# Using Klasp™ to Reduce Poultry Housing Ammonia Emissions

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**Species:** Poultry (Broiler, Chicken, and Turkey)
**Use Area:** Animal Housing
**Technology Category:** Chemical Amendment
**Air Mitigated Pollutants:** Ammonia

## Description:

Poultry producers traditionally use ventilation and acid-based litter amendments to lower pH, bind litter nitrogen, sequester phosphorus, and dry the litter cake. With respect to ventilation, energy costs increase as ambient temperature decreases. While acid-based litter amendments can be effective for the short- term control of ammonia ($NH_3$), this effect is typically short-lived in the broiler house environment. The use of litter amendments should provide the poultry producer a net benefit, by providing lower mortality, in-house ammonia control and energy savings, while meeting all environmental goals of the producer.

In-house air quality is a major concern in poultry production. Producers spend much of their time and investment in maintaining good air quality to maximize poultry growth and performance. Previous studies have correlated negative bird performance with poor indoor air quality due to $NH_3$ volatilization and dusts, (Kling and Quarles, 1974; Charles and Payne, 1966; Anderson et al., 1964; Quarles and King, 1974) and has implicated $NH_3$ as a component of poultry welfare (Kristensen and Wathes, 2000).

In a series of recent studies conducted by Casey W. Ritz at the University of Georgia, a new type of litter amendment utilizing proprietary ferric sulfate compounding has shown to be an effective litter amendment for minimizing ammonia concentrations, decreasing apparent litter moisture, and at the same time sequestering nitrogen and phosphorous. This product sold under the trade name Klasp™ is predominantly ($Fe^2$ $(SO_4)^3 \cdot NH_2O$) a dry, granulated form of ferric sulfate that contains approximately 20% iron as $Fe_3$.

This presentation will discuss the results of four demonstrations conducted in the summer, fall, and winter of 2007. The discussion will include $NH_3$ reductions in the broiler house, litter characteristics including nutrient levels and moisture, as well as the economics surrounding the use of the amendment. The purpose of this study was to evaluate the effectiveness of Klasp™, a new litter amendment, versus a commonly used alum-based litter amendment.

## Mitigation Mechanism:

Ammonia (NH3) concentration in poultry houses is a production issue that causes much concern for producers. Studies of birds housed in environments with NH3 present have not performed as well as birds not exposed to NH3 (Miles et al., 2004). Ventilation has been the primary method of removing and controlling NH3 from poultry houses. However, poultry producers also apply litter treatment products that lower pH, bind nitrogen (N), and dry the existing litter cake. The effects of ammonia and ammonia concentration in poultry houses were studied and documented in multiple houses (Ritz et al., 2006). Research on ammonia in poultry have shown the negative effects on bird health and bird performance when exposed to ammonia levels of 25 parts per million (ppm). Elevated ammonia levels lead to a diminished respiratory system, inducing low growth weights, low feed utilization rates, and high mortality rates. These factors and losses can be linked to the quantities of ammonia and ammonia compounds produced in the poultry house (Miles et al., 2004).

Ammonia is a water soluble, colorless, alkaline gas produced by microbial decomposition of nitrogenous compounds. Litter pH factors heavily in $NH_3$ volatilization. The application of litter amendments to reduce the pH of the litter is fundamental in the management of ammonia concentrations. Factors that influence litter amendment use are prolonged litter reuse, increased bird density, animal-related stress, disease, and short layout periods. Ammonia produced from poultry litter by the breakdown of uric acid can be inhibited if converted to $NH(^4)(+)$ (ammonium), which can be accomplished by lowering litter pH. The amount of ammonia emitted as $NH_3$ from the litter is reduced because of these reactions.

## Applicability:

Klasp™ ($Fe^2$ $(SO_4)^3 \cdot NH_2O$) is a dry, granulated form of ferric sulfate that contains approximately 20% iron. Klasp™ is a nontoxic and nonhazardous substance classified as a GRAS (Generally Regarded as Safe) substance to be used by

the poultry industry in pursuit of best management practices. As a best management tool Klasp™ effectively reduces ammonia, sequesters phosphorous and nitrogen and efficiently lowers litter pH while providing a drier house environment. These factors provide an improved bird environment and enhanced overall general animal health.

## Limitations:

Klasp™ is generally recognized as safe. Klasp™ is an acidic product; therefore appropriate measures should be used during handling. Gloves, a long sleeved shirt, and long pants should be used for the period of product application. A dust mask should be worn to prevent dust inhalation, and goggles worn for eye protection.

## Cost:

Cost is dependent on several factors. The producer's proximity to the chemical distributor, application rate, and use cycle of Klasp™ will contribute to the final per house cost.

## Implementation:

A rate of 45 kilograms per 93 m2 (100 pounds of Klasp™ per 1,000 ft2) of floor space is the typical recommendation for the treatment of broiler litter (32 kilograms during warm weather production). For most broiler houses, this will equal 680 to 907 kilograms (1500 to 2000 lbs) of Klasp™ per house for each grow-out. A rate of 45 kilograms per 93 m2 (100 pounds per 1,000 ft2) will lower ammonia production. Rate selection for each operation will depend on current management practices and needs, based on factors such as litter reuse, short layout periods, ventilation control, and existing litter moisture levels. Klasp™ can also be safely applied with birds in the house to address management issues that occur post-placement.

Prior to the application of Klasp™, poultry houses should be decaked or rototilled. Klasp™ can be applied up to four (4) days prior to bird placement. Broadcast spreading (cyclone or PTO spreader) is recommended as a litter top coat and incorporation into litter is not required.

Research has shown Klasp™ provides cost savings as a result of reducing the heating and ventilation costs normally associated with the use of litter treatments. There are no heating requirements for material activation prior to bird placement. The activation advantages provided by Klasp™ allow producers application flexibility and improved time management before bird placement. Klasp™ is activated by moisture not heat thus providing time flexibility and energy savings.

The integration and activation of Klasp™ with litter moisture promotes drier houses and extended product activity. With efficient horizontal penetration and coverage you can expect greater surface area impact per granule. Klasp™ provides increased activity and a longer residual effect when compared with other treatments. The highly deliquescent form of Klasp™ is easily spread and its non-clumping grains dissolve quickly providing superior performance in addition to enhanced bird welfare. Klasp™ has substantially less dusting during application leading to a lower impact on labor and does not corrode or adversely effect production equipment.
Klasp™ was, on average, superior to the control litter amendment in reducing NH3 emissions and concentrations in the houses during the first 10 to 12 days after bird placement. Klasp™ also significantly improved retention of nitrogen in the litter over the standard treatments, suggesting that there is an enhancement effect on nitrification of NH4 to the more stable NO3 form (Ritz et al., 2006).

## Technology Summary:

In conclusion, University trials and field testing have proven that poultry litter treated with Klasp™, have resulted in:

- Lower house ammonia levels
- Lower litter pH levels
- Drier houses with extended product activity and performance
- Reduction in ventilation requirements and auxiliary heat consumption
- Increased nitrogen content and improved litter value
- Excellent residual performance
- Enhanced application flexibility and time management

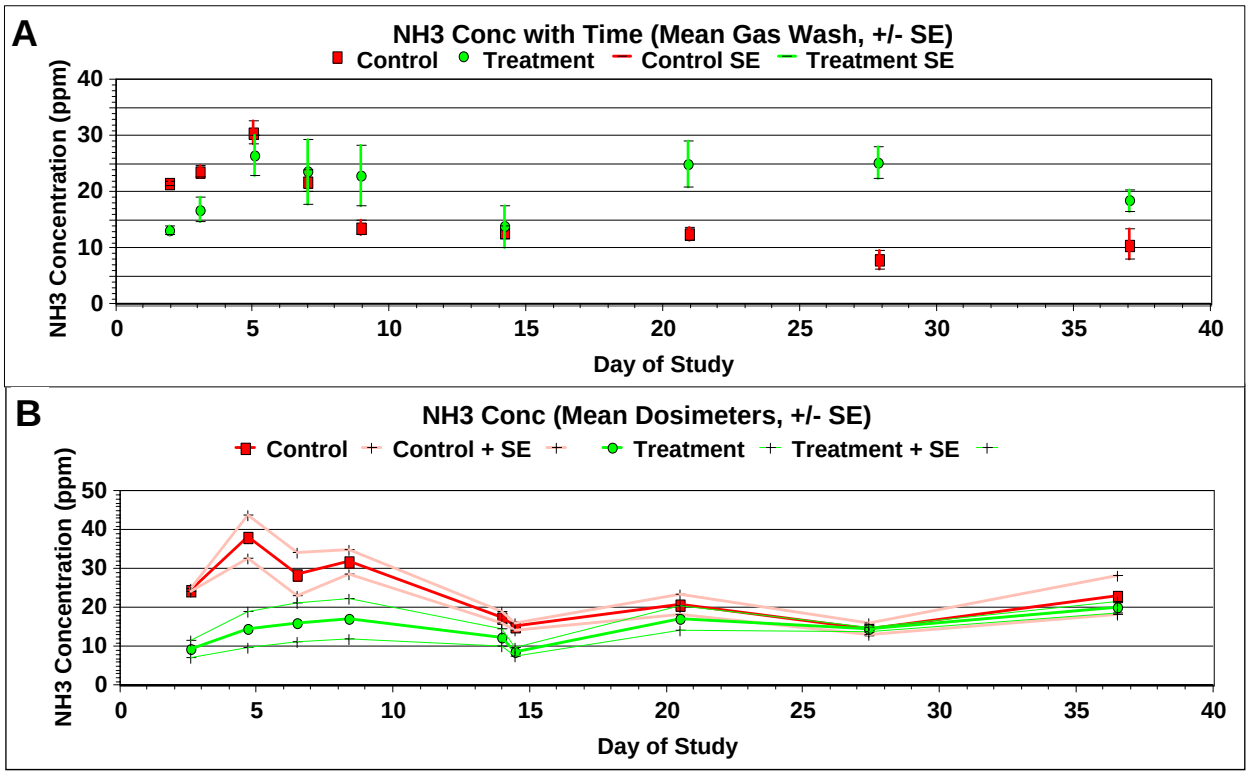


**Figure1. Ammonia ($NH_3$) concentrations in houses treated with alum (control) and Klasp™ (treatment), plotted with standard error bars.**

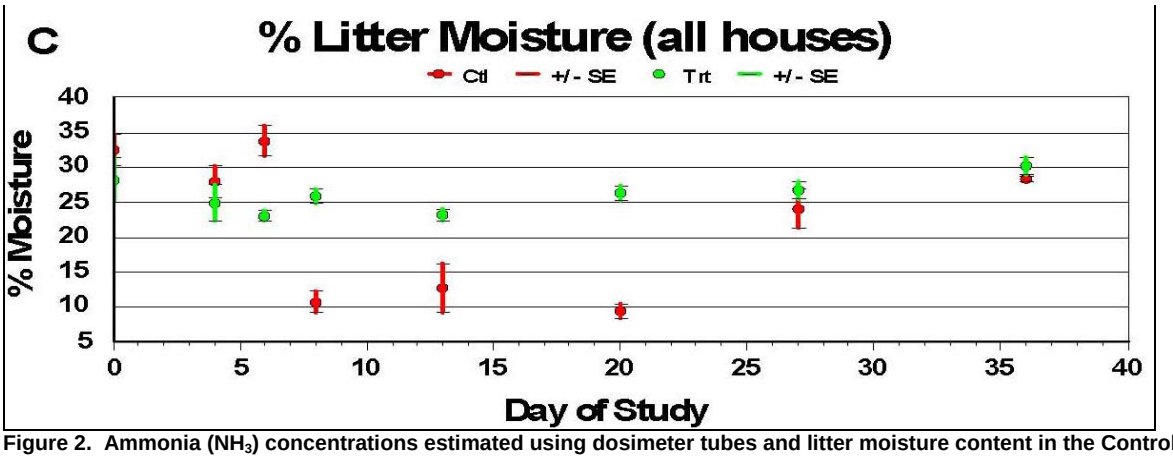


**Figure 2. Ammonia ($NH_3$) concentrations estimated using dosimeter tubes and litter moisture content in the Control (Houses #1 and 2) and Treatment (#3 and 4) houses. Averages are the means of Control and Treatment houses.**

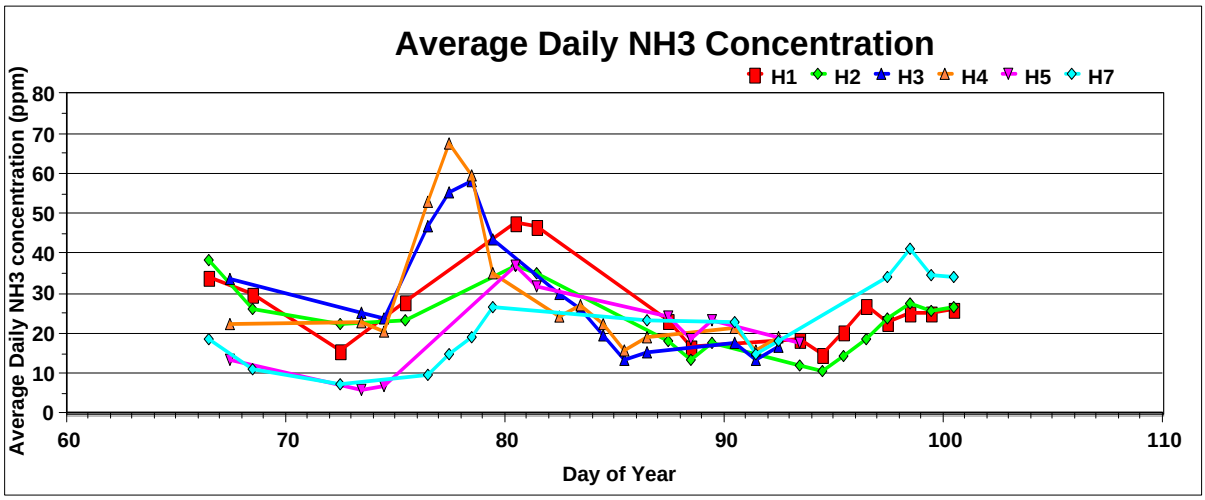


**Figure 3. Ammonia ($NH_3$) concentrations of alum-treated houses (H1, H3, H5) and Klasp™ treated houses (H2, H4, H7).**

**Table 1. Phosphorus analysis of alum and Klasp™ treated litter. Samples were taken before treatment application and after the broilers were processed.**

| | Molybdate Reactive Phosphorus (ortho- phosphate) | | | Total Dissolved Phosphorus | | |
|---|---|---|---|---|---|---|
| | Pre-treat (ppm) | Post-treat (ppm) | P-value | Pre-treat (ppm) | Post-treat (ppm) | P-value |
| **Alum Litter** | 3968 | 3996 | 0.466 | 4854 | 5166 | 0.110 |
| **Klasp™ Litter** | 3204 | 3893 | 0.015 | 4096 | 5081 | 0.002 |

# References:


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