

Prevention of Post-processing Contamination of Stock Meal with Salmonella and Other Pathogens

1997



A high priority must be given to the production of hygienic meat, and every segment of the red meat industry must put forth the necessary effort to reduce the incidence of pathogens.

Among those who can help safeguard Australian markets are renderers. Every renderer in Australia must be serious about producing meat meal free of vegetative bacteria and have a Quality Assurance program in place.

The problem

Although the cooking process kills *Salmonella*, *E. coli* and other vegetative bacteria that are in the raw material, meat meal can be recontaminated after cooking. Thus, renderers must implement carefully controlled procedures to prevent this.

Spore-forming micro-organisms are more likely to survive the processing conditions encountered in meat meal production.

The most serious threat from this type of contamination is botulism, a disease caused by the toxin-producing, spore-forming bacteria *Clostridium botulinum*. Another spore-forming micro-organism of concern is *Bacillus anthracis*, which is responsible for causing the serious livestock disease Anthrax.

Of additional concern are viruses and other agents. Viruses are extremely small organisms that are not as well understood as bacteria. An example of disease caused by an agent is Bovine Spongiform Encephalopathy (BSE), commonly known as “Mad Cow Disease”. The agent or “prion” is a small infectious, highly heat resistant, rogue protein.

Post-processing contamination

The nature of rendered meal should prevent significant growth of any post-cooking contaminants – however moisture can change this situation and present a problem.

Although, ideally meat meal should contain 8% - 10% moisture after cooking, moisture levels are commonly 4% - 7%. At these levels, water activity of the meal is too low to support any microbial growth. Even at moisture levels of 15% - 20%, only the most drought-resistant moulds should be able to grow. For *Salmonella* and other common pathogens to grow, meal moisture content must be around 40%.

Meat meals, therefore, should be stable – even if contaminated material is accidentally introduced into the cooked product. Although *Salmonella* introduced in this manner are likely to survive in meat meal, they cannot proliferate unless the meal is moist.

One-off casual contamination incidents such as this are extremely difficult to detect in a day’s production. In a rendering plant producing 8 tonnes of meal per day, for example, the chance of finding such incidental *Salmonella* contamination in a single, routine 25g meal sample is one in 350,000.

The build-up of moist meal at some point in the system is the precursor to the start of endemic, persistent contamination. If processors are to break the cycle of *Salmonella* contaminated animal feeds, emphasis must be placed on processing equipment design and plant layout.

Casual and endemic contamination

Even though *Salmonella* is only one of a number of pathogenic or spoilage bacteria that may infect meat meal, it is the indicator of meat meal hygiene.

Casual contamination occurs when infected material – such as raw material or drainage – directly or indirectly comes in contact with rendered product. Usually intermittent, casual contamination results in localised patches of *Salmonella* contamination, but may lead to endemic contamination.

Sources of casual contamination:

- Splash or aerosols from the raw materials area
- Tools, barrows, etc. from the raw materials area used in the dry meals area
- Infectious material transferred to the dry meals area via rodents, insects or birds
- Dirty boots and clothing of personnel moving from the raw materials area to the dry meals area
- The wheels of road transport vehicles, front-end loaders and fork-lifts moving into the dry meals area

Endemic contamination results when casually introduced bacteria are deposited in a warm, moist location where nutrients are present. These conditions, favourable for bacterial growth, are commonly found in screw conveyor casings,

bucket elevators, mill housings, bins and other locations in meat meal conveying and storing equipment. “Hot spots” are places where moisture and meal can collect and remain relatively undisturbed.

Endemic contamination at a hot spot can continually feed bacteria into a stream of meat meal as vibration – or just its own weight – breaks the highly contaminated meat loose and it falls into the “clean” meal. This results in the contamination of large quantities of meal, to the extent that a 25g sample taken from a 15 tonne bin will test positive to *Salmonella*. (Sometimes the existence of bacteria in large numbers can be detected by sniffing.)

Screw conveyors

Screw conveyors are an example of a potential source of such contamination.

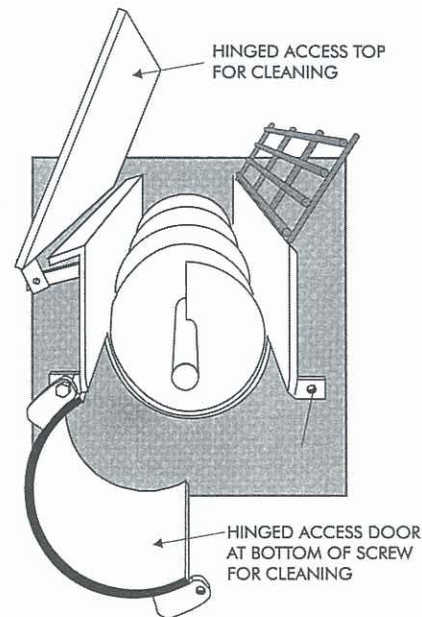
Screw conveyors, which have grilled covers and are situated between the press discharge and the cake elevator, should be fitted with a guard to eliminate the possibility of scrapings from operators’ boots falling through the grills during rendering operations. They should be fitted with solid covers at points where operators have to cross them.

Screw conveyors, vulnerable to water ingress during clean up, should also have moisture-proof, light-weight, removable covers which can be placed over them for the duration of the cleaning operation.

All screw covers must be lockable or bolted to conform with OH&S requirements. Where the EPA does not require the screw to be enclosed, a mesh cover is preferable to a solid cover.

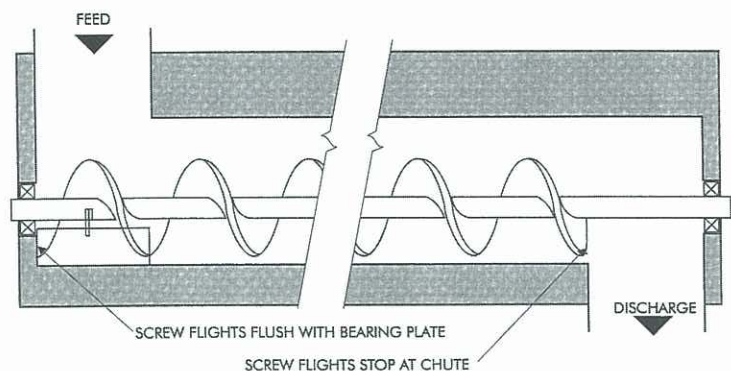
To allow effective cleaning, upward-angled screws conveying cooked product should be reversible and fitted with a lockable hinged door at the feed end. (Figure 1) Alternatively, there could be a diversion at the delivery end of the screw into a receptacle to allow material used to clean the screw to be recycled.

FIGURE 1 Angled screw open for cleaning – screw should be reversible to assist flushing of casing.



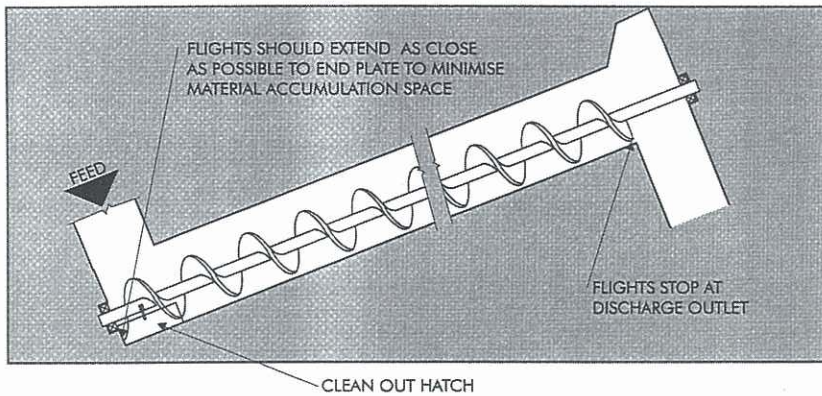
Where screws feed cooked product from a wet area to a dry area, the screw should slope back to the feed end at a minimum angle of about 5° to facilitate cleaning. Flights on cooked-product screws should extend to the back end of the casing at the feed end to eliminate free space where meal can collect. (Figure 2) Screws should be checked regularly for bearing, casing and flight wear to maintain minimal clearances and ensure there are no gaps where meal can accumulate and become contaminated.

FIGURE 2 Screw flights flush with end plate at entry and stop at start of discharge chute to minimise build-up in casing.



When there is no requirement to seal and vent a screw elevator, adequate venting at the top end should be provided to dissipate the air. A dust shield may be required but should be designed to ensure condensation does not fall into the screw casing. (Figure 3) The degree of enclosure required will depend on the amount of dust generated by the mill.

FIGURE 3 Naturally ventilated elevating screw enclosed to minimise dust escape.

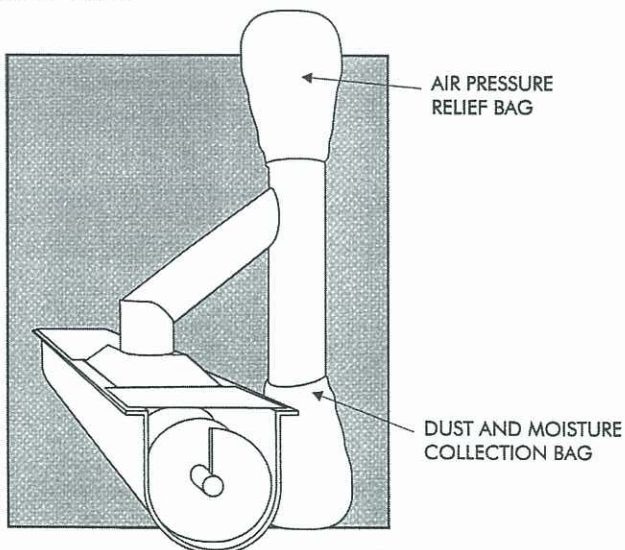


If mill discharge screws feed into the bottom of a bin, and the meal in the bin causes a build up of pressure in the screw, the pressure should be relieved by a wind sock.

The wind sock must be designed to prevent any material or moisture falling back into the screw. The dust/moisture collection points, including both the discharge vent and the knockout pot, should be designed for ease of cleaning and inspected and cleaned at intervals of adequate frequency to ensure its efficiency and hygienic condition. A quick release sock is ideal for both the discharge vent and the knockout pot collection points. (Figure 4)

FIGURE 4 View of bag to relieve air pressure from a mill screw conveyor discharging into a bulk meal bin whilst minimising dust escape.

The above are just some examples of potential sources of endemic contamination. A Quality Assurance Program is necessary to define all the precautions needed to prevent re-contamination of meat meal.



Additional information

CSIRO 1993, "Hygienic Production of Rendered Animal Products", CSIRO Meat Research Laboratory in association with Meat Research Corporation

Additional help and advice is available from Australian Meat Technology Pty Ltd. Phone:

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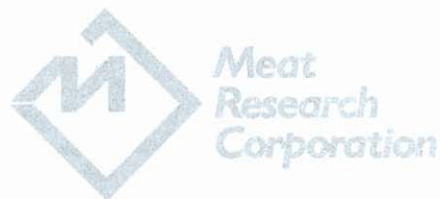
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