

# THE SALMONELLA REDUCTION PLAN FOR THE SOUTH AFRICAN COMMERCIAL POULTRY INDUSTRY

## Introduction

Salmonella bacteria are numerous and may cause disease in many host species (including human beings). The consumption of infected poultry and eggs have been linked to the transmission of the disease in humans.

It is for this reason that almost all countries have adopted a Salmonella reduction plan. The aim of this plan is to promote farming practices that reduce the incidence of both the organism as well as the disease in animals and humans.

Furthermore, the plan specifies a schedule for the testing of the target species of Salmonella that will allow early detection of the presence of the organism and promote actions that will limit the spread of both the organism and the disease. The plan will be phased in gradually over 2 years but will eventually encompass all commercial South African poultry farms.

The first step in the South African Salmonella reduction plan is to determine the prevalence of target Salmonellae in Grand Parent & Parent flocks at the onset. An annual surveillance of all Grand Parent & Parent flocks will be done in line with the monitoring program set out in this document. The first round of monitoring to establish a base line should be performed during 2011.

Yearly surveys of the target Salmonellae in other classes of poultry will be phased in by the end of 2012. The prevalence of other target Salmonellae in humans as reported by the NICD will be studied to determine whether the current target Salmonellae list should be expanded.

It is proposed that the following prevalence reduction guidelines are approved:

Minimal reduction of the percentage positive flocks in the country:

- a. 10% if the prevalence of the previous year was less than 10%
- b. 20% if the prevalence of the previous year was less than 20%
- c. 30% if the prevalence of the previous year was between 20 and 39%
- d. 40% if the prevalence of the previous year was 40% or more

## Goals

To decrease the prevalence of the target *Salmonella sp. as specified above* by 2012 for grandparent and parent flocks and for the end of 2013 for all other classes of poultry with successive % reductions in successive years as determined by the above prevalence.

1. *Salmonella* Enteritidis
2. *Salmonella* Typhimurium
3. *Salmonella* Gallinarum
4. *Salmonella* Pullorum

## Aims

**The primary aims of the salmonella reduction scheme are the following:**

- To implement measures (hygiene, biosecurity and appropriate veterinary measures that will reduce the incidence of salmonella target species at all levels of production including the selection Companies, feed Mills, hatcheries, and abattoirs and all commercial poultry farms).
- To maintain negative Salmonella target sp. status in Grand Parent and Parent flocks.
- To implement the goal % for Salmonella target sp in commercial flocks by means of an integrated scheme by 2012.

## Actions to achieve aims

**The main activities incorporated in the plan are:**

- **Strict control to maintain target Salmonella free status in pure line breeding stock.**
- Application of bio-security, hygiene and appropriate veterinary measures at all levels of the poultry production system.

- A monitoring system of the full range of poultry production systems and of poultry products.

## General bio-security improvements necessary to reduce the incidence of Salmonella sp on all poultry farms

*“Always Start Clean to Stay Clean”*

Bio-security is short for Biological Security. It encompasses a variety of procedures used to establish sanitation barriers between unwanted organisms and flocks.

- The first basic requirement for effective bio-security is to create a barrier zone around the poultry operation to help stop unauthorized movement in and out of the operation. An appropriate sign should be put up on the perimeters.
- The second basic requirement for effective bio-security is to establish ‘restricted’ and ‘unrestricted’ zones on your premises. Restricted zones can be defined as those areas restricted to personnel wearing appropriate attire. Unrestricted zones are free areas in which vehicles and service personnel are allowed to work and move about without restriction. Access to restricted zones should be limited to essential staff, vehicles and equipment only.

### Visitors and Staff

All visitors, staff and service personnel should change into protective clothing (coveralls, boots, hats/bonnets) when moving into a restricted zone. This clothing should preferably remain on the site and be cleaned in such a way that the biosecurity is not compromised. Spare clothing should be on hand for individuals who do not provide their own clean, protective clothing. Having showers available for people to use when entering and leaving a ‘restricted’ zone will also help to ensure bio-security and is essential for breeder flocks.

Management should ensure that all staff, including relief staff, understands the importance of personal hygiene and the means by which infections can be spread.

### Equipment and vehicles

Vehicles (e.g. feed trucks, which travel from farm to farm) and equipment can transmit diseases.

Access of vehicles to farms should be restricted. "Wheel baths" and/ or spraying of vehicles with a suitable disinfectant at the farm entrance can help to improve bio-security. Essential equipment should be disinfected or fumigated prior to allowing it to be taken into the restricted area.

### Bio-security in the buildings

All building surfaces should be smooth and impervious to facilitate effective cleaning and disinfection.

#### a) Exterior

Regular housekeeping will help to eliminate breeding areas for flies and rodents. All repairs to the exterior of the building should be completed before cleansing and disinfecting of the interior.

All houses to be constructed in such a way to prevent access by birds, rodents and snakes.

- i) Implement a rodent and fly/insect control plan.
- ii) Restrict access of birds and other animals into the houses. They have the potential to carry in disease.
- iii) Repair any damaged screens promptly.
- iv) Keep the area around the buildings clean, tidy and free of rubbish.
- v) Ensure adequate drainage of water away from the area to prevent pools of stagnant water that could act as breeding sites for micro organisms and insects.
- vi) Areas around manure pits should be kept trimmed and preferably a cover should be provided for the pit. For other manure handling systems, provide for the minimization of odour, rodent and/or insect prevalence.

#### b) Interior

- i) Separate footwear should be worn and stored in each production unit.

- ii) Any person entering the facility who has been suffering from diarrhoea should take extra care in personal hygiene (i.e. hand washing).
- iii) Depopulated houses should be cleansed and sanitised before restocking. An incomplete job is a waste of time and money and creates a false sense of security. Cleaning, drying, disinfecting and airing out should take a minimum of seven days.
- iv) Remove all manure and preferably spread only on cultivated land and not adjacent to the poultry house after composting or heat treatment for at least 28 days. Tractors and equipment used for handling manure should be thoroughly cleaned and disinfected before being used for other operations. If manure is to be spread on lands that will be grazed by livestock, it should be stacked for 4 weeks before spreading.
- v) Walls, ceilings, rafters, fans, heaters, cages, drinkers and feed troughs should be pressure washed and sanitised with disinfectant. Waterlines should be flushed and disinfected.
- vi) Dry and disinfect.
- vii) Air out.
- viii) If litter is used, ensure that it is of good quality and sterilised.
- ix) Proper management of litter during production is important to ensure acceptable dry status and siring thereof.
- x) Ventilation – air temperature, moisture content, direction, speed, volume and transported products such as gases, dust odours and organisms are normally controlled by ventilation systems. Proper management and maintenance of this system will improve the environment surrounding your flock.
- xi) Clean feed bins, troughs and pipes regularly as residues in these locations are favourite sites for Salmonella contamination.
- xii) Check water drinkers regularly for leaking or overflowing. Excessive moisture can promote bacterial growth. Litter management is important.
- xiii) Spilled feed below bins should be cleaned up.

### **Water and Feed quality**

- a) Your water source should be clean and not accessible to wild birds, water fowl or rodents. Untreated surface water should not be used. Water should be tested bi-annually pre- and post rain seasons for general quality and bacterial levels with emphasis on Salmonella target sp.
- b) Only buy feed from suppliers with a salmonella reduction plan in place at the feed mill

## **Key points for Salmonella Reduction in Broiler and Layer breeders (grandparent and parent flocks)**

1. **Biosecurity and Hygiene** All the above biosecurity practices are mandatory including the use of showers for staff accessing the secure area.
2. **Minimum Monitoring Schedule** (Monitoring must be done in a DAFF approved or SANAS 17025 accredited laboratory employing validated test methods. Laboratories must also participate in approved proficiency schemes for salmonella)

### **2.1 Broiler & Layer Breeders in Rearing (per house):**

- i) Day-Old chick box liners on arrival: 5 x liners in 1 pool per hatch. If more than one source flocks are placed, the pooled samples must be extended to include these.
- ii) Mortalities in the case of Pedigree lines and Grandparent stock: All first week mortalities to be kept deep frozen and bacteriological tests for Salmonella from organs (liver, spleen, yolk sac and ceaca) performed on a pool of 10 chicks per 1 x day's mortality for the first seven days.
- iii) Floored housing per house at **4 week intervals:**
  - a. 2 x pairs of boot swabs (steri-boots) (2 x analyses) and
  - b. 2 x dust swabs with samples taken from walls, lights, fans (2 x analyses) and
  - c. 1 x Feed sample (500 gram) and
  - d. 1 x Water sample (200 ml sterile container)

### **2.2 Layer Breeders in Production (per house):**

- i) Floored housing per house at 4 week intervals:
  - 2 x pairs of boot swabs (steri-boots) (2 x analyses) and
  - 2 x dust swabs with samples taken from walls, lights, fans (2 x analyses) and

- 1 x Feed sample (500 gram) and
- 1 x Water sample (200 ml sterile container)

#### iv) Vaccinations

- 1.1 Ensure pullets are appropriately vaccinated with an inactivated *Salmonella* Enteritidis vaccine before entering the laying house.
- 1.2 Ensure full doses of vaccine have been correctly administered to replacement pullets at least 4 weeks before entering the laying house (follow the manufacturer's recommendation).
- 1.3 Where there is a known risk of *S.Typhimurium* use an inactivated vaccine which incorporates this *Salmonella* spp. as well.
- 1.4 It is recommended to use a live *S.Enteritidis* and / or *S.Typhimurium* vaccine at day-old. This may be repeated between 10 and 14 weeks of age.
- 1.5 When using a live vaccine, ensure that antibiotic treatment is not used immediately before; during or after vaccination (follow the manufacturer's recommendations).
- 1.6 Competitive exclusion treatment (CE), using a registered product, can be given to enhance the effect of vaccination. CE should ideally be given to pullets at 'day old' (in which case the first live vaccination should be delayed) and prior to moving the pullets to the laying facilities.
  - 1.6.1 In a continuously occupied house it may also be advantageous to treat all birds with a CE product in the house when newly placed pullets are introduced to decrease the overall level of *Salmonella* excretion at that time.
  - 1.6.2 When transferring pullets to a laying facility it may be advantageous to repeat the treatment with a CE product on arrival.

## Key Points for *Salmonella* Reduction: Hatcheries

### 1. Biosecurity and Hygiene

Know your infection risk - you can't control *Salmonella* properly without knowing the possible source Monitor breeding flocks after moving, before eggs are hatched (see minimum monitoring schedule)

- **Stop *Salmonella* coming in on contaminated eggs and materials** Re-route eggs from known infected flocks. Fumigate eggs with formaldehyde on entry to the hatchery. Use boot and trolley wheel dips. Do not allow delivery staff into hatchery. Sample delivery vehicles (including foot wells) and disinfect regularly, internally and externally.
- **Stop spread of *Salmonella* in setters and during egg transfer**
  - Avoid premature hatching.
  - Keep setters clean - moving to single stage as refurbishments allow.
  - Fog setters with disinfectant regularly.
  - Keep dedicated area for egg transfer.
  - Clean and disinfect egg transfer area after each use and transfer table after each farm batch.
- **Reduce spread of *Salmonella* in incubators during hatching**
  - Keep eggs from same flocks together as much as possible.
  - Maintain formaldehyde evaporation throughout hatch.
  - Screen outlet vents from inlets or direct outlets to exterior.
  - Operate hatcher rooms on 'all in - all out' basis.
  - Take off eggs from known infected and suspect flocks last or on separate day.
  - Do not begin power washing until all hatchers in hatcher room are empty.
- **Avoid persistence of *Salmonella* in incubators between hatchings**
  - Maintain formaldehyde evaporation throughout hatch.
  - Remove gross debris from empty hatcher and exhaust vent space before power washing.
  - Use flexible 'flue' brushes and high pressure washing with angled lance to totally clean exhaust vents.
  - Dismantle moveable equipment to achieve a deep clean.
  - Ensure disinfectant sprayed into all vents after cleaning with flexible pipe brush, and onto cleaned internal and external surfaces.
  - Use fans to dry surfaces after disinfection then fog or fumigate with formaldehyde or effective disinfectant.
  - Avoid recontamination by not using hatchers for drying trolleys, trays and other equipment.

- **Avoid persistence of *Salmonella* on chick sorting equipment**
    - Clean thoroughly and disinfect with an effective disinfectant whilst equipment is moving.
    - Include air vents and stir fans.
    - Sample cleaned surfaces for cleanliness and *Salmonella* - use any known infected flock to test the hygiene programme.
    - Ensure that staff handling chicks washes & disinfects hands frequently and wear disposable gloves where possible.
  - **Avoid moving *Salmonella* from dirty to clean areas**
    - Arrange trolley and tray returns so they do not pass through contaminated areas.
    - Install disinfectant trolley wheel and boot dips between main sections of the building.
    - Maintain pressure gradient to ensure air flows from clean to less clean areas.
    - Ensure that the waste and tray wash rooms are cleaned and disinfected frequently.
  - **Ensure that tray washers are effective**
    - Set up and maintain tray washers to achieve a good clean, increasing water temperatures and detergents where required.
    - Ensure the use of effective disinfectants and metering devices.
    - Check effectiveness of tray wash using bacterial counts and absence of *Salmonella* when infected eggs hatched.
    - Ensure tray drying areas are regularly cleaned and disinfected.
    - Use space heater rather than setters and hatchers to dry trays.
    - Ensure no recontamination occurs via spray drift or leaking ventilation ducting.
  - **Ensure regular cleaning and disinfection of waste skips and water separators**
    - These areas act as a focus of contamination for wildlife and produce contaminated aerosols which can be drawn into the building.
    - Keep waste enclosed, and area clean and tidy.
    - Disinfect the area and use insecticide treatment regularly.
    - Site waste areas away from and downwind of hatchery air intakes.
    - Site exhaust fans away from and downwind of air intakes and preferably use enclosed sanitary trap to catch dust.
  - **Ensure hatchery staff are dedicated to high hygiene standards and that they and vehicles do not carry infection off site**
    - Supply full protective clothing for staff and shower in/out facilities.
    - Supply good hand wash facilities throughout the building and supplies of disposable gloves.
    - Maintain good hygiene training and compliance monitoring programme and explain to staff why each thing they do is important.
    - Involve key staff in monitoring and collation of hygiene results.
    - Ensure delivery vehicles are dedicated and cleaned and disinfected between each delivery.
    - Ensure cab and drivers' clothing is kept cleaned and disinfected.
    - An automatic vehicle disinfectant spray wash is to be present at the hatchery entrance.
2. **Minimum Monitoring Schedule (Monitoring must be done in a DAFF approved or SANAS 17025 accredited laboratory employing validated test methods. Laboratories must also participate in approved proficiency schemes for salmonella)**
- i) **Every 2 weeks** Chick box liners: 5 chick box liners in 1 pool per flock of origin
  - ii) General Monitoring of the hatchery weekly (Pedigree & GP hatcheries) to monthly (Broiler/Pullet hatcheries):
    - Source water
    - Dust swabs of the following areas:
      - i. Air handling units
      - ii. Drains
      - iii. Egg transfer machine
      - iv. Chick take-off and carousels

Staff: Refer to Department of Health. Monitoring staff should be a pre-requisite, as SE is primarily a human pathogen and humans may act as SE carriers.

## **Key Points for *salmonella* reduction in commercial laying flocks**

### **1. Biosecurity and Hygiene**

- **Farms should preferably be run on an 'all in - all out' basis.**
  - If possible, e.g. by co-operation with other farms to maintain the appropriate supply of required egg grades, aim for total 'all in - all out' production on farm.
  - Where this is not possible empty as many houses at one time as possible.
  - Where it is not possible to empty whole houses and *Salmonella* infection is present entry to the laying house must be strictly controlled.
- **Ensure that rodent and fly/insect/beetle control is effective**
  - Do not allow a breeding population of farm pests to become established.
  - Avoid/clean up feed spills and keep buildings and surroundings clean, tidy and free of clutter/vegetation.
  - Be constantly on the lookout for signs of pest problems - rodent tracks, droppings, increases in fly populations.
  - Maintain baiting points around the perimeter of the site, around outside of houses and liberally within houses, away from birds.
  - Bait droppings pits and storerooms.
  - Change bait at least weekly - more often if it is being taken heavily.
  - Where rodent populations have built up empty whole house at depopulation, including pit, remove feed and bait more intensively before and after cleaning and for first few weeks after introducing the new flock.
  - Where fly, beetle or mite problems have built up treat environment where possible during the life of the flock and treat intensively, including cleaning out droppings pit, at depopulation.
- **Ensure that egg collection equipment is clean**
  - The laying house should be kept as clean as possible and broken / liquid egg, feed spillage and dust should be cleaned on a regular basis.
  - The ends of the egg belts should ideally be fitted with brushes which remove most of this contamination as the belts are running. Ideally dust collection trays should be provided beneath these to catch the debris for disposal.
  - Egg conveyors which run between houses and / or to the egg packing room should be regularly cleaned and disinfected. Debris falling beneath conveyors should be cleaned and disposed of. Floor surfaces beneath conveyors should be regularly cleaned and disinfected.
  - Egg belts, belt brushes and other egg handling equipment should be cleaned on a regular basis.
  - Debris on the floor beneath belts and conveyors should be regularly removed.
  - Floor surfaces should be regularly cleaned and disinfected.
- **Ensure that egg handling is done hygienically and equipment is clean (also applicable for egg (pack) rooms and egg pack stations)**
  - Staff should always wash/sanitise their hands before collecting eggs, between collections from different flocks, after any other activity which may lead to contamination of hands before collecting eggs and after handling eggs.
  - Dirty, cracked or broken eggs should be removed from the collection system as early as possible and handled separately, as higher risk items, thereafter.
  - If any flock health or egg-handling problems is suspected of causing excessive breakage or faecal contamination of eggs it should be investigated and corrected.
  - If eggs originating from known infected flocks are being packed the process should be separated by time and / or space from the eggs originating from other healthy non-infected flocks.

- Egg handling and packing equipment including tables, vacuum lifters, candlers, grading machines, conveyor belts and surrounding floor and wall surfaces etc. should be regularly cleaned and disinfected. This should ideally be done at the end of each working day.
- Machinery should be cleaned and disinfected, where possible whilst in motion so that all surfaces can be adequately covered. An effective disinfectant compatible with food production use (e.g. a chlorine product at suitable concentration) should be applied to all the cleaned surfaces.
- Periodically, equipment should be dismantled (to allow removal of organic matter which has built up in inaccessible parts of the machinery), properly cleaned and disinfected where possible.
- Egg stores, trolleys, trays and pallets, as well as farm delivery vehicles (including forklifts and trucks), should also be regularly cleaned and disinfected.

- **Ensure that cleaning and disinfection is effective**

- Aim to empty whole house otherwise it is not possible to clean and disinfect effectively.
- Where possible aim to empty the whole site as it is difficult to prevent re-introduction of infection by rodents, insects, dust, etc, if there is active infection elsewhere on the site.
- Allow sufficient time to allow a deep clean of building surfaces, equipment, etc.
- Check carefully just after washing - if it is still easy to find pockets of dirt then it was not done properly.
- Let all surfaces dry after washing, fans can be used to speed this up.
- Use an effective disinfectant: formaldehyde or gluteraldehyde/QAC combination products are likely to be most effective.
- Fog whole building to saturation point with undiluted formalin solution.
- The longer the house is left empty the less likely it is that pathogens will survive in sufficient numbers to infect birds.

- **Avoid spreading infection between houses**

- Control pest populations effectively.
- Use dedicated equipment for each house.
- Maintain disinfectant foot dip or dedicated boots for each house.
- If there is a known positive flock and the rest are clear deal with the positive flock last.

- **Additional treatment of water and feed may be beneficial**

- Feed treatment e.g. acidification (with or without formalin) may also help to reduce the risk of newly placed birds acquiring infection from resident infected birds in the above situation. Make sure that these products are compatible with live vaccines, if not the product should be withdrawn during the time that live vaccines are administered.
- Water treatment e.g. acidification may help to reduce the extent of infection or excretion of *Salmonella* within a flock and thereby minimise contamination of eggs.

**2. Minimum Monitoring Schedule** (Monitoring must be done in a DAFF approved or SANAS 17025 accredited laboratory employing validated test methods. Laboratories must also participate in approved proficiency schemes for *Salmonella*). The monitoring schedule is applicable for all layer flocks producing eggs for human consumption on a commercial basis.

i) **Day-old chick box liners on arrival:** 5 x liners in 1 pool per placement

ii) **Caged pullets and layers: At 4, 16 (approximately 2 weeks before the birds come into lay or before being moved to the laying accommodation), 24, 40 and 55 weeks of age on one house per site**

- i) 2 x dust swabs / samples taken on manure belt (analysis – see below) and
- ii) 1 x dust swab / sample taken on the cage floor (analysis – see below) and
- iii) 2 x dust swab / sample taken from walls, lights, fans (1 x analysis on all 5 the dust swabs / samples)
- iv) 1 x Feed sample (500 gram). This sample is only taken on the farm if the feed mill does not sample and test the feed according to AFMA's "Code of practice for the control of *Salmonella* in the production of animal feed".

- iii) **Floored housing:** At 4, 16 (approximately 2 weeks before the birds come into lay or before being moved to the laying accommodation), 24, 40 and 55 weeks of age on one house per site
- i) 2 x pairs of boot swabs (steri-boots) (1 x analyses) and
  - ii) 2 x dust swabs / samples taken from walls, lights, fans (1 x analyses)
  - iii) 1 x Feed sample (500 gram). This sample is only taken on the farm if the feed mill does not sample and test the feed according to AFMA's "Code of practice for the control of *Salmonella* in the production of animal feed".
- iv) **General monitoring:** As instructed by the responsible consulting or state veterinarian (interval and number of sampling areas)
- Rodents:** Trap in depopulated houses for bacteriology.  
**Staff:** Refer to Department of Health. Monitoring staff should be a pre-requisite, as SE/ST is primarily a human pathogen and humans may act as SE/ST carriers.
- iv) **Special monitoring:** Double the recommended number of samples taken for routine monitoring, at double the frequency until there have been 3 successive negative results.
- i) If *Salmonella* was present (confirmed in a laboratory as stated above) in the previous flock in a house. Applies when new birds are placed in the same house.
  - ii) Where *Salmonella* has been detected or suspected in the rearing stage. Applies when these pullets arrive on the laying farm.

### 3. Vaccination

- Ensure pullets are appropriately vaccinated with an inactivated *Salmonella* Enteritidis vaccine before entering the laying house.
- Ensure full doses of vaccine have been correctly administered to replacement pullets at least 4 week before entering the laying house (follow the manufacturer's recommendation).
- Where there is a known risk of *S.Typhimurium* use a vaccine which incorporates this as well.
- When there is a risk of pullets acquiring *S.Enteritidis* and / or *S.Typhimurium* during the rearing phase use a live *S.Enteritidis* and / or *S.Typhimurium* vaccine at day-old.
- If a live vaccine is used ensure that antibiotic treatment is not used immediately before, during or after vaccination (follow the manufacturer's recommendations).
- Competitive exclusion treatment (CE) using a registered product comprising an anaerobic culture of harmless caecal bacteria can be given to enhance the effect of vaccination. CE should ideally be given to pullets at 'day old' (in which case the first live vaccination should be delayed until week 3) and just before moving the pullets to the laying accommodation. In a continuously occupied house it may also be advantageous to treat all birds in the house when newly placed pullets are introduced to decrease the overall level of *Salmonella* excretion at that time.

## Key points for salmonella reduction in egg (pack) rooms / egg pack stations

### 1. Biosecurity and Hygiene

- **Ensure egg collection and transport are done hygienically**
  - Eggs should be collected and moved to a clean cold storeroom, separate from the poultry house which as soon as possible after collection.
  - The cold storeroom should ideally be temperature controlled. It is desirable to maintain eggs at a temperature of no more than 20°C.
  - New trays, or dedicated colour-coded trays that do not leave the farm, should ideally be used if manual collection of eggs is done within the poultry house. After grading, a different set of trays which have not been used within the poultry house should be used for dispatching eggs.
  - Egg collection/transport trays (cardboard / keyes) should be visibly clean i.e. free from faeces, broken egg or feathers.
  - Dirty cardboard egg trays should be discarded.
  - Cardboard egg trays should ideally be used only once. If this is not possible they should ideally only be used in the same house or premises where they have been used previously.

- Where plastic keyes trays are used, these should be cleaned every time after use with an appropriate detergent and disinfectant. After cleaning they should be visibly clean as stated above.
  - All trays (cardboard and keyes) should be stored in a clean, dry environment which is free from dust, wild birds, rodents and significant arthropod populations.
  - Vehicles used for transporting eggs should be maintained in a visibly clean condition on the inside and the outside.
  - If eggs of a known infected flock are present these eggs should be collected last if possible. If not the collection must be separated by time and space. Equipment should be cleaned and disinfected prior to use on eggs of the next healthy flock.
- **Ensure that egg handling is done hygienically and equipment is clean (also see key points for Salmonella reduction in commercial layers flocks)**
    - Grading and packing equipment should be kept clean dry. All equipment should be regularly disinfected with a suitable disinfectant e.g. a QAC based product.
    - Hand washing and sanitisation facilities should be readily available for egg packing staff and maintained in a clean condition.
- 2. Minimum Monitoring Schedule** (Monitoring must be done in a DAFF approved or SANAS 17025 accredited laboratory employing validated test methods. Laboratories must also participate in approved proficiency schemes for *Salmonella*). The monitoring schedule is applicable for all farms, egg pack rooms and egg pack stations supplying eggs for human consumption.
- 2.1 Eggs: Every month**
- i) Eggs (egg pulp): A 100ml sample from a pool of 150 cracked eggs/"leakers" of every commercial laying farm supplying eggs for human consumption.
- 2.2 General monitoring:** As instructed by the responsible consulting or state veterinarian (interval and number of sampling areas)
- Rodents: Trap in depopulated houses for bacteriology.  
Staff: Refer to Department of Health. Monitoring staff should be a pre-requisite, as SE/ST is primarily a human pathogen and humans may act as SE/ST carriers.

## Key Points for *Salmonella* Control: Broiler Flocks

- 1. Bio-security and hygiene**
- **Ensure broilers are sourced from appropriately vaccinated breeder flocks**
    - Pedigree and Grandparent flocks should ideally not be vaccinated with *Salmonella* vaccines.
    - Ensure full doses of vaccine have been correctly administered to parent stock and replacement pullets.
    - Where there is a known risk of *S. Typhimurium* use a vaccine which incorporates this.
    - If a live vaccine is used ensure that antibiotic treatment is not used immediately before or during vaccination.
  - **Operate farms and houses as near to 'all in - all out' as possible**
    - Farms must always be run on an 'all in - all out' basis.
    - Where this is not possible empty as many houses at one time as possible.
    - Acidified feed (with or without formalin) may also help reduce the spread of *Salmonella* between birds.
  - **Ensure that rodent and fly/insect/beetle control is effective**
    - Do not allow a breeding population of farm pests to become established.
    - Avoid/clean up feed spills and keep buildings and surroundings clean, tidy and free of clutter/vegetation.
    - Be constantly on the lookout for signs of pest problems - rodent tracks, droppings, increases in fly populations.
    - Maintain baiting points around the perimeter of the site, around outside of houses and liberally within houses, away from birds.

- Bait shavings stores and other storerooms.
- Change bait at least weekly - more often if it is being taken heavily.
- Where rodent populations have built up empty whole house at depopulation, remove feed and bait more intensively before and after cleaning and for first few weeks after introducing the new flock.
- Where fly, beetle or mite problems have built up treat environment where possible during the life of the flock and treat intensively at depopulation.

- **Ensure that cleaning and disinfection is effective**

- Aim to empty whole house otherwise it is not possible to clean and disinfect effectively.
- Where possible aim to empty the whole farm as it is difficult to prevent re-introduction of infection by rodents, insects, dust, etc, if there is active infection elsewhere on site.
- Allow sufficient time to allow a deep clean of building surfaces, equipment, etc.
- Check carefully just after washing - if it is still easy to find pockets of dirt then it was not done properly.
- Let all surfaces dry after washing, fans can be used to speed this up.
- Use an effective disinfectant: formaldehyde or glutaraldehyde/QAC combination products are likely to be most effective.
- Fog whole building to saturation point with undiluted formalin solution.
- The longer the house is left empty the less likely it is that pathogens will survive in sufficient numbers to infect birds.

- **Avoid spreading infection between houses**

- Control pest populations effectively.
- Use dedicated equipment for each house.
- Maintain disinfectant foot dip or dedicated boots for each house.
- If there is a known positive flock and the rest are clear deal with the positive flock last.

## 2. **Minimum Monitoring Schedule** (Monitoring must be done in a DAFF approved or SANAS 17025 accredited laboratory employing validated test methods. Laboratories must also participate in approved proficiency schemes for salmonella)

2.1 **Bacteriological Monitoring:** Once per site 3 weeks before slaughter. Boot swabs: 1x pair per house pooled to a maximum of 5 pairs into one sample

2.2 **General Monitoring:**

**Rodents** Trap in depopulated houses for bacteriology.

**Staff** Refer to Department of Health. Monitoring staff should be a prerequisite, as SE and ST are primarily human pathogens and humans may act as carriers.

If *Salmonella* has been present in previous flocks in a house - monitor more intensively after birds arrive.

If *Salmonella* has been identified or suspected in the source broiler breeders - monitor more intensively after birds arrive.

## **Key Points for Salmonella Control: Feed**

- AFMA's "Code of practice for the control of Salmonella in the production of animal feed" is to be used as an integral part of the reduction scheme.
- Known pathogenic Salmonella serovars are rarely isolated from feeds and feed raw materials, but feed must be considered as a primary source of infection. Regular bacteriological monitoring must be carried out to detect sources of contamination.
- Efficient rodent and wild bird control at the feed mill is essential.
- Effective feed mill decontamination procedures and feed treatment to reduce the risk of Salmonella transfer to poultry farms.
- Storage of feed on the poultry farm should be limited and strictly controlled to prevent contamination of the feed from rodents and wild birds.
- Minimum monitoring programs as described in the AFMA code are to be implemented.

## Key Points Salmonella reduction in Abattoirs

Conditions and actions in the abattoir during processing that are conducive to higher levels of micro-organisms on the carcass and are therefore to be avoided are:

- Wet, soiled and dirty broilers received at the abattoir
- Dirty scalding tanks with four pass tracks
- Poorly managed pluckers at defeathering
- Dirty spin chillers with too low levels of replenishing water and contra-flow
- Dirty cutting equipment
- Dirty chutes or common surface areas
- Excessive handling of the products
- Contaminated brine injection
- Poor evisceration techniques resulting in especially bile contamination
- A dirty environment in the abattoir
- Inefficient carcass washing and decontamination

The following precautions need to be in place:

- Good contra-flow three pass scalding tanks, preferably with strong contra-flow replenishing water and rinsing between each stage.
- Efficient warm water (+- 30°C) carcass wash immediately after defeathering, before the feather follicles close.
- Efficient equipment for mechanical evisceration, especially to remove the lungs and prevention of bile soiling
- Efficient high pressure in-and outside wash after evisceration
- To contain any possible growth of micro-organisms (all bacteria), refrigeration must be done to cool down the carcasses to below 7°C, preferably 4°C as soon as possible.
- Maintain the cold chain during distribution and educate the consumer to maintain the cold chain right into the domestic fridge.
- Food safety and shelf life are important to keep a perishable product, such as fresh chicken meat, both in good condition as well as safe. This can both be done by meticulously maintaining the cold chain.
- Regular verification is done by continuous analyses of the final product for spoilage and pathogenic organisms to ensure a safe and wholesome product for the consumer.

## THE USE OF ANTIMICROBIAL THERAPY AND PROBIOTICS IN SALMONELLA REDUCTION

### Antimicrobials

The use of antimicrobials to treat a salmonella infection is controversial. Nevertheless, if antimicrobials are used judiciously, they can play a role in limiting the spread of salmonella.

Provided that all aspects of the control program are in place, they can lead to a significant decrease in the level of bacterial infection in the flock and minimize vertical transmission.

The following points must however be noted:

If it is used it is important to use it at the correct dose and for the correct period of time

The environment (chicken houses) cannot be 'treated' during production and remain contaminated. This means that antimicrobial therapy alone cannot eradicate an infection. Treated flocks therefore may remain carriers of the infection after treatment.

Treatment is only allowed under direct veterinary supervision in breeder flocks to minimize the risk of vertical transmission of target Salmonellae and strategic treatment of broiler flocks to minimize human health risks.

**No treatment of commercial egg layers is allowed.**

## Probiotics

A probiotic is a culture of 'good' bacteria. The principle behind their use is that these bacteria establish themselves in the intestines and therefore prevent the SE from establishing. This would be of particular importance after the use of antimicrobials. In practice, however, their use has had variable results. Before using these treatments it is important to obtain professional advice.

## Appendix 1

### Salmonella Reduction Plan – Summary of Critical Control Points

Control point	Keeping <i>Salmonella</i> out	Controlling the spread
Unit	<p>For new units - locate well away from other farms and landfill sites. Keep clean and tidy. Perimeter fence/information signs. Clean parking for vehicles off-site. Provide washing / disinfection facilities / footbaths. Clean and disinfect houses and surrounding areas regularly.</p>	<p>Keep clean and tidy. Provide washing / disinfection facilities / boot dips / protective clothing. Clean and disinfect houses and surrounding areas regularly. All in/all out system</p>
Rearing, laying & broiler flocks	<p>Obtain day old chicks from breeding flocks or hatcheries complying with relevant legislation for the monitoring of <i>Salmonella Enteritidis</i> and <i>Salmonella Typhimurium</i>. Introduce an effective <i>Salmonella</i> monitoring programme. Ensure adequate empty time between flocks. Ensure adequate procedures in place at hatchery and breeding flocks to detect and control <i>Salmonella</i>. Check pullets are from a reliable source.</p>	<p>Use separate protective clothing and/or disinfectant footbaths for each house. Control wild birds and rodents. Step-over barriers, use of boot dips.</p>
Staff	<p>Educate, train and inform. Keep “work clothes” on site and clean and disinfect regularly. Provide written hygiene protocols and monitor for compliance. Clean rest room, washing and toilet facilities.</p>	<p>Keep “work clothes” on site and clean and disinfect regularly. Provide written hygiene protocols and monitor for compliance. Wash hands before handling birds.</p>
Pest control	<p>Effective control programme. Tidiness / avoid feed spills.</p>	<p>Check controls are effective and seek specialist advice if not working. Increase controls at depopulation.</p>
Visitors	<p>Restrict entry. Visitors' book to be used. Provide clean protective clothing.</p>	<p>Provide clean protective clothing. Inform visitors of biosecurity &amp; hygiene rules.</p>
Feed	<p>Ensure adequate procedures are in place at feedmill to detect and control <i>Salmonella</i>. Secure, clean storage away from birds.</p>	<p>Avoid re-use of feed from empty houses.</p>
Litter	<p>Clean source, not contaminated.</p>	<p>Dispose of safely.</p>
Water	<p>Water to be Tested &amp; / or from a chlorinated source.</p>	<p>Enclosed system. Flush &amp; disinfect (peroxygen product) water lines. Clean and disinfect system</p>

Control point	Keeping <i>Salmonella</i> out	Controlling the spread
Animal waste	Careful disposal of litter/manure away from site.	before/after each flock.  Clean up spillages of litter/manure around houses and do not allow wash water to flow into adjacent occupied houses. Dispose of dead birds safely.
Equipment	Do not share equipment. Clean and disinfect regularly.	Clean and disinfect equipment when shared between different houses of the farm. Clean and disinfect regularly.
Depopulation/Repopulation	Clean personnel. Clean vehicles. Clean crates.	Implement cleaning and disinfection programme. Plan ahead. All in/all out.
Vaccination	Use appropriate vaccination schedules and other aids to <i>Salmonella</i> control.	Refer to the guidelines of the <i>Salmonella</i> reduction Plan.
Antimicrobial treatment	If used it is important to ensure that the correct dose is used and for the correct period of time.	Antimicrobial therapy alone cannot eradicate an infection. The environment (chicken houses) cannot be 'treated' during production and remain contaminated. The birds could therefore become re-infected.
Probiotics	A probiotic is a culture of 'good' bacteria.	The principle behind their use is that these bacteria establish themselves in the intestines and therefore prevent <i>Salmonella</i> spp. from establishing

## Appendix 2

# General checklist for cleaning and disinfection of units at depopulation

### Preparation

- Note depopulation date and prepare a plan
- Ensure rodent controls are effective
- List items for repair and maintenance and order replacements
- Ensure cleaning equipment, disinfectant available
- Ensure competent staff available
- Ensure other animals in occupied houses on adjacent land will not be contaminated during cleaning
- Run down feed supply
- Remove and store end of crop feed stocks in a manner which avoids contamination

### At depopulation

- Remove all birds from the building
- Apply control measures for insects, mites, beetles etc. as necessary
- Remove and dispose of carcasses
- Remove residual feed
- Check rodent control effective/intensify as necessary
- Carry out repairs to building structure as necessary

### Cleaning and washing

- Clean out manure, bedding, dust, waste, etc.
- Take all movable equipment outside, clean and wash
- Disconnect electrical equipment as necessary
- Drain, flush, clean water system, dismantle as necessary
- Clean feeding system thoroughly, feed areas, bins, hoppers etc.
- Clean ancillary rooms, fans, storage areas, rest rooms, farm vehicles and other equipment
- Clean bins used for waste material, boot dips
- Clean equipment used for the storage and disposal of dead birds
- Pressure wash the building, pens, other areas to remove remaining dirt
- Dispose of all waste safely
- Ensure that all cleaning equipment is cleaned and disinfected
- Complete repairs and maintenance

### Apply disinfectant

- Ensure the building is dry
- Follow label instructions
- Apply approved disinfectants at prescribed dilution rates +/- Formaldehyde at 2%-5% to:  
(Ensure that all necessary safety precautions have been taken to protect personnel)
  - ⇒ the building structures
  - ⇒ moveable equipment and reassemble
  - ⇒ all ancillary and common areas
  - ⇒ feed storage areas, bins, hoppers
  - ⇒ flush water system and drinkers with appropriate disinfectant, such as a peroxygen product
  - ⇒ equipment used for the storage and disposal of dead birds

### Fogging

- Apply 30-40% formaldehyde solution (neat formalin) or other suitable disinfectant at fogging concentration through a thermal fogger to re-saturate surfaces after spray disinfectant has dried
- Ensure that all necessary safety precautions have been taken to protect personnel.

### Before restocking

- Replace rodent bait
- Check no areas overlooked and equipment is functioning.

- Ensure there is no potential for contamination of bedding, feed or replacement stock on entry to the site.

## **Appendix 3 Guidelines for taking samples for the detection of Salmonella (after DEFRA regulations)**

### **Boot swabs**

For each flock\* In the event of a flock having been treated with antimicrobials, the sampling for the detection of salmonella shall be done at least 1 week after the applicable withdrawal period . In the event of recent treatment with antimicrobial therapy , the number of samples being taken must be doubled.

- 1) At least two pairs of boot/sock swabs per house shall be taken. Both boot/sock swabs must be pooled into one sample. In flocks where it is not possible to use boot/sock swabs as access to the houses is not possible, they may be replaced by hand drag swabs, where the boot swabs or socks are worn over gloved hands and rubbed over surfaces contaminated with fresh faeces, or if not feasible, by other sampling techniques for faeces fit for the intended purpose.
- 2) Before using the boot/sock swabs, their surface shall be moistened with maximum recovery diluents (MRD:0,8 % sodium chloride, 0,1 % peptone in sterile deionised water),  
The use of farm water containing antimicrobials or additional disinfectants shall be prohibited.  
The recommended way to moisten boot swabs shall be to pour the liquid inside before putting them on. Alternatively, boot swabs or socks may be autoclaved with diluents within autoclave bags or jars before use. Diluents may also be applied after boots are put on using a spray or wash bottle.
- 3) Boot swabs must not be applied over boots which have been immersed in boot wash but must be applied over previously sterilized boots or new boot covers.
- 4) It shall be ensured that all sections in a house are represented in the sampling in a proportionate way and that at least 100 steps are taken with each pair of boot swabs. Each pair should cover about 50 % of the area of the house. (in the event of the requirements for increased numbers of samples being taken, the house must be divided into the appropriate number of sections and sampled.
- 5) On completion of sampling the boot/sock swabs shall be carefully removed so as not to dislodge adherent material. Boot swabs may be inverted to retain material. They shall be placed in a bag or pot and labelled to identify the flock sampled, and the date the samples were taken.
- 6) The sample shall reach the accredited laboratory within 24 h.

### **Faecal samples**

In cage flocks, 2 × 150 grams of naturally pooled faeces shall be taken from all belts or scrapers in the house after running the manure removal system; however, in the case of step cage houses without scrapers or belts 2 × 150 grams of mixed fresh faeces must be collected from 60 different places beneath the cages in the dropping pits.

### **Dust samples**

250 ml of dust containing at least 100g of sample must be collected.

### **Positive results**

In the event of a positive result, the laboratory is advised to notify the state who shall quarantine the farm and supervise additional sampling to verify the result. No further action shall be taken until the positive result has been verified. In the event of a positive result, double the number of recommended samples must be taken for salmonella detection. In the event of a second sample being negative, a third sample must be taken. In the event of a third sample being negative, the quarantine is ended.

\* 'flock' means all poultry of the same health status kept on the same premises or in the same enclosure and constituting a single epidemiological unit; in the case of housed poultry, this includes all birds sharing the same airspace.

## Appendix 4 Summary of the samples to be taken for salmonella monitoring

Operation	Type of samples	Frequency	Number of samples
<b>Breeders GP and parents before lay</b>	Chick box liners	On arrival	5 x liners in 1 pool per hatch
	Mortalities (GP)	Frozen and take after 1 week	Organs from 10 chicks per day pooled (7 samples)
	House samples	Once every 4 weeks	2 pairs of boot swabs (not pooled)
			2 dust swabs (walls lights fans)
	Feed	Once every 4 weeks	500g
Staff	monthly	Faecal swabs(see department of health)	
<b>Breeders during lay</b>	House samples	Once every 4 weeks	2 x pairs of boot swabs (steri-boots) not pooled 2 x dust swabs / samples taken from walls, lights, fans (not pooled)
	Feed		500g
	Staff	Once per month	Faecal swabs (see dept of health)
<b>Hatchery</b>	Chick box liners	Every 2 weeks	5 chick box liners in 1 pool per flock of origin
	Dust swabs	Every week	Air handling units, Drains, Egg transfer machine, Chick take-off and carousels
	Water	weekly	source
	Staff	Once per month	Faecal swabs (see dept of health)
<b>Commercial layers caged</b>	Chick box liners	On arrival	5 x liners in 1 pool per hatch
	House samples	4 and 16 24 40 55 weeks	samples taken on the manure belt x2(caged) , 1xdust swab from the floor, 1x dust swab from the wals, lights, fans
	Feed samples		500g
<b>Commercial floor</b>	Chick box liners	On arrival	5 x liners in 1 pool per hatch
	House samples	4 and 16 24 40 55 weeks	2 x pairs of boot swabs (steri-boots) (2 x analyses) and 2 x dust swabs / samples taken from walls, lights, fans (2 x analyses)
	Feed samples		500g
<b>Broilers</b>	House samples	Each site 3 weeks prior to slaughter	1x pair of bootswabs per house pooled to a maximum of 5 houses

<b>Abattoir and cutting plant</b>	Neck skin samples	Once a week	3 x pools of 5 collected randomly
<b>Pack Station</b>	Egg pulp	Once per month	100ml sample from a pool of 150 cracked eggs/"leakers" of every commercial laying farm supplying eggs