Environmental Issues, Practices and Initiatives
- A Canadian Perspective –

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Seoul, South Korea
April 24-27, 2012
Canadian Pork Production

• 2011 domestic hog slaughter: 22 m head.

• Canada exported 5.8 m live hogs in 2011 – all to the US – (although largely as a result of COOL, this has declined by almost 50% in the last 5 years).

• Canada exported almost 1.2 m tonnes of pork to over 140 countries, over $3.2 b in export sales.
Canadian Pork Production

NUMBER OF PIGS PRODUCED BY PROVINCE
27 Million Hogs in 2011, from 1.3 Million Sows, on 6800 farms
(% of Canada, million head)

Data source: AAFC, Statistics Canada, author's estimates April 2010

MANITOBA 32.4% 8.8
ONTARIO 22.8% 6.2
QUEBEC 26.8% 7.3
SASK. 6.6% 1.8
ALBERTA 9.9% 2.7
ATL. PROV. 0.7% 0.2
B.C. 0.7% 0.2

27 Million Hogs in 2011, from 1.3 Million Sows, on 6800 farms

Data source: AAFC, Statistics Canada, author’s estimates April 2010
Canada’s 2 main hog production areas
(68 m ha [169 m a] of ag land in Canada total)
Manitoba

Canada’s 6th largest province

650,000 km²
(250,000 sq m)

The Province of Manitoba is about the size of: Italy, the UK, South Korea & Netherlands combined.

Population 1.2 million

Lake Winnipeg
City of Winnipeg
Red River
Churchill
Hudson Bay

Manitoba Flag
Manitoba Coat of Arms
Agriculture in Manitoba

- 7.6 million ha (18.8 m acres) of agricultural land,
- 4.9 m ha (12 m a) cropped,
7.6 million ha of ag land in Manitoba
(68 m ha [169 m a] of ag land in Canada total)
Main agricultural commodities grown in Manitoba in order of importance:

2010 - 27 million hogs

Agriculture in Manitoba

19,000 farms, averaging 405 ha (1000 acres) per farm
Manitoba Hog Numbers

• In 2011, Manitoba produced 8.1 million pigs from about 314,000 sows (down from about 10 million & 370,000 in 2007).

• Manitoba exported about 3.1 million live weanlings (40% of our total number of pigs) and about 400,000 live slaughter hogs, mainly to the USA – down from 5.5 million weanlings and 1.2 million market hogs exported in ’07 (largely as a result of COOL).

• About 500 hog Producers in Manitoba on about 1,600 sites – down from about 1,200 producers in 2005.
Annual Number of Pigs Produced in Manitoba

- **Market Hogs**
  - Peak: 5.35 million in '05
  - No. of Market Hogs estimated at 4.64 million in 2011

- **Weanlings**
  - Peak: 2.95 million in '06
  - No. of weanlings estimated at 3.1 million in 2011

- **Hogs in Mb at one time**
- **Sows**
  - Peak no. of sows: 368,000 in '06
  - No. of Sows estimated at 314,000 in 2011
The Manitoba Hog Numbers

• 2011 sales of about 5 million market hogs to the 2 plants in Manitoba (Maple Leaf in Brandon and HyLlfe in Neepawa)

• Over 93% of the resulting pork is exported out of Manitoba to other provinces and to about 35 other countries.

• Manitoba is the largest pork exporter in Canada.

• Total 2011 Manitoba pork/hog revenues exceeded $1.5 billion employing about 12,000 people.
Manitoba Hog Barn Locations

LEGEND
- Municipal Boundaries
- Hog Barn Locations
  - Animal Units (Estimated)
    - Less Than 100 AUs
      No. of Locations: 1,024
    - 100 to 300 AUs
      No. of Locations: 297
    - Greater Than 300 AUs
      No. of Locations: 456
      Total No. of Locations: 1,777

Source of Data:
2006 Property Assessment Rolls

[Map showing hog barn locations across Manitoba with labels and legend for various animal units.]
Lake Winnipeg

10th largest freshwater lake in the world
Glacial Lake Agassiz

Largest freshwater lake to ever exist

Total extent that glacial Lake Agassiz reached during its lifespan
14,000-10,000 years ago
1 million km² watershed
Drains parts of 4 US States and 4 Canadian Provinces
Lake Winnipeg
Recreation
Lake Winnipeg
Commercial Fishing
and Farming
The Red River ‘Valley’ in Manitoba is FLAT
Flooding in Manitoba’s Red River Valley

At its height in the 1997 flood, the River formed a lake up to 40 km (25 miles) wide.
In southern Manitoba, the land is frozen for about 5 months of the year.

Low rainfall & very flat landscape and very little tile drainage.

Almost all runoff occurs from snowmelt in the spring.
Algae on Lake Winnipeg

Lake Winnipeg Research Consortium
Research Ship: Namao
Sources of P applied to Manitoba Cropland

Year


Tonnes of P per Year (thousands)

Synthetic Fertilizer
Beef
Swine
Dairy
Poultry

Source: Steve Sheppard, 2011
So what has been the reaction?

The provincial government has passed numerous **laws and regulations** over the last 15 years, including:

1. setting **phosphorus and nitrogen limits** on manure in parts per million and kgs/ha as it is applied to farm land.

2. limits on application of manure related to soil types.

3. farmers must file **annual Manure (or Nutrient) Management Plans** with the government based upon required **annual soil tests along with reports after the manure is applied.**
So what has been the reaction? cont’d

4. Many have also filed **Environmental Farm Plans** with the government.

5. Other existing manure application limits include **minimum setback distances from waterways and wells**.

6. There are also minimum **setback locations for hog operations from residences and communities**.
So what has been the reaction? cont’d

7. Up-coming Regs (Nov 2013) will require further changes, including a complete ban on winter (between Nov 10 & Apr 10) spreading of manure, although only about 15% of producers currently winter spread. Large producers are already prevented from winter application, so the 2013 deadline will apply only to some smaller producers.

8. A minimum of 400 days of manure storage will also be required by Nov 2013 for new operations and the phosphorous limits will apply to some exempt operations at the same time.
9. The big regulatory limit came in June of last year however: the provincial government banned all new or expansions of existing hog operations in the province unless expensive manure treatment was added (despite the fact that it has been estimated by scientists that only 1.5% of P in Lake Winnipeg can be attributed to hogs).
## Summary of Main Manure Regulations in Manitoba

### A. Winter Application of Manure
- **Winter** means between & including Nov 10 & Apr 10 of the same winter – about 150 days.
- Current Requirements:
  1. Winter application of manure is currently allowed for hog farms less than 300 AUs only if established before Apr 2004 & if they have not expanded.
  2. Winter application of manure is **not** allowed for hog farms of 300 AUs or more, nor for a hog farm of any size established or expanded to 300 AUs or more after Apr 2004.
  3. For hog farms where winter application is allowed, manure cannot be applied in the winter on any land:
     a) within 10m (33') of any property line;
     b) within 150m (500') of any surface water course, sinkhole, spring or well - if the land has a mean slope of less than 4%;
     c) within 300m (1000') of any surface water course, sinkhole, spring or well - if the land has a mean slope of between 4% & 6%;
     d) within 450m (1500') of any surface water course, sinkhole, spring or well - if the land has a mean slope of between 6% & 12%; and
     e) with a slope greater than 12%.

- Requirements after Nov 9, 2013:
  - Winter application of hog manure is **not allowed** in the province after Nov 9, 2013.\(^1\)

### B. Fall Application of Manure
- **Fall** means between Sept 10 & Nov 10 of the same year.
- Current Requirements:
  1. In regularly inundated areas including the Red River Valley Special Management Area (RRVSMA), manure applied in the fall must be injected or incorporated within 48 hours, except where a field is cropped with perennial forage or is under minimum tillage management.
  2. On lands outside of regularly inundated areas (including the RRVSMA), standard manure application rules apply to Fall application.

- Requirements after Nov 9, 2013:
  - No change in the rules

### C. Manure Phosphorus (P) Thresholds
- The following phosphorus (P) thresholds apply to all farms, except for farms in: the RM of Hanover, the RM of La Broquerie & farms that have submitted a P Compliance Plan:
- Current Requirements:
  1. Where the soil test P levels (using the Olsen Procedure) in the top 15cm (6”) of soil anywhere in the application area are:
     a) less than 60 parts per million (ppm) P – there are no restrictions on P\(_2\)O\(_5\) application;
     b) between 60 ppm & 120 ppm P – may apply up to 2x the crop removal rate of P\(_2\)O\(_5\); 
     c) between 120 ppm & 180 ppm P – may apply up to 1x the crop removal rate of P\(_2\)O\(_5\); and 
     d) over 180 ppm P – cannot apply any P\(_2\)O\(_5\) without advance approval from Manitoba Conservation & Water Stewardship (MCWWS).

- Requirements after Nov 9, 2013:
  - As of Nov 10, 2013\(^1\) the P thresholds, as stated in Section 2 (at left), will apply to all farms in the province.

### D. Multi-year (Rotational) Fertilization
- Current Requirements:
  1. If soil test levels are between 60 ppm & 180 ppm P – you may apply all of the P\(_2\)O\(_5\) that will be removed by the crops in a multi-year rotation in the first year of the rotation, provided that:
     a) no more than 5 years’ worth of P\(_2\)O\(_5\) is applied in the first year; and 
     b) no additional manure is applied during the rotation or until soil test P levels return to their pre-application levels.

- Requirements after Nov 9, 2013:
  - No change in the rules

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\(^1\) Manitoba Pork Council (2014). *Main Manure Regulations in Manitoba*. Hanover, Manitoba.
## Issue  
### E. Soil Nitrate (N) Limits

1. Manure cannot be applied to any portion of land that will result in residual nitrate nitrogen (NO₃-N) within the top 60cm (2') being more than:
   a) 157.1 kg/ha (140 lbs/a) on Agriculture Capability Class 1, 2 or 3 soils, except 3M & 3MW soils;
   b) 102 kg/ha (90 lbs/a) on Class 3M, 3MW or 4 soils; or
   c) 33.6 kg/ha (30 lbs/a) on Class 5 soils (unless the farm was established before Apr 2004, has not expanded since then & has been allowed in writing by MC&WS);
2. N within the top 60cm (2') cannot be more than 2x the above limits at any time (starting at application & including during the growing season).

### F. Manure Applicator's Licensing

1. Anyone applying and/or transporting manure commercially (for a fee) must successfully complete the Manure Applicators' Course (through Assiniboine Community College) & must obtain a Custom Manure Applicator's License from MAFRI.
2. Hog farmers that have 300 AUs or more and that apply manure to land they do not own or lease, must successfully complete the Manure Applicators' Course and must obtain an Off-Farm Manure Applicator's License from MAFRI.

### G. Manure Management Plans (MMPs) & Nutrient Management Plans

1. All hog farms of 300 AUs or more, or any hog farms that were established or expanded after Oct 31, 2009 must file an annual Manure Management Plan with MC&WS.
2. Farmers with less than 300 AUs that intend to apply manure to Zone N4 lands must submit a Nutrient Management Plan to MC&WS if they are not filing an MMP.
3. MMPs must be filed annually before:
   a) February 10, if manure is to be applied as fertilizer for spring crops; or
   b) July 10, if manure is to be applied in the Fall or Winter.
4. MMPs received after the Feb 10 and July 10 deadlines, must be accompanied by a $100 (plus tax) fee and may be filed no less than 14 days before application of manure.
5. Soil test results must be submitted to MC&WS prior to application of manure.
6. MMPs may be prepared & filed by the owner/operator or a Manure Management Planner.

### H. General Prohibitions for Manure Application

1. Manure cannot be applied or discharged into any surface water, surface watercourse or groundwater, nor can manure be applied or discharged in a manner that would cause pollution of surface water or groundwater.
2. Manure cannot leave a farm’s boundaries except when it is to be applied to farm land in accordance with other manure application and handling regulations.
3. Manure must be applied as fertilizer to any land on which a crop is growing or will be planted during the next season.
4. Manure cannot be burned without prior approval from MC&WS.
5. Without prior approval from MC&WS, manure cannot be applied:
   a) onto Zone N4 lands (unless the farm was established before Apr 2004 & has not expanded since);
   b) onto unseeded land before Aug 15 if the land is not to be seeded before the next spring; or
   c) if it will cause pollution of surface or ground water.

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**Summary of Main Manure Regulations in Manitoba**
I. Manure Application Setback Limits from Surface Water

- See also the General Prohibitions for Manure Application in Part H.
- The rules as stated in Part A.3 a) to e) on page 1, also apply to Winter application of manure near Surface Water or a Surface Watercourse.
- A wetland, bog, marsh or swamp is considered ‘Major’ if:
  - It has an area greater than 2 ha (5a).
  - It is connected to 1 or more downstream water bodies or groundwater features.
  - Contains standing water or saturated soils for periods of time sufficient to support the development of hydrophytic vegetation, or
  - It is a constructed storm water retention pond.

The rules as stated in Part A.3 a) to e) also apply to Winter application of manure near Surface Water or a Surface Watercourse.

J. Manure Storage Facilities (MSFs)

1. A permit is required by MC&WS prior to construction, modification or expansion of a MSF. An approved permit will contain conditions that must be met before or during construction - depending on the condition. A Professional Engineer must certify that the placement or construction of a MSF is in accordance with the rules in the LMMMR (including Schedule ‘A’) and guided by MC&WS’s relevant Technical Reference Documents.

2. New or significantly altered earthen MSFs must have between 400 & 500 days of storage capacity. Other types of MSFs must have between 250 & 500 days of capacity (except under-floor pits with less than 30 days of storage). Existing MSFs that do not meet these storage capacity requirements can remain at their current size - unless the MSF does not have capacity to avoid winter manure application by Nov 10, 2013, in which case their capacity must be increased.

3. Since Mar 30, 1998, no liquid MSF can be built in a 100 year flood area, unless flood protected to at least 60cm (2’) above the 100 year flood level or as approved by MC&WS – except for under-floor concrete pits with less than 30 days storage that were in operation before 2009.

4. Any earthen MSF which is not used for more than 1 year requires a De-Commissioning Plan or Maintenance Plan approved in advance by MC&WS.

5. All MSFs must be registered with MC&WS. MSFs built before registration or a permit was necessary, are still required to be registered with MC&WS.
### Summary of Main Manure Regulations in Manitoba, Cont’d.

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| 1. No MSFs shall be constructed for new hog farms or expanded for existing hog farms anywhere in Manitoba unless the manure is to be treated with a MC&WS-approved anaerobic digester or other environmentally-sound treatment system that is similar to or better than anaerobic digestion in the opinion of MC&WS. Exceptions will be considered for existing hog farms which are building a new MSF or expanding their existing MSF to avoid winter application (i.e. not expanding their number of AUs).
| 2. New or expanding hog farms of 300 AUs or more must first obtain local (municipal) approval with a Technical Review Committee (TRC) review, including a Comprehensive Site Assessment and posting on a provincial Public Registry prior to obtaining a permit from MC&WS.
| 3. A permit is required from MC&WS for any manure treatment system or for any outdoor confined area (such as hoop structures) housing 10 AUs or more.
| 4. Hog farms with 300 or more AUs must submit to MC&WS an annual water analysis report of the farm’s livestock drinking water source by Dec 31 of each year. |

| **L. Minimum Separation Distances for Siting of Hog Farms and MSFs** | |
|---|---|---|
| **Size of Hog Farm in AUs** | Separation Distance in Metres (feet) from a Single Residence | Separation Distance in Metres (feet) from Designated Areas |
| | To Earthen MSF | To Barn & Non-Earthen MSF | To Earthen MSF | To Barn & Non-Earthen MSF |
| 10-100 AUs | 200m (656’), 100m (328’), 800m (2625’) | 530m (1739’) |
| 101-200 AUs | 300m (984’), 150m (492’), 1200m (3937’) | 800m (2625’) |
| 201-300 AUs | 400m (1312’), 200m (656’), 1600m (5249’) | 1070m (3511’) |
| 301-400 AUs | 450m (1476’), 225m (738’), 1800m (5906’) | 1200m (3937’) |
| 401-800 AUs | 500m (1640’), 250m (820’), 2000m (6561’) | 1330m (4364’) |
| 801-1600 AUs | 600m (1968’), 300m (984’), 2400m (7874’) | 1600m (5249’) |
| 1601-3200 AUs | 700m (2297’), 350m (1148’), 2800m (9186’) | 1870m (6135’) |
| 3201-6400 AUs | 800m (2625’), 400m (1312’), 3200m (10499’) | 2130m (6988’) |
| 6401-12,800 AUs | 900m (2953’), 450m (1476’), 3600m (11811’) | 2400m (7874’) |
| Over 12,800 AUs | 1000m (3281’), 500m (1640’), 4000m (13123’) | 2670m (8760’) |
| **All Hog Farms** | | |
| | MSFs must be located at least 100m (330’) from any: surface watercourse, sinkhole, well or property boundary. No well or drainage ditch shall be constructed within 100m (330’) of a MSF. |

| **M. Animal Unit (AU) Calculations for Pigs** | |
|---|---|---|
| **Type of Pig** | **AUs Produced by 1 Pig** | **Number of Pigs to Produce 1 AU** |
| Sows, Farrow to Finish | 1.25 | 0.8 |
| Sows, Farrow to Weanling | 0.25 | 4 |
| Sows, Farrow to Nursery | 0.313 | 3.2 |
| Weanlings (up to 50lbs / 23kgs) | 0.033 | 30 |
| Growers / Finishers | 0.143 | 7 |
| Boars (Artificial Insemination Operations) | 0.2 | 5 |

Prepared by Manitoba Pork with information from the provincial government departments of: MC&WS, MAFRI, and Manitoba Local Government.
Some of the technology & BMPs being used in Canada includes:

**Manure storage covers**
Methane can be collected and **burned for energy** under certain circumstances. Can lower GHGs as well as odours. (About 15% are covered in Manitoba)

**Liquid Solid Separators**
Mechanical separators come in a variety of types including: Centrifuges, screen presses, rotary screens, roller presses and others.
Some of the technology and BMPs being used in Canada, cont’d…

More Liquid Solid Mechanical Separators

The main purpose is to separate the liquids from the solids so as to make transport to another location easier (less expensive). This also separates out most of the Phosphorus which remains mainly in the solid fraction. It can also enhance composting.
Gravity (Passive) Liquid Solid Separation – settling cells. Earthen ‘lagoons’ are the most common form of manure storage in Manitoba. Almost all Manitoba pig manure storage types are liquid manure systems.

Some of the technology and BMPs being used in Canada, cont’d...
Some of the technology and BMPs being used in Canada, cont’d…

Anaerobic Digestion
Methane can be collected and burned for energy. Can lower GHGs as well as odours.

About 26 Anaerobic Digesters are currently being used in Livestock Operations in Canada, 1 in Manitoba.
Other **Manure Treatment** methods

- Other methods of dealing with manure include *composting, drying* and *incineration* among others. Other methods include *ongoing improvements in genetics* and *feeding systems*.
- There are numerous *variations* within all treatment methods.
Issues with **Mechanical Liquid Solid Separation and Anaerobic Digestion**

- Very **expensive**.
- **Low electricity rates** (at least in Manitoba) make the creation of energy using AD too expensive.
- **Farms are too far apart** – makes it difficult to combine effluent from different operations.
- **Cold climate** – means everything (including all pumps and pipes) have to be heated and put in buildings.
- If there is **enough farm land** to apply manure at agronomic rates – ‘treatment’ of manure is unnecessary.
PIG DENSITIES FOR SELECTED REGIONS

NO. OF PIGS PER HECTARE (arable land and improved pasture)

Datasource: various, author’s estimates

THOUSAND HECTARES
NO. OF PIGS PER HECTARE (arable land and improved pasture)

TAIWAN
NETHERLANDS
BELGIUM/LUX.
N. CAROLINA
S. KOREA
JAPAN
QUEBEC
GERMANY
IOWA
ONTARIO
ALBERTA
SASKATCHEWAN
MANITOBA

Manitoba

Pig density (Y2)
Arable land and improved pasture (Y1)

THOUSAND HECTARES

Datasource: various, author’s estimates
In Manitoba, because we have lots of farm land, are naturally low soil P, and have to import synthetic fertilizers, so we favour:

- Manitoba hog farmers are leaders in North America in manure injection.
- Manure application rates are based upon annual soil analysis & fertilizer requirements, manure analysis, timing, method of application, weather conditions & the proposed crop.
Liquid Manure Injection

- About **80%** of injected manure is done by **professional manure applicators**. It is very high-tech & sophisticated, using in-cab computers, GPS & auto-steer tractors in order to ensure **precise** application.

- Manitoba has the **highest rate of injection/incorporation** of hog manure in Canada and perhaps in North America. It is estimated that over 85% of hog manure is injected in Manitoba (about **1.4 billion litres [350 m gallons]** annually) - which means it **cannot run off even in spring run off season**.
Liquid Hog Manure Injection Equipment using drag hoses
Manure Injection Equipment
Manure Injection Equipment
Facts about Liquid Hog Manure Injection in Manitoba

• About 3 main different types of injection used.

• Sometimes liquid manure tanks are pulled behind the tractor, but now most often, ‘drag hoses’ are used. The drag hoses pump liquid manure directly from the storage facility or sometimes from mobile tanks.

• The drag hoses are flexible and range from 15cm-20cm (6”-8”) in diameter. They can be up to 5 km (3 miles) long, and with appropriate booster pumps can pump up to 8800 litres (2200 gallons) per minute.

• Row spacing between injection holes or furrows range from 15cm-35cm (6-14”)

• Spread bars range from 3m-20m (10’-64’) in width with most being in the 30-35’ range.

• Most tractors use GPS and auto steer and computerized flow with onboard mapping.

• After manure has been injected, another pass is often made over the field with a cultivator to turn over the soil & further incorporate the manure into the soil.
I am part of the solution.

It is my job to ensure that nutrient run-off does not enter our streams and lakes.

We are invested in the future of our environment, and we constantly strive to reduce our environmental footprint.

We use GPS and GIS technologies to pinpoint the exact location and amount of organic fertilizer applied to fields to provide for ideal soil nutrient levels.

This is my job. I am part of the solution.

Sheldon Stott
Director of Environmental Affairs
HyLife
- a Manitoba pork producer

Watch Sheldon’s video at manitoba-pork.com
Thank You!
Is that bacon I smell??