Monensin Addition to Swine Manure Deep Pits for Foaming Control

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Foaming on the manure surface in deep-pit barns is not a new phenomenon, but until recently, spontaneous foaming was rare. Foaming incidence has increased significantly since 2008 and concerns over the potential hazards posed by foam have risen accordingly.

Typically, in deep-pit swine finishing barns with histories of developing foam, several inches of foam build up and cover the surface, although foam depths of 5 ft or more have been observed. Foam traps and holds biogases emitted during anaerobic decomposition of stored manure. Disrupting the manure or foam surface releases bursts of biogas with methane concentrations of 50-70% by volume. When mixed with ambient air, the resulting concentration can be in the explosive range (5-20%). This increases the potential for an explosion or flash fire (flammable gas levels) when a heater, motor, or light switch is activated or when a worker begins spark-inducing maintenance tasks (e.g., grinding or welding).

Foaming incidents seem to be primarily confined to Minnesota, Illinois, and Iowa, with only sporadic cases outside the upper Midwest. Foaming manure has been implicated as the underlying cause of several barn explosions (flash fires) in Minnesota, Iowa, and Illinois.

Recent explosions or flash fires associated with foaming manure have caused extensive building damage. Pigs were severely burned and most had to be immediately sent to market or euthanized. No human deaths have been associated with the fires, but workers have been injured after being propelled by a blast or exposed to intense heat. Two workers were hospitalized with second- and third-degree burns.

Monensin mode of action

Monensin is fed to beef, dairy, and poultry to improve feed efficiency, weight gain, and reproductive performance, and to prevent coccidiosis and bloat.

Monensin is a naturally derived product that alters composition of the microbial population in the rumen. In general, it increases production of propionic acid, thus decreasing the amount of acetic acid, a precursor for methane. Put simply, this means more energy is made available to the animal and less energy is lost in methane gas emissions. Monensin helps reduce bloating in cattle by reducing foam in the rumen.
Field research

Research funded by the Minnesota Pork Board and Minnesota Agricultural Experiment Station was conducted in late 2011 at sites with typical grow-finish buildings (1000-1100 head, single- or double-wide, 8-ft-deep pits). Sites were chosen with groups of four barns to ensure similar management style, genetics, diet, and building age at each test site. Within each site, the four barns were randomly assigned to dosing treatments of 0 (control), 2.5, 5.0, and 10.0 lb of Rumensin® 90 (monensin) per 100,000 gallons of manure.

Table 1 contains the foam depth (inches) at the time Rumensin® 90 was added to the pits, along with foam depths three and six weeks later for the four application rates. Each column is a single pit within a site. By six weeks after application, foam levels were reduced significantly in a majority of rooms at all treatment levels.

Adding poloxalene (Bloat Guard®) to pits at other sites did not successfully reduce foaming.

Suggested preventive measures

Based on the results described above, the following recommendations have been developed to help reduce pit foaming incidence. During fall pumping of a deep pit with a history of foaming, and after the pit is emptied but while the agitation system is still in place, add 1-2 lb of Rumensin® 90. Preliminary indications suggest that preventive measure will last six to nine months.

Be sure to monitor the manure surface regularly (weekly is adequate) to determine whether foam is present. If present, measure foam depth to determine whether additional action is needed. If foam depth is approaching 6 inches, adding Rumensin® 90 is recommended.

Table 1. Foam depth in swine manure deep-pits at four monensin application rates and three time intervals.

<table>
<thead>
<tr>
<th>Application Rate, lb / 100,000 gal</th>
<th>Site 1</th>
<th>Site 2</th>
<th>Site 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-application</td>
<td>Foam depth, inches</td>
<td>Foam depth, inches</td>
<td>Foam depth, inches</td>
</tr>
<tr>
<td>0</td>
<td>20</td>
<td>21</td>
<td>11</td>
</tr>
<tr>
<td>2.5</td>
<td>20</td>
<td>18</td>
<td>14</td>
</tr>
<tr>
<td>5</td>
<td>20</td>
<td>21</td>
<td>14</td>
</tr>
<tr>
<td>10</td>
<td>20</td>
<td>18</td>
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</tr>
<tr>
<td>3 wk post application</td>
<td>10</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>6 wk post application</td>
<td>0</td>
<td>13</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>12</td>
<td>0</td>
</tr>
</tbody>
</table>
Recommendations for actively foaming pits

As of August 2012, based on our findings, we are recommending that producers who have pits at risk for foaming add Rumensin® 90 at a rate of 5 lb per 100,000 gallons of stored manure. A lower rate may help reduce foaming, especially if additional Rumensin® can be added at a later date or more time can be allowed before assessing results. Foam reduction may take as much as two weeks following treatment. While this is our current advice, more work is needed to determine the best dosing rate, timing or season of application, and duration of effects (several months are expected). Take care not to overdose the pit, which results in a “dead” pit with no biological activity.

The following are preferred methods for using Rumensin® to control manure foaming (most preferred method is listed first):

1. In an all-in/all-out system after the pigs are marketed, sprinkle Rumensin® 90 evenly throughout the empty room or building. As the empty building is power-washed, the additive will be worked through the slats, falling onto the manure surface.

2. If the room is occupied, carefully drop Rumensin® 90 through the slat openings. The more evenly the product can be applied around the room, the faster and better it will work. This can be accomplished by using a small PVC pipe and funnel (or using a small cup or tablespoon). This method works well under watering cups/bowls or nipple waterers, helping the product move into the pit. If Rumensin® 90 is only added through the slat openings in the alley, follow the addition with five gallons of water to help disperse the granules.

3. Add Rumensin® 90 through manure pump-out ports. This method requires time for the product to diffuse throughout the manure pit, which may delay or not accomplish the intended goal. Agitation may help work the product into manure, but be sure to avoid releasing gases (methane and hydrogen sulfide) and know that agitation may make foaming worse in the short term.

Using a sprayer is not recommended because Rumensin® 90 is not water-soluble, thus difficult to remain in solution and may plug sprayer nozzles.

Coban®

Coban® 90 is another branded monensin product that is used in the poultry industry. It contains the same level of monensin as Rumensin® 90. If Coban® 45 is used, double the product dosage to 10 lb per 100,000 gallons of manure. If Coban® 60 is used, then increase dosage by 50% to 7.5 lb per 100,000 gallons of manure.
Safety

Avoid human or pig exposure to Rumensin® 90 or Coban®. Both cause burning eyes, skin reactions, and lung irritations if inhaled or ingested. Also note that monensin can be lethal to pigs if ingested.

Environmental consideration

The Material Safety Data Sheets for Rumensin® 90 Premix and Coban® Premix indicate that monensin is toxic to fish at a LC50 (lethal concentration for 50% of the population) 9.0 and 16.6 mg/L (milligrams per liter) for rainbow trout and Bluegill sunfish, respectively; but has a half-life of 7.5 days in soil. Using the application rate recommended in this UM Extension fact sheet and acceptable nutrient applications rates to cropland, any runoff should yield monensin concentrations in receiving waters less than 1% of the level (listed above) determined to be detrimental to fish. A comprehensive research program has not been conducted on the environmental effects of monensin in manure.

Note that neither Rumensin® 90 nor Coban® is environmentally approved to be added to manure in a pit if the nutrients will be applied to land. The Minnesota Pollution Control Agency (MPCA) has not made an official statement about use of Rumensin® 90 or Coban® for suppression of foam in manure pits.

Rumensin® 90 and Coban® Premix are not registered as pesticides with the U.S. EPA or Minnesota Department of Agriculture (MDA) and the product manufacturer makes no claims that these products control pests, so they do not fall under MDA jurisdiction. Consequently, no pesticide license or certification is required to use Rumensin® 90 or Coban® Premix.

Based on preliminary research regarding addition of monensin to deep swine pits to reduce foaming, the authors [researchers] estimate that as long as manure is handled and applied to land according to current regulations, monensin contained in manure that has been pumped from deep pits should not be an environmental hazard. To further reduce the risk of monensin running off the land, manure injection or immediate incorporation is recommended. If pits must be pumped in early spring, wait until soil has thawed to ensure manure is not applied to frozen ground. Monensin has been used in dairy and beef diets for more than 40 years, without any known environmental hazards or concerns due to monensin concentrations in manure.