

Minimizing Microbial Contamination in Feed Mills Producing Poultry Feed ¹

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Salmonella contamination in live bird preharvest production facilities can usually be traced to three production factors: (1) feed contamination, (2) environmental contamination, and/or (3) egg transmission. Each factor has an influence on and interrelationship with the others. If an established Hazard Analysis and Critical Control Point (HACCP) program is to be successful in reducing the total number of salmonella and other pathogenic microorganisms to as near zero tolerance as possible, then all three of the above listed factors must be considered as potential sources of contamination. Technologically, the weakest link in salmonella control in live preharvest facilities is often the ability to produce salmonella-free feed consistently. If salmonella infection of birds is to be prevented, salmonella contamination of the bird's environment and feed must also be controlled.

The quality of ingredients used for feed production by a poultry feed milling facility is important because what birds eat can affect flock quality and the wholesomeness of a flock's meat and eggs. Most raw feed ingredients used as an energy and/or a protein source in diets of poultry are grown, harvested, processed, and transported by someone outside of the poultry industry. Therefore, the ingredient quality control component of a poultry operation's feed mill is an important first step in preventing the contamination of birds on the farm. Serotyping becomes very important when tracing the origin of a salmonella infection in animals, especially humans. For example, it is well known

that salmonella can be transmitted from feed ingredients to the completed mixed feed and on to live poultry. This transmission sometimes results in the production of salmonella-positive products (i.e., meat and eggs). Many times the salmonella serotypes found in feed ingredients are not the same as those commonly found in processed poultry. Therefore, it is foolish to believe that a salmonella control program intended solely to eliminate salmonella in the feed would control other salmonella types found in meat and eggs. An integrated HACCP program is essential.

Feed mills should follow the guidelines "Recommended Salmonella Control for Processing of Livestock and Poultry Feeds," published by the American Feed Industry Association (1501 Wilson Blvd., Suite 1100, Arlington, VA 22209). No single generic, microbiologically oriented HACCP program is best for all feed mills because each feed mill presents a unique management situation. Some commonalities, however, exist in all feed mills, and these are discussed in general to help minimize contamination of finished feed by pathogenic microorganisms such as salmonella.

- First and foremost, the feed mill premises are important. Prevention of microbial contamination should be a major consideration in the engineering and construction of the facility.
- Every feed mill should identify each critical control point, monitor that point for pathogens on a regular basis.

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and have a plan for corrective action if contamination is discovered. Ingredient inventories should be matched with the diets mixed and the flocks to which they are delivered. A bank of feed samples should be established so that they are available for analysis in the event a trace-back situation should arise. Feed samples should be sealed and stored in a clean, dry location.

- Each feed ingredient used in the milling of finished feed has its own unique risk of being contaminated. High risk ingredients should be screened carefully. Generally, animal proteins have higher levels of salmonella contamination than do plant proteins. Poultry offal meal and feather meal should be considered high risk ingredients. These products often contain the same serotypes that are concurrently identified as causing contamination in local poultry populations. Adequate records should be kept on each feed ingredient supplier, including baseline quality control data.
- It may be advisable at times to minimize the use of high risk feed ingredients in diets of certain animals such as very young, stressed, or breeder birds. Young birds are very susceptible to salmonellosis when they are 1 to 14 days of age. Consideration should be given to using pelletized /crumbled feed during this time of high susceptibility to salmonellosis since the temperature achieved during the pelletizing process is effective in killing salmonella.
- The feed mill should have a functional biosecurity program to minimize contamination. Buffer zones will prevent nonemployees from entering the feed milling plant. Visitors should be considered to be contaminated and provided with coveralls, disposable shoe covers, sanitized rubber boots, or other appropriate biosecurity measures.
- Rodents and wild birds must not be allowed in or near a milling facility. Nesting materials should be removed and potential nesting sites eliminated.
- Dust control in the feed milling facility is essential for controlling salmonella. Dust is the major source of salmonella contamination in feed mills.
- Traffic patterns of employees should be designed to minimize the possibility of cross contamination. Employees working in the ingredient receiving areas should not be allowed to enter the finished-feed area and vice versa. Different-colored uniforms could be used to ensure compliance.
- The feed ingredient receiving and unloading area should be clean, neat, organized, and well drained. Ingredients should be rejected prior to unloading if they are contaminated with rodent and/or bird droppings or any insect infestation. Unloading pits should be free of any visual signs of previous ingredients. Pits can be flushed with small amounts (100 lbs) of low risk ingredients at the end of each day. Ground corn (100 lbs) containing from 0.5% to 1.0% organic acids (propionic, acetic, or formic) can also be used periodically for sanitation to minimize the risk of contamination. Mixtures of these acids can also be added as supplements to finished feed to reduce the number of viable salmonella.
- Store all raw feed ingredients in clean, waterproof silos.
- Transportation vehicles should be inspected and sanitized on a regular schedule. Litter, offal, and carcasses should never be hauled by the same vehicles that haul feed ingredients or finished feed. Designated trucks should be used only to deliver feed to breeder flocks.
- The feed milling facility's air handling system should be segregated by location. Air inlet areas (stacks) for pellet cooling can be a major source of microbial contamination and should be designed and located so as to minimize contamination of finished pellets by providing clean incoming air. Air handling systems should be cleaned thoroughly on a scheduled basis. Air filters should be able to remove all dust (≥ 5 micrometers).
- Bin cleanliness in the feed storage area is essential and should be monitored on a regular basis. Unsanitary conditions should be rectified. Feed spills should be cleaned up immediately.
- Milling equipment, including conveyor equipment, should be identified (i.e., by color ring or number) throughout the facility, so if contamination occurs in a specific area the associated equipment can be identified and sanitized.
- Methods must be employed to reduce temperatures in ground grains rapidly to prevent moisture migration and condensation inside the ground grain storage tanks, thus promoting bacterial as well as fungal growth.
- Flushing of horizontal (screw-type) and boot-type conveyors with 100 pounds of corn containing organic acids on a regular basis will minimize the risk of horizontal contamination.
- Surfaces of batch scales and mixers should be periodically inspected and cleaned of adhering feed material.
- Finished pellets must not be allowed to come into contact with objects prior to falling into the cooler. Pellets falling on the floor must be considered a possible source of contamination and should not be added back to the finished feed.

- Liquid fat application devices designed to apply fat to pellets must be kept sealed, be operated in dust-free locations, and be cleaned daily. Ground corn containing organic acids should be used daily to clean conveyors between fat application devices and feed storage.
- Separate storage bins and trucks must be assigned for mash and pelleted feeds. These bins and trucks must be inspected and cleaned regularly.
- Feed delivered to farms in bulk or in bags must be placed in clean storage bins or areas. Each poultry house should have two feed bins to allow growers to clean and sanitize the bins properly as needed and without interruption of the feeding schedule. The bins should be completely emptied, one at a time.
- Any animal protein used as a feed ingredient in poultry feed should be purchased from rendering plants participating in the Animal Protein Producers Industry (APPI) Salmonella Reduction/Education program or the Fishmeal Inspection program sponsored by the National Marine Fisheries Service (NMFS). The APPI or NMFS can provide a list of participants in their respective programs.
- Educational programs for all feed mill employees should be considered essential. The HACCP program should be discussed in detail with employees. Suggestions to improve the HACCP program should be solicited from employees at regular intervals.