

***Standard Operating Procedure:  
Plan for Ammonia Reduction?  
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Ammonia used to be considered only as a nuisance odor emitted by dairies and other livestock operations. Now, ammonia is known to react with atmospheric nitric and sulfuric acids to form fine particulate matter (known as PM<sub>2.5</sub>), which is a major contributor to smog production. This fine particulate matter is of concern because it has numerous important human health effects. It can penetrate deep into the lung tissue, contributing to asthma, bronchitis, and other lung diseases, and has also been linked to heart attacks and strokes. In addition, when ammonia is converted to PM<sub>2.5</sub> it becomes more mobile and can travel longer distances to affect populations and/or be re-deposited to the ground through rainfall or dry deposition. Nitrogen deposition in Rocky Mountain National Park has resulted in increased soil and water N levels, which can cause changes in plant species and eutrophication. So ammonia is not just a nuisance anymore; it can have serious human health and mountain ecosystem impacts,

Regulations concerning ammonia emissions are likely to be developed in the future.. There are practices that you can use to be pro-active and reduce ammonia emissions now, and more are in development. If you use a combination of BMPs, dairies can reduce ammonia emissions by 65-70% (Powell, 2006).

Best management practices (BMPs) can be utilized to reduce ammonia emissions. Since the production facility, manure storage and treatment areas, and sites where manure is applied to land are all major sources of ammonia emissions, ammonia BMPs should be chosen in each of the areas of nutrition, production site management, manure storage and treatment, and land application of manure.

Nutrition BMPs focus on precision feeding, the practice of providing the animals what they need and no more. Overfeeding protein has been shown to increase ammonia emissions from both monogastrics and ruminants, so take care to avoid this practice. Analyzing feeds regularly is a useful BMP for precision feeding since feed contents are quite variable. Phase feeding is a commonly used practice for meeting livestock nutrient needs without exceeding them. By dividing the herd by growth stage and productivity, more precise diets can be fed that meet animal needs while minimizing ammonia losses to the air. These practices can also save you money! Experiments in Switzerland (Kulling et al., 2001) found dramatic reductions (up to 76%) in ammonia emissions from laboratory simulations of manure storage from dairy cows fed reduced protein in the diet. The milk production of 68 lbs/d was maintained in the low protein diets by supplementation of a commercially available 'bypass methionine'. A recent study by Misselbrook et al. (2005a) showed that reducing crude protein in dairy diets reduced ammonia emissions when manure was applied to land. Lower crude protein diets reduced urinary urea-N levels thus leading to less ammonia loss from land application.

Therefore, nutritional changes continue to reduce ammonia emissions during manure storage and land application.

In pens, dust control BMPs will help to reduce ammonia loss by decreasing the airborne PM<sub>2.5</sub> potential. Frequent manure harvesting combined with pen moisture management can be very effective in minimizing dust. Watering the pens, especially those areas with low activity and low moisture, is an effective BMP. Another recent study compared ammonia losses from dairies using different bedding types (Misselbrook and Powell, 2005). Sand bedding reduced ammonia loss by over 50% as compared to chopped corn stalks and composted manure, and chopped straw and pine shavings had intermediate ammonia losses.

BMPs for manure storage and treatment can also be helpful to reduce ammonia loss to the air. Reducing storage time reduces N loss to the atmosphere by reducing the reaction time. Covering manure stockpiles and lagoons, and keeping stockpiles dry also reduce N emissions. Aerobic lagoons and anaerobic digesters are also known to conserve nitrogen. The crust that sometimes forms naturally on dairy lagoons was recently measured to reduce ammonia emissions by up to 50% (Misselbrook et al., 2005b). Bedding type continues to have an impact if solid manures are composted; wood chip bedding results in much lower nitrogen loss to the air than straw bedding during the composting process (Hao et al., 2004).

When manure is applied to land, BMPs continue to play an important role in reducing ammonia emissions. Incorporation of manure immediately after application is critical to retaining nitrogen in the soil. Slurries should be injected and drop nozzles could be used for sprinkler irrigation to reduce “air time” and minimize ammonia losses.

I don't mean to alarm you with yet another concern, but ammonia emissions regulation is likely. Decisions made now could ease your compliance later. We'll keep you up-to-date so you can choose BMPs that are appropriate for your operation.

### References

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