Salmonella Risk Reduction Guide

A guideline for Salmonella risk reduction in commercial egg production

The most important food safety hazard in egg production is Salmonella contamination of eggs or egg products. Under current legislation, businesses that produce or process eggs must implement measures to control the food safety hazards, including Salmonella.

Understanding how to implement a good Salmonella control program in an egg business is a complex issue. There is no 'one size fits all' program because of differences in how egg farms produce eggs. However, there are certain actions or practices that you can take throughout the egg production/processing system to reduce or prevent the risk of Salmonella contamination on eggs. This guide describes some of these practices and is to assist Queensland egg businesses in developing or improving appropriate Salmonella risk management strategies. Having an effective Salmonella control program will ultimately improve the ability of your business to control Salmonella, (as well as most other food safety hazards) and to continue to produce safe and suitable eggs.

1. External Farm Environment

Operational step	Salmonella risk reduction measure	Yes	Some	No	N/A	How can I ensure and check this?	Yes
Outside farm environment	- Are immediate surrounding areas tidy and uncluttered?	☐	☐	☐	☐	- Visual observation of the environment	☐
	- Farm security present?	☐	☐	☐	☐	- Keep pest control records/inspection and/or index findings	☐
	- Biosecurity protocols in place for human and vehicle traffic?	☐	☐	☐	☐		
	- Effective pest control?[1]	☐	☐	☐	☐		
	- Adequate drainage to prevent water pooling and mud?	☐	☐	☐	☐		
	- Other stock/wildlife/pets are not in close proximity to poultry?[2]	☐	☐	☐	☐		
Layer shed configuration	- Single-aged laying flocks?[3]	☐	☐	☐	☐	- Visual observation of pest exclusion measures / pest control	☐
	- Boot wash at shed entry?	☐	☐	☐	☐	- Keep pest control records/inspections and/or index findings	☐
	- Hand washing facilities available in sheds?	☐	☐	☐	☐		
	- Effective pest control within the shed?	☐	☐	☐	☐		
	- Segregation of growing areas from manure/waste?	☐	☐	☐	☐		

[1] Pests include rodents, flies and birds that can carry Salmonella. Ineffective control is indicated by heavier numbers of pests than might be expected in a livestock environment. Ideally, rodent and fly index monitoring would be in place.
[2] Is there any potential for other stock/wildlife/pets to have immediate access to poultry, or manure run-off allowed into poultry paddock/shed? This can lead to transfer of Salmonella from other animals to poultry.
[3] Single-aged laying flocks give you the ability to clean a shed thoroughly before the next placement, but only if the shed is treated as a 'biosecure' unit

Operational step	Salmonella risk reduction measure	Yes	Some	No	N/A	How can I ensure and check this?	Yes
External egg conveyors	- Egg conveyors are in good working condition and suitable for use? - Egg conveyors are protected from environment?	☐ ☐	☐ ☐	☐ ☐	☐ ☐	- Visual observation of conveyor condition and cleanliness	☐
Siloed Feed Storage	- Silos and storage sheds are integral to sheds?	☐	☐	☐	☐	- Visual observation of silo integrity, free from damage, rust or other contaminants	☐
Feed/Water supply	- Approved supplier arrangements in place with feed/ingredient suppliers?[4] - If self-producing feed (mixing ingredients), a hygiene and monitoring program is in place - Potable grade water provided to birds?[5] - Measures present to prevent fouling of feed and water with faeces?[6] - Salmonella control agents added to feed (e.g. organic acids, probiotics)? Was a consultant involved?	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐	- Vendor declarations from supplier of feed/ingredients as contaminant-free or evidence of a QA program for pathogen control - Water testing results for faecal coliforms (faecal bacteria) - Faecal coliform and/or Salmonella test results from bulk stored feed or feed ingredients - Visual observations of contamination prevention in feeders and drinkers	☐ ☐ ☐ ☐

[4] Feed and/or feed ingredients are received from a reputable supplier with a QA pathogen control & monitoring program

[5] Water provided to birds must be treated to remove any pathogens (e.g. chlorinated, filtered, town water certified etc.)

[6] For example, poultry cannot perch above feeders or drinkers and defecate into them

2. Layer Management

Operational steps	Pathogen risk reduction strategies	Yes	Some	No	N/A	How can I ensure and check this?	Yes
Replacement birds	- Approved supplier arrangements for replacement birds?[7]	☐	☐	☐	☐	- Vendor declarations from supplier or evidence of QA / pathogen control and monitoring program	☐
	- Verification of decontaminated coops and trucks?[8]	☐	☐	☐	☐	- Visual observation of clean coops and trucks on delivery	☐
	- Birds verified as Salmonella Enteritidis / Typhimurium-free?[9]	☐	☐	☐	☐	- Salmonella Enteritidis / Typhimurium testing of day-old chicks	☐
Bird health and monitoring	- There is a Salmonella monitoring program in place in sheds (i.e. faeces, boot or drag swabs)?	☐	☐	☐	☐	- Salmonella test results from pooled faeces or boot/sponge swabs from poultry sheds	☐
	- Corrective actions when Salmonella (especially S. Typhimurium) is detected?[10]	☐	☐	☐	☐	- Corrective action records	☐
	- Regular veterinary / nutrition consultancy?	☐	☐	☐	☐		
	- Bird morbidity/mortality recorded?	☐	☐	☐	☐	- Mortality/morbidity records	☐
	- Regular removal of pests and dead/escaped birds?	☐	☐	☐	☐	- Observe absence of dead birds, pests	☐

[7] Poultry are received from a reputable supplier with a QA / pathogen control and monitoring program
[8] Poor hygiene by the transport company can lead to infection of your replacement stock
[9] Has the egg farm ever independently verify that birds are Salmonella Enteritidis and/or Typhimurium free?
[10] Corrective actions include (but are not limited to) increased biosecurity at this shed to prevent spread around the farm, greater cleaning/hygiene during production and turnarounds, increased candling/monitoring during grading, discarding all floor/dirty eggs from this shed to minimise risk

Operational steps	Pathogen risk reduction strategies	Yes	Some	No	N/A	How can I ensure and check this?	Yes
	- Recording of feed/water intake? - Do you maintain accurate and complete egg production records? - Birds culled at 72-80 weeks?[11] - Feed regime adjusted for age production?	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	- Maintain egg production records	☐

3. Laying Shed Environment and Equipment

Operational steps	Pathogen risk reduction strategies	Yes	Some	No	N/A	How can I ensure and check this?	Yes
Laying sheds caged NA ☐	- Adequate daily cleaning program in place (removal of broken eggs, dead birds/rodents, spilled feed)? - Egg collection system (cages, egg belts, conveyors, collection tables) are regularly cleaned and kept free of manure, organic matter and egg yolk - Effective shed cleaning/sanitation/downtime program?[12] - Dedicated equipment or practices that minimise transfer of pathogens between sheds?[13]	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	- Visual observation of daily shed hygiene - Salmonella test results from faeces and sponge swabs of floors, cages, belts equipment and fans - Standard Operating Procedures (SOPs) and cleaning records for cleaning/sanitation/downtime program - Verification of the effectiveness of the cleaning program by	☐ ☐ ☐ ☐

[11] While many farms may cull poultry after this time, older birds may be more susceptible to Salmonella infection and brittle shells/broken eggs may lead to greater contamination issues through-chain

[12] An adequate cleaning program includes removing all visible organic matter, cleaning followed by disinfection using appropriate chemicals, concentration and application. Two weeks downtime to limit bacteria growth could be used as a guide.

[13] Is equipment (collection trolleys, footwear, clothes) specifically used in each shed or if shared, are they cleaned and disinfected before moving to another shed?

Operational steps	Pathogen risk reduction strategies	Yes	Some	No	N/A	How can I ensure and check this?	Yes
Laying sheds caged (continued)	- Adequate manure management (i.e. faeces not reaching the floor of cages or by birds)?	☐	☐	☐	☐	microbiological testing - Visual observation of intact eggs leaving cage and on conveyor system (no excessive breakages)	☐
	- Eggs roll away from birds promptly?	☐	☐	☐	☐		
	- Shed / egg and manure conveyor belts dry?	☐	☐	☐	☐		
	- Conveyor system is not causing egg breakages?	☐	☐	☐	☐		
	- Separation of clean (egg collecting/handling) and dirty (dead bird/rodent removal) activities?	☐	☐	☐	☐	- Ensure farm staff observe good hygiene practices (separation, hand washing) when handling birds or eggs	☐
	- Egg collection more than once per day?[14]	☐	☐	☐	☐		
	- Very dirty or cracked eggs are discarded before transfer to the grading floor?[15]	☐	☐	☐	☐	- Monitoring of numbers of cracked and very dirty eggs at layer shed for early detection of bird health or equipment problems	☐
Laying sheds – Barn / Free Range NA: ☐	- Egg collection more than once per day?[16]	☐	☐	☐	☐	- Visual observation of general shed hygiene and egg collection system	☐
	- Sequential collection (youngest to oldest sheds)?[17]	☐	☐	☐	☐		
	- Hand cleaning available?	☐	☐	☐	☐	- Salmonella test results of faeces and sponge swabs (egg belt, drinkers, nest boxes) or	☐
	- Adequate daily cleaning programme in place and (removal of broken eggs, dead	☐	☐	☐	☐		

[14] A highly effective Salmonella management practice is to remove eggs from the poultry environment (including faeces) as soon as possible to minimise contamination

[15] Very dirty and cracked eggs carry the highest risk of transferring Salmonella from the laying shed to the grading floor.

[16] A highly effective Salmonella management practice is to remove eggs from the poultry environment (including faeces) as soon as possible to minimise contamination

[17] Older birds are more susceptible to Salmonella infection. By moving people/equipment from youngest birds to oldest birds, the risk of transferring the bacteria is minimised.

Operational steps	Pathogen risk reduction strategies	Yes	Some	No	N/A	How can I ensure and check this?	Yes
	birds/rodents, spilled feed)? - Egg collection system (nest boxes, egg belts, egg collection baskets, conveyors, collection tables) are regularly cleaned and kept free of manure, organic matter and egg yolk - Separation of clean (egg collecting) and dirty (dead bird/rodent removal) activities? - Very dirty and cracked eggs are discarded before transfer to the grading floor? - Effective shed cleaning/sanitation/program?[18] - Verification of cleaning program between flocks (Salmonella)?	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐	boot swabs of floor - Ensure farm staff observe good hygiene practices (separation, hand washing) when handling birds or eggs - Verification of the effectiveness of the cleaning program by Salmonella testing	☐ ☐
	<u>Floor eggs</u> - Staff are trained in floor egg identification and segregation from nest-laid eggs? - Do you discard floor eggs?[19] - If floor eggs are recovered, are there additional steps to manage contamination and verified as effective? - Corrective action system in place to rectify floor egg issues?[20]	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	- SOPs for handling and managing contamination risks of floor eggs - Monitoring and recording of numbers of floor eggs and corrective actions to reduce their number	☐ ☐

[18] An adequate cleaning program includes removing all visible organic matter, cleaning followed by disinfection using appropriate chemicals, concentration and application. Two weeks downtime is a guide
[19] Floor eggs may look clean and intact but because of increased contact with dirt, birds, organic matter, have a higher level of Salmonella contamination in positive sheds.
[20] Examples of corrective actions to reduce floor eggs include training poultry to use nest boxes or repair or improvements to nest boxes to make them more appealing to poultry

4. Egg Processing Environment and Equipment

Operational steps	Pathogen risk reduction strategies	Yes	Some	No	N/A	How can I ensure and check this?	Yes
Egg Collection Grading Room(s) configuration and general food safety requirements [21]	- Rooms are adequately segregated and maintained from layer sheds and dirty areas to prevent contamination?	☐	☐	☐	☐	- Visual observation of grading room hygiene and configuration so that all areas are continually free of yolk and other organic matter	☐
	- Grading and collection equipment is constructed and installed that allows effective cleaning and sanitising?	☐	☐	☐	☐	- SOPs and procedures for cleaning and sanitation of floors/equipment	☐
	- Waste is properly segregated from clean areas and final product?	☐	☐	☐	☐	- Salmonella testing of sponge swabs of grading and collection equipment	☐
	- An effective cleaning/sanitising program is in place (including verification)?	☐	☐	☐	☐	- Keep pest control records/inspections and/or index findings	☐
	- Pest control program in place and effective?	☐	☐	☐	☐	- SOPs and procedures for egg collection and storage times	☐
	- Ungraded eggs are stored under temperature control and graded within a minimal timeframe (i.e. same day)? [22]	☐	☐	☐	☐	- Temperature monitoring of cool rooms	☐
	- Cracked and very dirty eggs are discarded before dry cleaning/washing?	☐	☐	☐	☐		

[21] Refer to the FSANZ Food Standards Code Standard 3.2.2 “Food Safety Practices & General Requirements” and 3.2.3 “Food Premises and Equipment”

[22] Are eggs stored in a manner that controls bacterial growth (i.e. < 8°C)? For example, ungraded trolleys of eggs could contain a proportion of contaminated, cracked eggs that then increase the Salmonella load when put through the cleaning system.

Operational steps	Pathogen risk reduction strategies	Yes	Some	No	N/A	How can I ensure and check this?	Yes
	- If very dirty eggs are recovered, are there additional steps to manage the increased risk?[23]	☐	☐	☐	☐	- SOPs for pre-washing of dirty eggs and / or rewash	☐
	- Staff have skills and knowledge for their job functions (including hygiene, separation of clean/dirty and corrective actions)?	☐	☐	☐	☐	- Question staff to ensure training is effective and current - Training records	☐ ☐
	- Potable water, hot and cold, present for cleaning?	☐	☐	☐	☐		
	- Facilities for hand and boot washing available and effective?	☐	☐	☐	☐		
Egg cleaning	<u>Wet cleaning (washing)</u> - Staff have appropriate relevant skills and knowledge around the operation of egg washing?	☐	☐	☐	☐	- Training records and question staff to ensure training is effective and current	☐
	- Are eggs presented for washing at a suitable temperature?[24]	☐	☐	☐	☐	- SOPs for egg washing procedures that include monitoring time out of cool room	☐
	- Egg washing machines are suitably maintained and operating correctly?	☐	☐	☐	☐	- Visual observation of all egg washing equipment as free or organic matter and yolk	☐
	- The interior of egg washing machine is clean and free of organic matter, yolk etc?	☐	☐	☐	☐	- Egg washer cleaning SOPs and monitoring	☐

[23] While very dirty eggs should ideally be discarded, additional steps may include monitored pre-washing.
[24] If wet washing, the internal temperature of the egg is important as if eggs are too cool (direct from cold room), the high temperature of wash water could crack shells. Alternatively, if the egg internal temperature is higher than the wash water, then bacteria can get sucked into the egg.

Operational steps	Pathogen risk reduction strategies	Yes	Some	No	N/A	How can I ensure and check this?	Yes
	- Egg washing water is clean (replenishment periods if recycling)?	☐	☐	☐	☐	- During grading, monitoring records of chemical (pH, free chlorine etc) and temperature parameters	☐
	- Appropriate (and compatible) chemical/s and efficacious levels of active chemicals being used, preferably with consultation?[25]	☐	☐	☐	☐	- Validation data of egg washing system: sample pre and post washing egg samples and test for faecal coliforms[28]	☐
	- Continual monitoring of chemical dosage, pH and temperature?[26]	☐	☐	☐	☐	- Salmonella test results of sponge swabs of egg grading/washing equipment (infeed and discharge rollers, suction cups, inside egg washer etc)	☐
	- A validated and approved egg washing procedure is in use (i.e. validation data within 2 years)?[27]	☐	☐	☐	☐		
	- Adequate drying of eggs (no moisture left on eggs)?	☐	☐	☐	☐	- Visual observation of egg washing effectiveness and drying	☐
	<u>Dry cleaning</u> - Disposable cloths, scourers or brushes used for dry cleaning only?	☐	☐	☐	☐		
	- Wet cloths are not being used for egg cleaning?	☐	☐	☐	☐		

[25] Chemical usage is appropriate for food contact and used in accordance with manufacturer's instructions
[26] Most businesses with effective egg washing procedures monitor all chemical and temperature parameters at least hourly during grading
[27] See AECL guidelines or similar for an approved egg washing procedure
[28] Testing for faecal coliforms (bacteria) gives you an indicator of your *overall control* of bacteria like Salmonella when egg washing

Operational steps	Pathogen risk reduction strategies	Yes	Some	No	N/A	How can I ensure and check this?	Yes
Egg candling	- Candling equipment operational and functioning correctly?	☐	☐	☐	☐	- Visual inspection of candling operation and checks on the candler - SOPs of candling procedure including corrective actions by the candler when higher than usual numbers of cracked eggs are identified	☐
	- Good even lighting in the candling area?	☐	☐	☐	☐		☐
	- Clean mirrors for candling?	☐	☐	☐	☐		
	- Candling conveyor speed manageable to prevent operator fatigue?	☐	☐	☐	☐		
	- Regular breaks to assist concentration?	☐	☐	☐	☐		
	- Staff have appropriate relevant skills and knowledge to identify cracked eggs?	☐	☐	☐	☐		
	- Candling area regularly cleaned of organic matter and yolk?	☐	☐	☐	☐		
	- Automatic detection machinery regularly checked for sensitivity and calibrated to ensure correct functioning	☐	☐	☐	☐		
	- Effective identification, separation and recording of unacceptable (cracked/dirty) eggs?	☐	☐	☐	☐		
	- Verification process/ consumer checks performed at packing?[29]	☐	☐	☐	☐		

[29] Verification process checks or consumer checks are conducted at packing to ensure there has been no leakage of cracked or dirty eggs through the system. A representative sample of packed eggs should be checked and the number of cracked, dirty or other faulty eggs identified and recorded. Corrective actions should also be included on the monitoring form. The number of eggs will depend on the level of production, but the more checks, the better.

Operational steps	Pathogen risk reduction strategies	Yes	Some	No	N/A	How can I ensure and check this?	Yes
	- Adequate corrective action provisions in place if cracked/dirty eggs are detected during verification process checks?	☐	☐	☐	☐	- Monitoring of verification process checks	☐
Egg Packing, Distribution and Storage	- Approved supplier for packing materials?	☐	☐	☐	☐	-	
	- Packaging clean and stored appropriately?	☐	☐	☐	☐	- Visual observation of packaging cleanliness and checked as intact	☐
	- Storage area visually clean and free of excessive build up?	☐	☐	☐	☐	- Visual observation of general hygiene and configuration of storage areas (free of organic matter, broken eggs etc)	☐
	- Pest and vermin excluded from storage area (including packaging)	☐	☐	☐	☐	- Pest control records/inspections and absence of rodents/birds in these areas	☐
	- Unacceptable (cracked / dirty) eggs identified and segregated from acceptable eggs and stored at <8°C	☐	☐	☐	☐		
	- Cracked / broken eggs only sold to an accredited egg processor?	☐	☐	☐	☐	- Review of egg processor accreditation (for sale of cracked eggs)	☐
	- Egg pulp stored at < 5°C	☐	☐	☐	☐		
	- Distribution records (including customer database) maintained	☐	☐	☐	☐		

Operational steps	Pathogen risk reduction strategies	Yes	Some	No	N/A	How can I ensure and check this?	Yes
	- Recall procedure in-place and verified - Sufficient temperature and air circulation within the egg storage area to cool eggs within 24 hours of collection[30] - Whole eggs stored under appropriate temperature control[31]	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	- Assessment and review of recall procedure - Temperature monitoring	☐ ☐
Egg Traceability	- Egg stamping/ packaging true to label and comply with requirements, including inner, cartons, outer and pallets - Traceability for eggs from farm to grading floor maintained and recorded including the application of appropriate, unique ID	☐ ☐	☐ ☐	☐ ☐	☐ ☐	- Visual observation of stamping and packaging labels - Review of egg production records and ability to trace products	☐ ☐

Comments and observations:

[30] Adequate air circulation is measured by space left between pallets and storage room walls
[31] Egg stored at < 15°C. Cold storage <5 °C is best practice as it prevents the growth of bacteria.