

# AMPAT Air Management Practices Assessment Tool

## Animal Housing—Dietary Manipulation Overview

**Application:** used for building ventilation air and manure storage emission

### Pros

- Easily implemented when done in consultation with a nutritionist.
- Many options impact multiple emissions.
- Changes may cost very little.

### Cons

- Additive and feedstuff availability and costs may fluctuate.
- Nutritional needs change as the pig grows and may lead to more complex feed choices.

### Description

When considering the reduction of emissions from animal housing and manure storage, the feeding, watering, and resulting manure are the sources of those emissions. Perhaps it seems like an oversimplification, but if one can reduce the nutrients in manure, then the resulting emissions should be reduced. The efforts that have been studied have been broken into two main areas, nutrient input reduction and nutrient form modification. Nutrient input reduction provides inputs that are closely suited to the needs of the animal at the time they are needed, thereby reducing overfeeding of certain nutrients which, in turn, reduces the amount of excreted nutrients. Nutrient form modification changes the chemical form of the nutrients being excreted so they are not as easily volatilized.

Several feed management and diet formulation practices have been shown to be helpful in lowering excreted nutrients. Practices which improve feed efficiency by 0.1 will generally decrease nutrient excretion by 3.3 percent. A few techniques shown to have impact are discussed below.

#### Phase and Split-Sex Feeding

These practices recognize that animals of different sizes or sexes have different nutritional needs and diets are tailored as to not provide excessive nutrients. Gilts, for example, require higher protein levels than do barrows. Studies have shown that by using three phases rather than a single phase results in a 17 percent reduction in ammonia emission and using phase feeding throughout the life cycle can reduce ammonia emission by 45 percent and odors by 55 percent.

Figure 1. Avoid providing excess nutrients.  
(Courtesy of National Pork Board)

#### Lowering Crude Protein

Traditionally corn/soybean diets were formulated to meet all the amino acid requirements resulting in protein being provided at a level higher than required. Crude protein can generally be reduced by 3.5 to 4.5 percent and the amino acids supplied using supplemental amino acids without impacting pig performance. This resulted in reductions of ammonia emission of 40 to 60 percent, hydrogen sulfide emission of 30 to 40 percent and odors of 30 to 40 percent. Sutton (2008) provides guidance on how different protein sources impact odor.

#### Adding Fermentable Carbohydrates

Adding soybean hulls, wheat bran or midds, or sugar beet pulp to diets reduces nitrogen excretion in urine as urea which shifts more nitrogen to feces and lowers the pH. This makes the excreted nitrogen more stable and less likely to volatilize. Soybean hulls have been added to diets at a rate of 10 percent with 3.4 percent fat and found to reduce ammonia emissions by 20 percent, hydrogen sulfide by 32 percent and odor by 11 percent. Additionally, nitrogen in the manure was increased by 21 percent.



### Grind Particle Size

Particle size of 650 to 750 microns provides more surface area than larger particles and help to make feed nutrients more available, which reduces excreted nutrients. When particle size is reduced from 1000 to 600 microns the nitrogen excreted is reduced by 20 to 24 percent. Particles that are too small may cause ulcers in pigs.

### Feed Wastage

Feed that is wasted and ends up in the manure storage can influence the emission rates. Spilled feed can enhance bacterial activity, causing additional odors and emissions. Proper adjustment and maintenance of feeders is essential.

### Dust Suppression

Adding one percent or more of fat to the diet will reduce the dust from the feeding system. Pelleting feed and liquid feeding are also techniques which may have advantages. European studies show liquid feeding to reduce odors by 23 to 31 percent.

### Sulfur Content in Water

Water sources high in sulfur should be considered in formulating diets since excess sulfur will be excreted and eventually contribute to hydrogen sulfide emission.

The formulating of appropriate rations for strong animal health and productivity is a complex issue and should be developed in consultation with your nutritionist. This summary was meant as an overview and more detail can be obtained from Sutton (2008), Carter et al (2012) and Applegate et al (2008).

### Effectiveness

Component	Effectiveness	Notes
NH3	30 to 50%	Varies with technique selected.
H2S	30 to 50%	
Odor	20 to 40%	
Particulate Matter	50 to 80%	
Volatile Organic Compounds (VOC)	—	
Cost	\$	

### Cost Considerations

Cost depends on the technique selected. Some techniques, such as phase and split feeding, may have facility adaption costs but may reduce actual feed cost. Potential exists for improved feed



Figure 2. Reduced particle size reduces the amount of nitrogen excreted. (Courtesy of National Pork Board)

efficiency and reduced feed wastage which may result in lower cost of production. Additive and feedstuff availability and cost may change frequently and may require flexibility.

### More Information

#### eXtension

- Diet and Feed Management to Mitigate Airborne Emissions. <http://www.extension.org/sites/default/files/Dietand%20Feed%20FINAL.pdf>
- Diet Modification to Reduce Odors, Gas Emissions and Nutrient Excretions from Swine Operations. [http://www.extension.org/pages/24031/diet-modification-to-reduce-odors-gas-emissions-and-nutrient-excretions-from-swine-operations#.U0Fvy\\_ldWSo](http://www.extension.org/pages/24031/diet-modification-to-reduce-odors-gas-emissions-and-nutrient-excretions-from-swine-operations#.U0Fvy_ldWSo)

#### Purdue University

- Diet and Feed Management Practices Affect Air Quality from Poultry and Swine Operations. <https://www.extension.purdue.edu/extmedia/as/as-582-w.pdf>

#### National Pork Board

- Feed Management Practices to Minimize Odors from Swine Operations. [http://www.pork.org/filelibrary/Fact-sheets/Environment/Feed\\_Mgmt\\_5.pdf](http://www.pork.org/filelibrary/Fact-sheets/Environment/Feed_Mgmt_5.pdf)

### References

- Applegate, T.J., B. Richert, A. Sutton, W. Powers, R. Angel. 2008. Diet and Feed Management Practices Affect Air Quality From Poultry and Swine Operations. Purdue Extension AS-582-W. Purdue University, W. Lafayette, IN. pp. 7
- Carter, S., A. Sutton, and R. Stenglein. 2012. Diet and Feed Management to Mitigate Airborne Emissions. eXtension Air Quality Education in Agriculture. pp. 10.
- Sutton, A. 2008. Feed Management Practices to Minimize Odors from Swine Operations.

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