Welcome to Manure Du Jour – Season II

Serving Pennsylvania’s Best Practices for Animal Ag-, Air- and Water Quality Protection

Cryptosporidium, Cattle & Drinking Water

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Manure Du Jour

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Potomac River Basin Drinking Water Source Protection Partnership

July 22, 2010
Define “Source Water”: 

A. Headwaters of a stream 
B. Streams and rivers upstream of a drinking water intake 
C. Areas contributing ground water to water supply wells 
D. All of the above
Presentation Goals

- Share concerns about *Cryptosporidium* and its impact on drinking water and public health

- Share information about the Potomac River Basin Drinking Water Source Protection Partnership

- Ask opinions on this issue and seek guidance from the agriculture community
A Shared Vision:

- Collaboration of water utilities and governmental agencies
- Efforts to safeguard public health and the environment
- Assess current and potential water quality issues in the Potomac River basin’s drinking water sources
- Began after the completion of the Washington D.C. metropolitan area source water assessments
  - Federally mandated vulnerability assessments of drinking water sources
Potomac River Basin

- Potomac River is drinking water source for nearly 5 million residents

- 14,670 sq mi
  - Maryland
  - Pennsylvania
  - Virginia
  - West Virginia
  - District of Columbia
DWSPP Priority Areas

- Contamination from accidental spills of hazardous materials or intentional acts
- Disinfection Byproducts
- Emerging Contaminants
  - Endocrine disrupting chemicals
  - Pharmaceuticals
  - Personal care products
- Pathogens
  - Cryptosporidium
Poll #1

Which animals can carry Cryptosporidium?

A. Guinea Pigs
B. Snakes
C. Cattle
D. Humans
E. All of the above
**Cryptosporidium**  
(krip-toe-spor-id-ee-um)

Protozoan parasite associated with large outbreaks of human illness (referred to as cryptosporidiosis)
Cryptosporidium

- Can be transmitted to humans by cattle
  - *C. parvum* is human-infectious species found in cattle

- Can survive in the environment for long periods of time in a hardy cyst form (oocysts)
  - People can be infected by just a few oocysts
  - Rapid life cycle - can reproduce in intestinal wall within several hours
Public Health Concerns

- *Cryptosporidium* oocysts are resistant to conventional water disinfection practices.
  - Healthy humans can experience gastrointestinal issues lasting from 2 days to 2 weeks
  - Infection can be fatal for individuals with weakened immune systems
Significant Human Health Concerns

**DRINKING WATER OUTBREAKS:**

- Carrollton, GA (1987): 13,000 people sick
- Milwaukee, WI (1993): 100 deaths, 403,000 sick
- Las Vegas, NV (1994): 19 deaths, 110 sick
Why Conduct a Source Tracking Project?

- Limited existing data on occurrence, sources, and species
- Existing Crypto data did not indicate sources or identify species and human infectivity
- The project would identify most significant hosts/sources contributing to *Cryptosporidium* loads:
  - at WTP intakes, in priority sub-watersheds, and by land-use
- The project would assess level of risk from Crypto (i.e., human-infectious or not)
- The results of the project would be used to assess and focus source protection efforts on significant sources
Study Sample Location Characteristics

<table>
<thead>
<tr>
<th>Land use and contamination source</th>
<th>Monocacy River</th>
<th>North Fork Shenandoah River</th>
<th>Great Seneca Creek</th>
<th>Corbalis WTP &amp; Potomac WFP*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total area (acres)</td>
<td>447,397</td>
<td>415,791</td>
<td>6,218</td>
<td>7,286,006</td>
</tr>
<tr>
<td>Residential</td>
<td>2.1%</td>
<td>2.0%</td>
<td>24.5%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Commercial/industrial</td>
<td>0%</td>
<td>0.1%</td>
<td>3.9</td>
<td>1.5%</td>
</tr>
<tr>
<td>Agricultural-pasture/hay</td>
<td>43.4%</td>
<td>30.4%</td>
<td>2.8%</td>
<td>23.9%</td>
</tr>
<tr>
<td>Agricultural-crop</td>
<td>20.8%</td>
<td>2.8%</td>
<td>18.1%</td>
<td>10.6%</td>
</tr>
<tr>
<td>Park/grass</td>
<td>3.5%</td>
<td>4.3%</td>
<td>1.9%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Forest/woods</td>
<td>26.6%</td>
<td>60.1%</td>
<td>46.8%</td>
<td>60.3%</td>
</tr>
<tr>
<td>Water/wetland</td>
<td>2.5%</td>
<td>0.3%</td>
<td>0.2%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Other</td>
<td>1.0%</td>
<td>0.1%</td>
<td>1 (0%)</td>
<td>0.5%</td>
</tr>
<tr>
<td>Potential contamination source</td>
<td>Agricultural and wastewater discharge</td>
<td>Agricultural discharge</td>
<td>Wastewater discharge</td>
<td>Agricultural and wastewater discharge</td>
</tr>
</tbody>
</table>

*Corbalis WTP & Potomac WFP*
Crypto Prevalence in the Potomac Basin

- At base flow, the two watershed sites under influence of cattle farms (North Fork Shenandoah River and Monocacy River) had much higher occurrence of *Cryptosporidium* oocysts than the site under influence of urban wastewater (Great Seneca Creek).

- At storm flow, the Great Seneca Creek site also had lower contamination intensity than the other two watershed sites.

- The prevalence and contamination intensity of *Cryptosporidium* at the two treatment plant intake sites (downstream of watershed sites) were similar to those at the North Fork Shenandoah River and Monocacy River sites.
Contamination Sources

- *C. andersoni*, a species pathogenic to cows, was common at all four sites influenced by agriculture and largely absent at the urban wastewater site.

- Wildlife genotypes were occasionally found at other sites, especially the Potomac WFP site.

- Species pathogenic to humans (*C. hominis* and *C. parvum*) were not found in water samples.

- The genotyping results suggest that many of the Crypto oocysts in the water treatment plant source waters were from older calves and adult cattle.
Contamination Potential

Given that *C. andersoni* and *C. parvum* both originate from cattle, there is the potential for *C. parvum* in local drinking water sources.

C. parvum Remains a Concern
Poll #2

Infected cattle can shed up to ___________ Cryptosporidium oocysts per gram of feces?

A. 10  
B. 100  
C. 1 million  
D. 10 billion
Infected manure enters water, who is vulnerable?
C. parvum on the Farm

- Major concern for herd health
- Very common in young calves
  - Especially in pre-weaned calves younger than 2 months of age, since they are still developing their immune systems and therefore are more susceptible to disease.
- Calves as young as 2 to 7 days old have been shown to shed Crypto
Farmers can protect their own livestock, their neighbor’s livestock and the drinking water of many people downstream

**By reducing pathogens:**

- In the herd
- During manure collection and storage
- During land application of manure
- Exposed to water bodies
The best method of control is to limit the fecal-oral route of transmission of oocysts between young animals.
A combination of Best Management Practices (BMPs) will also help to improve the health of livestock and prevent Crypto and other contaminants from leaving the farm and making their way into the environment.
Similar BMPs already promoted on farms will help improve the health of the livestock and protect receiving waters.

INCLUDING:

- Nutrient management plans
- Manure storage facilities
- Buffers or vegetative strips
- Calf hutches
- Stream bank fences
A la Carte Implementation

- Maximize flexibility
  - Allow for differences in natural conditions and operational logistics across farms

- Offer a “menu of options” based on:
  - Time
  - Distance
  - Temperature
  - Run-off
Poll #3

Manure, which is potentially contaminated with *Cryptosporidium*, should be distributed on fields during __________ weather and after _____ weeks of storage to reduce possible waterborne transmission following heavy runoffs?

A. warmer, 2  
B. warmer, 12  
C. colder, 2  
D. colder, 12
Human Health Benefits

Reduce risk to:

- Illnesses & death
- Productivity & wages
- Medical expenses
Herd Health Benefits

- Reduce death loss
  - Cryptosporidiosis can combine with other diseases to increase illness and death

- Reduce diarrhea and weight loss

- Increase milk intake amongst calves

- Improve profitability
  - Savings in labor and time treating affected calves

- Improve the recovery rate of affected calves
Why Are We Here Today?

We are looking for:

- **Guidance:** How can we best spread our message to the farming community?

- **Partnerships:** How can we build our message into existing resources that farmers know and trust? What resources can we leverage to foster greater implementation of BMPs?
Poll

How would you rank farmers’ awareness of the drinking water human health impacts of Crypto?

1. Very aware
2. Moderately aware
3. Aware
4. Moderately unaware
5. Very unaware
The HUMAN health information will ______ influence farmers’ decisions to implement BMPs.

- greatly
- moderately
- minimally
- not
Poll

The HERD health information will _______ influence farmers’ decisions to implement BMPs.

- greatly
- moderately
- minimally
- not
Poll

Will you use this information when promoting BMP implementation amongst the farmers you work with?

1. Not likely
2. 50/50
3. Very likely
4. Not sure
Poll

Who are farmers most likely to trust on this issue? (Rank top 2 choices)

1. Peer farmers
2. TSPs (i.e. Vets, NRCS, SCD, Extension, etc)
3. Academics
4. Regulators
5. Water suppliers
Poll

What is the best way to communicate the Crypto message to farmers?

1. In-person meetings with trusted sources
2. Hard copy of educational materials
3. Electronic copy of educational materials
4. Newspaper articles
5. Other ___________________
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Thank you for listening and sharing
Question and Answers

• Recording of this session can be viewed at: www.aec.cas.psu.edu

Speaker: **Plato P.T. Chen**, PE
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Resources

Speaker: **Daphne Pee**
Regional Liaison, Mid-Atlantic Water Program (MAWP)

www.potomacdwspp.org
http://extension.psu.edu/water/drinking-water
Next on Manure du jour

• Wed, Aug 25, 1:30 PM  – **Assessing BMPs in Spring Creek Watershed** - A Conservation Effects Assessment Project (CEAP)
  
  – Rob Brooks, Professor of Landscape Ecology and Director of Penn State’s Riparia (formerly Cooperative Wetlands Center)