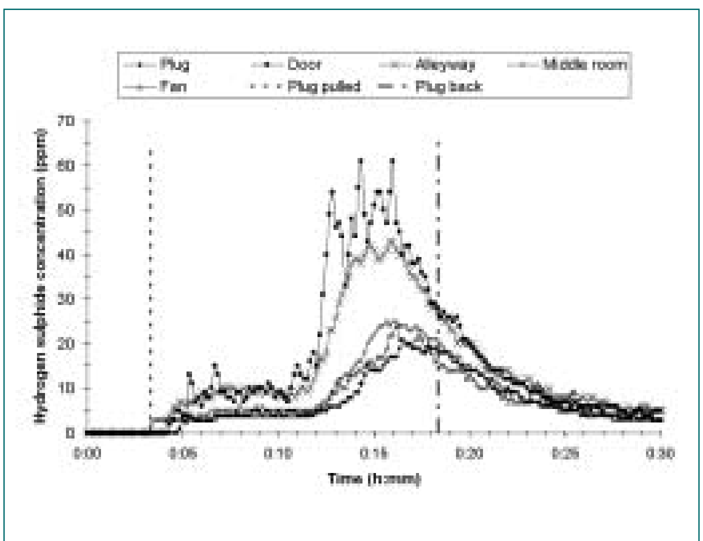


Figure 2 Hydrogen sulphide concentration distribution within the room during a plug-pulling event in a grower-finisher room during the summer period.



Stressful handling of pigs

Harold W. Gonyou, Ph.D.

"Downer" pigs are a problem for both packers and producers. Levels of downer pigs arriving at various U.S. packing plants are typically reported at 0.25 to 0.75 %; however, levels as high as 10 % have been reported for individual loads. The incidence of downer pigs has increased from 0.08 to 0.30 % over the past 10 years. Stressful handling appears to be a triggering factor for the occasional high levels of downer pigs. Although genetic predisposition has been suggested, the 'stress' gene is not a prerequisite for the condition as statistics show 90% of dead pigs arriving at Canadian packing plants do not carry the 'stress' gene. High levels of blood lactate and ammonia, lower blood pH, blotchy skin, open-mouthed breathing, vocalizations, muscle tremors and a refusal to walk are typical symptoms of these animals. The behavioural and physiological symptoms are characteristic of a hyperthermic animal under stress resulting in the typical fight/flight response and attempts to dissipate heat. The metabolic symptoms are due to the rapid release of energy from either or both the muscle and liver resulting in a build up of lactate and ammonia in the blood. This increase in lactate causes metabolic acidosis, which may be involved in the refusal of the animal to move. In this study we attempted to shift the acid/base balance of the animal by increasing the electrolytes in the diet, hoping to increase the buffering capacity of the blood and reduce the risk of acidosis during stressful handling.

The current model used to study stressful handling of animals is based on handling groups of animals with the understanding that a social stress (unfamiliar animals) as well as frustration during movement due to crowding would represent typical commercial handling situations. Additionally, the electric prod is used in the current stressful model to increase the level of stress since electric prods are believed to be a major source of stress in aggressive handling procedures. In these studies we examined both the need for group handling and the electric prod in the handling model.

Two studies were conducted; using a total of 336 pigs, to determine if altering the acid/base balance of the pigs through diet manipulation would affect the pig's response to stressful handling and to evaluate features of the model used for inducing stressful handling situations.

The experiments were designed to compare stressful handling (aggressively run through a course within the barn) for individually-run or group-run pigs on either a high or low electrolyte balance diet (Study 1). In addition, comparisons were made between aggressively handled pigs with or without an electric prod compared to gently handled pigs (Study 2).

In Study 1 we had a downer rate (at least one typical synptom) of 38%. The results show a decrease in blood pH and an increase in the levels of lactate, ammonia, glucose and glycerol in the blood as well as an increase in rectal temperature in downer pigs compared to non-downers (Table 1). These changes are indicative of the rapid mobilization of energy in downer pigs as a response to aggressive handling. Group-run pigs had lower blood O^2 and CO^2 and higher blood glycerol post-handling than did individually-run pigs. A higher proportion of downers in the group-run pigs (54%) suggests that group handling of pigs was more effective in inducing downers for model purposes. Altering the acid/base balance of the diet did not affect the pig's response to aggressive handling in either study. The high electrolyte balance diet raised the pre-handling blood pH in the first experiment but this did not prevent the typical physiological responses to handling and did not affect the incidence of downers.

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Table 1. Comparison of metabolic responses (post-handling) in downer and non-downer pigs.

Handling Size	Non-downer	Downer
Number of pigs	90	54
Rectal temperature, ºC	40.3	41.2
Blood pH	7.29	7.24
Blood lactate[1], mg/dl	105.6	149.3
Blood ammonia[1], umol/l	89.4	143.0
Blood glucose[1], mmol/l	8.81	10.88
Blood glycerol[1], mg/dl	39.8	50.9

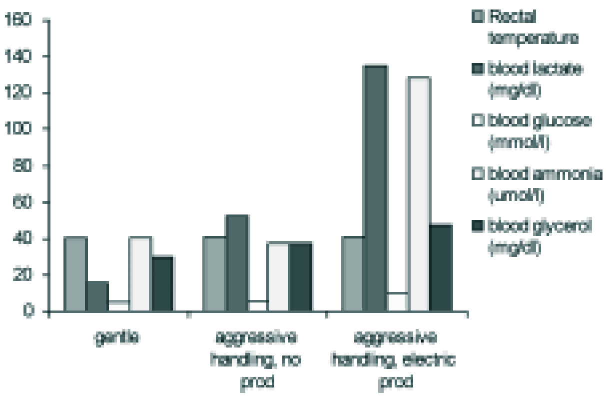
[1]Values shown were taken post-aggressive handling.

Table 2. Effect of the use of an electric prod on metabolic responses and the incidence of downers in aggressively handled pigs.

Handling Manner	Gentle	Aggressive
Electric Prod	-	+
Number of pigs	48	96
Number of downers (% of total pigs)	7 (15)	33 (34)
Blood lactate[1], mg/dl	47.1	134.5
Blood ammonia[1], umol/l	36.3	123.5
Blood glucose[1], mmol/l	5.80	9.68
Blood glycerol[1], mg/dl	39.5	48.4

[1]Values shown were taken post-aggressive handling.

Figure 1. Metabolic responses of gently handled and aggressively handled pigs with or without the use of an electric prod.



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In the second study, we obtained downer rates of 2, 15 and 34% for pigs handled gently, aggressively but not prodded, and aggressively including electric prodding, respectively. Among the aggressively handled pigs, the use of an electric prod resulted in a greater metabolic response to handling compared to the non-prodded pigs (Table 2). Aggressively handled, non-prodded pigs had higher blood lactate and glycerol levels post-handling than gently handled pigs (Figure 1). This suggests that aggressive handling, even without the use of a prod, may contribute to the 'downer' response, but this response is exacerbated by use of the electric prod.

The Bottom line

The use of the electric prod during aggressive handling contributes to the incidence of downer animals.

Aggressive handling of pigs can result in the metabolic response associated with downer pigs.

Altering the dietary electrolyte balance was not effective in reducing the metabolic response of pigs to aggressive handling or the incidence of downers.

Strategic funding for this project was provided by Elanco Animal Health.

Continued from page 1

In order to improve the current knowledge about GHG emissions from swine production systems, a collaborative research project between the Institut de recherche et de développement en agroenvironnement du Québec (IRDA), Prairie Swine Centre Inc. (PSC), Université Laval and the University of Saskatchewan was initiated in January 2001. The purpose of this project is to measure GHG emissions from swine production buildings, manure storage and manure treatment facilities over a 2-year period. GHG emissions are assessed for different types of production buildings (e.g. gestation, farrowing, nursery and finisher rooms, partly and fully slatted floors), of manure storage facilities (e.g. earthern manure storages (EMS) and tanks, covered and uncovered facilities) and of manure treatment systems (Figure 1). The research project is one of many that are funded by the Climate Change Funding Initiative in Agriculture (CCFIA) program of Agriculture and Agri-Food Canada all across the country with the overall goal of better assessing the contribution of the Canadian agricultural sector to the global GHG emissions in Canada.

Approximately midway into this project, some preliminary emission data have been collected and those data appear to be of the same order of magnitude as those reported in the literature from studies conducted elsewhere in the world. Based on these results, some preliminary estimates of the overall GHG emissions from swine production systems have been calculated and the results are presented in Table 1. At the present time, these estimates suggest that Canadian swine production systems do not constitute a major source of GHG caused by human activities.

Table 1. CO2, CH4 and N2O emissions from all anthropomorphic and agricultural sources and from the swine production industry in Canada.

Source	CO2		CH4		N2O	
	(kT/yr)	(%)	(kT/yr)	(%)	(kT/yr)	(%)
All sources	508,000	100	4,300	100	210	100
Agriculture	2,000	0.39	1,070	25	115	53
Swine (direct)[1]	-	-	127.7	3.0	3.4	1.6
Swine (total)[2]	295.0	0.058	127.7	3.0	4.5	2.1

1. Total GHG emissions from direct swine production and manure management activities.
2. Total GHG emissions from direct swine production and manure management activities plus the emissions associated to the production of feed grain (fossil fuels, oxidation of soil organic matter, crop residues, fertilizers).

Following the completion of this series of research projects, it will become possible to identify the agricultural sectors which should be targeted for GHG emission reductions in the future along with appropriate mitigation measures. Although the relative contribution of the pork industry to the global GHG emissions in Canada can be considered to be small, there exist opportunities to further reduce those emissions. The frequent removal of manure from the production buildings offers the potential of reducing CH_4 and N_2O emissions compared to standard practices. With respect to storage and land application of manure, more scientific information about the comparative impacts of different technologies (e.g. aeration or covering of storage facilities, surface application vs injection or incorporation of manure) on GHG emissions and on odour emissions and ammonia losses is needed before it becomes possible to identify technological options that have significant positive impacts on all of these important issues. On the manure treatment front, anaerobic biodigestion processes offer the potential of converting the methane produced through the microbial decomposition of manure into carbon dioxide if that methane is used to generate energy. The potential benefits of that option with respect to GHG emissions are twofold: 1. methane, a more potent GHG gas, would be substituted by carbon dioxide and, 2. the energy generated would result in an overall reduction in the use of fossil fuels.

What Lies Ahead?

Whether or not the Kyoto Protocol or any other international commitment to reduce GHG emissions are implemented in the near future, it is unlikely that the current global warming trend will be stopped. The Earth's climate will continue to change and human activities, including agriculture and swine production, will need to adapt to these new environmental conditions. Where and how pork is produced in Canada will most likely have to change in light of the different warming trends that will be experienced in the different regions of the country.

PSC Contract Research Staff

Expertise That Industry Counts On

Prairie Swine Centre's Contract Research Program provides confidential research services to private corporations and industry associations. In contrast to the public research programs (ethology, nutrition, engineering) that focus on the interests of western swine producers, PSC Contract Research program addresses the needs of companies in the pork and related industries (pharmaceuticals, vaccines, feed additives, feedstuffs, equipment, biotechnology, etc). It is a "customer-oriented research service" says Dr. Eduardo Beltranena, who leads the Program. "The study design, protocol, the conduct of animal trials, statistical analysis and reporting are entirely customized to the client company requirements". Dr. Murray Pettitt, Assistant Manager, emphasizes the dynamic pace of the Program: "our clients are often under pressure to introduce a product or technology; we do our best to work within their timelines". Companies thus have a unique opportunity to access PSC's excellent animal facilities, program personnel expertise and the support of on-site and/or off-site scientists.

Solid expertise is evident from Prairie Swine Centre's Contract Research Program professional staff. The two senior technicians, Ms. Raelene Petracek and Ms. Alison Orr have been with the Program almost since its inception. Both have substantial training and expertise, acquired on-site and in the USA in the highest standards of research conduct: Good Laboratory Practices (GLP) and Good Clinical Practices (GCP). These standards are required by the US Food and Drug Administration, Health Canada and the Canadian Food Inspection Agency for the conduct of regulatory studies towards product registration in order to guarantee product efficacy and the public's safety regarding animal products.

Raelene Petracek

Raelene grew up on a farm in the Rosetown, SK area. She graduated from the University of Saskatchewan with a B.Sc. Ag. in 1986. Her involvement in research trials started soon after graduation in the Department of Animal & Poultry Science where she worked with most agricultural livestock species. When PSC was started, Raelene worked with its first director and current President, Dr. John Patience. After incorporation, she started with the Contract Research Program and has remained there ever since. Over the years, she has stood out as being extremely resourceful, coming up with new and different ways of doing experiment tasks. Raelene has a memory for details, remembering study-specific procedures and activities from client experiments conducted years ago. Sponsors are delighted, realizing that if she remembers that much, their new experiment will undoubtedly be attended to by someone who really cares. Raelene's other passion is raising bison with her husband Harvey and daughter Alexa at their ranch in Esterhazy, SK.

Alison Orr

Alison was born in Irvine, Scotland and immigrated to Maple Creek, SK as a child. She developed an interest in animals and livestock while helping her father in the post-mortem room at the Western College of Veterinary Medicine. Alison obtained her B.Sc. Ag from the University of Saskatchewan, working for a short time at Agriculture Canada, and then joining the Contract Research Program at Prairie Swine Centre in 1994. Alison is an important part of the program with her careful organization and meticulous attention to details. She handles several client projects at the same time, each with different critical phases. Such level of competency amazes Sponsors as they realize they can count on Alison to deliver high quality research results while meeting their pressing deadlines. She is no stranger to multi-tasking as Alison is also the mother of 3 boys (Tom, Mathew and Adam) with a 4th to arrive in November.

Coming Events

Hog & Poultry Days

December 4 & 5, 2002

Winnipeg Convention Centre, Winnipeg, MB

For more information contact:

Murray Smith (204) 945-0500

musmith@gov.mb.ca

Alberta Pork Annual Meeting

December 4&5, 2002

Coast Plaza Hotel

Calgary, Alta.

Banff Pork Seminar

January 14 – 16, 2003

Banff, Alberta

Focus on the Future Conference 2003

March 25 & 26, 2003

Saskatoon, Sask.

Sask Pork Expo

March 3&4, 2003

Saskatoon, Sask.

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Please send your cheque or money order to:

Lee Whittington, Managing Editor
Prairie Swine Centre Inc.
P.O. Box 21057, 2105 - 8th St. E.
Saskatoon, SK S7H 5N9 Canada

Tel: (306) 667-PIGS (7447)
Fax: (306) 955-2510
www.prairieswine.ca