Feedlots and Water Quality – What are the Issues?

2011 SBIC Beef & Forage Symposium
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# Saskatchewan Feedlot Capacity

<table>
<thead>
<tr>
<th>One-time Capacity (head)</th>
<th>Number of Feedlots</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over 20,000</td>
<td>1</td>
</tr>
<tr>
<td>10,000 to 20,000</td>
<td>6</td>
</tr>
<tr>
<td>5,000 to 10,000</td>
<td>6</td>
</tr>
<tr>
<td>2,500 to 5,000</td>
<td>22</td>
</tr>
<tr>
<td>1,000 to 2,500</td>
<td>38</td>
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</tbody>
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Recent Developments in the Saskatchewan Feedlot Sector

• 2000-2003
  – Hazenmore (10,000+)
  – Rhein (8,500)
  – Grenfell (5,000)
  – Melfort (4,000 head expansion – 7500 head capacity)
  – Bethune (3,500)
  – Eston (2,500 hd. expansion – 5,000 head Capacity)
Recent Developments in the Saskatchewan Feedlot Sector

- **2008**
  - Construction of two 10,000 head feedlots-Porcupine Plain and Rockglen

- **2007**
  - Expansions (5,000 head each) at Ceylon and Hazenmore

- **2006**
  - Expansions (~5,000 head) Moosomin and Grenfell

- **2004**
  - Construction 7,500 head feedlot Ceylon
Recent Developments in the Saskatchewan Feedlot Sector

- 2010
  - Proposal to construct a feedlot in the irrigation district of RM of Rudy with potential capacity of 36,000 head
Wake-Up to Feedlot Danger!
Saskatoon Star Phoenix
September 2010
What is being said?

- Harm surface water quality
- Excessive nutrient loading of rivers and streams
- Destroy drinking water quality for urban and rural centers
- Start of feedlot alley
- Poison water supply with
  - toxins
  - blue green alga
  - bacteria
  - protozoa
  - chemicals
REPORT OF THE WALKERTON INQUIRY

PART TWO

A Strategy for Safe Drinking Water

The Honourable Dennis K. Gruending
What are the Issues?
What Are the Issues?

- Microbial Pathogens
- Chemical Residues
- Antibiotic Use/Resistance
- Nutrient Run-off
  - N and P contamination of surface waters
Fact 1: Cattle Produce Manure and Lots of it!

- ASAE (2005) estimated urine and fecal production for finishing cattle 65 pounds a day
- Saskatchewan Agriculture – uses the figure of 57 pounds a day
- Colorado State U– 1000 pound steer produces between 50 and 60 pounds per day
- UofS metabolic trials 1200 to 1300 lb heifers – 35 to 50 pounds per day

(Manure and urine wet basis)
Fact 2: Manure can contain some nasty things!
Microbial Pathogens

• Protozoa
  – Cryptosporidium
  – Giardia

(Source http://www.marvistavet.com/html/cryptosporidium.htm)
Cryptosporidium Diversity
(16+ species – Variety of Hosts)

• Cattle are a host for
  ➢ C. parvum (young calves)
  ➢ C. andersoni (older animals)
  ➢ C. bovis & C. ryanae

• Humans are host for
  ➢ C. hominis
  ➢ C. meleagridis
How do People Develop *Cryptosporidium* infections?

1. Direct transmission (host to host)

2. Indirect (ingestion of contaminated food or water)
How do People Develop *Cryptosporidium* infections?

1. Major route of human infections is person to person (human sewage) - *C. hominis*

2. Causative agent for infections in North Battleford (7000 + infected) and Milwaukee (400,000 + infected)
How do People Develop Cryptosporidium infections?

1. Second way people can develop cryptosporidiosis is animal to human transmission
   - C. parvum

2. Cattle/sheep are often cited as the hosts responsible for zoonotic transmission
Other Pathogens of Concern

• *E. coli* 0157:H7
  – Serious issue for the industry
  – Cattle can be major shedders of this organism
  – *E. coli* 0157:H7 has been linked to food borne illness in people
  – The Walkerton Water Tragedy was directly related to *E coli* 0157: H7 contamination of the town’s water supply
  – Cattle were the source of infection
Chemicals of Concern

• Steroid Hormones
  – Natural (estrogen & testosterone)
  – Synthetic (estrogen, zeranol, trenbolone)

  – Steroids are used by animal for metabolic purposes, metabolized and excreted primarily in urine
  – Excreted metabolites are generally less potent than original steroid
**Endocrine Disrupting Chemicals**

Endocrine-Disrupting Effects of Cattle Feedlot Effluent on an Aquatic Sentinel Species, the Fathead Minnow

Orlando et al. 2004

Enviro Health Perspectives
Environmental Fate of Excreted Hormonal Metabolites?

• Published research of Angela Lorenzen (AAFC) and co-workers (2005 & 2006) focused:
  – fate of estrogen and estrogen metabolites in swine
  – persistence and pathways of testosterone dissipation in soil (varied moisture, organic matter content, temperature and bacterial loads)

• Showed hormonal metabolites are rapidly degraded in soil by aerobic microbes
“We conclude that testosterone is rapidly and thoroughly biodegraded in agriculture soils under a range of conditions typical of a temperate growing season and thus is unlikely to pose a long-term risk to adjacent aquatic environments”

Lorenzen et al. (2005) J. Envir. Quality
How do we ensure that feedlots are part of the solution and not the problem?
Regulatory Oversight

Saskatchewan Ministry of Agriculture
Regulatory Oversight

• Government of Saskatchewan
  • Ministry of Agriculture
  • Ministry of Environment
  • Saskatchewan Watershed Authority
  • Other affected agencies

• Rural Municipality Approval Process
Regulatory Oversight

• Intent is to ensure feedlots are:
  • Sited properly
  • Designed properly
  • Operated properly

• Two overriding principles:
  • Ground Water protection
  • Surface Water protection
Regulatory Oversight

• Approval process requires a site investigation (professional engineering firm)

• Determine any environmental sensitivities with site / assess the risk of contamination
  • Topography / drainage patterns
  • Drilling of bore holes → assess underlying geology including aquifer(s) location
  • Soil sampling / physical & chemical properties
  • Vertical and horizontal hydraulic gradients

• Geologically secure, variable or sensitive site
Surface Water Protection

• Function of both regulatory oversight as well as due diligence of the operator

• Well drained pens are essential for optimal animal performance and welfare

• Building in Saskatchewan or Alberta you need to contain potential surface run-off in the event of an abnormal precipitation event

• This entails designing holding ponds of a sufficient size that will collect normal as well as abnormal run-off from the facility
Surface Water Protection

• Nutrient Management Plan - function of both regulatory oversight as well as due diligence of the operator

  • Sufficient land area to receive manure produced

  • Saskatchewan – based on crop nitrogen requirements
Surface Water Protection

• Success of this plan depends on due diligence of the operator
  • Adherence to proper spreading guidelines
  • Surface application vs. incorporation
  • Composting vs. applying fresh
  • Monitoring soil nutrient accumulation – Phosphorus
Summary and Conclusions

• Feedlots can co-exist with environment

• Realistic assessment of the risks

• Site selection, facility design and operation are critical to ensure groundwater and surface water protection