Salmonella Enteritidis Operational Response Plan

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Foreword

This project was conducted to develop a more prescriptive and applied response plan and thus the "*Salmonella* Enteritidis Operational Response Plan", which will replace the preceding Australian Eggs "*Salmonella* Enteritidis Response Plan" 2017. The new operational plan will provide in effect the Standard Operating Procedures (SOP) and Work Instructions (WI) for the industry to implement, in an attempt at achieving the containment and eradication of future *Salmonella* Enteritidis outbreaks.

This project was funded from industry revenue which is matched by funds provided by the Australian Government.

This report is an addition to Australian Eggs Limited's range of peer reviewed research publications and an output of our R&D program, which aims to support improved efficiency, sustainability, product quality, education and technology transfer in the Australian egg industry.

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About the Author

Peter Scott is Managing Director of Scolexia and has more than 30 years' experience in the Australian poultry industry as a veterinary pathologist, veterinarian, researcher and member of egg industry R&D committees. He has successfully completed many projects for Australian Eggs and other industry organisations.

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Abbreviations

ACCC	Australian Competition and Consumer Commission
AI	Avian influenza
AE	Australian Eggs Limited
AECL	Australian Egg Corporation Limited
APVMA	Australian Pesticides and Veterinary Medicines Authority
cfm	Cubic feet per minute
CRC	Cooperative Research Centre
CVO	Chief Veterinary Officer
CWD	Clean-up, wash down and disinfection
DPI	Department of Primary Industries
EAD	Emergency Animal Disease
EADRA	Emergency Animal Disease Response Agreement
EIRDC	Egg Industry Research and Development Council
ELISA	Enzyme-linked immunosorbent assay
EPA	Environment Protection Authority
ESA	Egg Standards Australia
IC	In contact
IP	Infected property
LEP	Liquid egg processing
MSDS	Material Safety Data Sheets
NATA	National Association of Testing Authorities, Australia
NDV	Newcastle Disease
NSEMAP	National *Salmonella* Enteritidis Monitoring & Accreditation Program Guidelines
OH&S	Occupational Health and Safety
OPP	Ortho-phenylphenol
PCR	Polymerase chain reaction
POL	Point of lay
QN	Quarantine Notice
RIRDC	Rural Industries Research and Development Corporation
SE	*Salmonella* Enteritidis
SEORP	*Salmonella* Enteritidis Operational Response Plan
SOP	Standard operating procedures
TDS	Total dissolved solids
WI	Work instructions

Executive Summary

A more prescriptive and applied response plan and thus the "*Salmonella* Enteritidis Operational Response Plan" will replace the preceding Australian Eggs "*Salmonella* Enteritidis Response Plan" 2017. The new operational plan will provide in effect the Standard Operating Procedures (SOP) and Work Instructions (WI) for the industry to implement in an attempt at achieving the containment and eradication of future *Salmonella* Enteritidis outbreaks.

The aim of this project is to produce an operational response plan that can be used by industry and government as a working document.

The foundation of this plan is to:

- rapidly identify and contain the infection on infected farms;
- recall and destroy, or divert to processing, any potentially contaminated eggs;
- rapidly determine the extent of infection in the industry; and
- eliminate the infection from infected farms.

1 Introduction

1.1 *Salmonella* Enteritidis (SE)

In a report for AECL (formally EIRDC) in 2003 entitled *"Salmonella* Enteritidis surveillance and options for the Australia egg industry" (RIRDC Project No. AUV-1A), the lead statement was:

> *The Australian egg industry is currently considered to be free of Salmonella Enteritidis (SE), a significant cause of human food poisoning in many countries. However, the potential cost to the community and to the egg industry, should it become established in Australia, is very high. This project was undertaken to assist the egg industry to develop a national policy on SE, including options for surveillance to ensure early detection and recommendations on the appropriate response to contain and eradicate infections should they occur. Full implementation of the recommendations in this report will depend on extensive consultation between the AEIA (now Australian Eggs), layer-breeder companies, egg producer representatives, Animal Health Australia and Governments to develop a truly national approach to SE preparedness and response in Australia.*

At the time of writing this current *Salmonella* Enteritidis (SE) Operational Response Plan, the SE status of Australia has changed.

In May 2018 there was an increased incidence of SE human food poisoning cases in the Sydney region of NSW that epidemiologically were not typical of being acquired during overseas travel. The source of contamination was traced to table eggs being supplied domestically by an egg producer located in an outer suburb of Sydney (IP1).

The strain of SE, on typing and genomic analysis, had never before been recognised within Australia or internationally. Subsequent to the identification of this original SE source through both active and passive surveillance, a number of other commercial layer properties were identified in NSW and Victoria to be positive for the same SE strain. In all cases SE positive properties had horizontal contacts which included adjacent farms, egg and vehicular movements, and packing/grading floors. These properties were of all system types including cage, barn, free range and organic.

What was evident from the initial investigation by the responsible authorities was a high incidence of noncompliance associated with egg handling and traceability, and overall substandard biosecurity practices.

As a consequence of this the NSW DPI issued a Biosecurity (*Salmonella* Enteritidis) Control Order 2019 to assist in the management of the biosecurity risk posed by the spread of SE. The Order commenced on 1 August 2019. The Control Order was updated in 2020 to include mandatory testing for SE at licensed egg premises in NSW. Further background to the SE outbreak can be viewed at https://www.dpi.nsw.gov.au/animals-and-livestock/poultry-and-birds/health-disease/salmonella-enteritidis.

Prior to this outbreak, the Australian egg industry did not have state or national policies on SE and neither did the various government jurisdictions have a formalised response program. Attempts were made to have SE covered under the Government and Livestock Industry Cost Sharing Deed in Respect of Emergency Animal Disease (also known as the Emergency Animal Disease Response Agreement or EADRA), as is the case with Newcastle Disease (ND) and Avian Influenza (AI). This was recommended in the 2003 report and by the Victorian *Salmonella* Action Group, however this has not been

implemented and while SE is a notifiable disease in Australia, there was no formal response plan (like an AUSVETPLAN) in the event of its incursion into a commercial poultry flock. In addition, not being part of the EADRA means that while quarantine can be imposed there was no nationally agreed formal mandated response for depopulation and eradication funded through the EADRA cost-sharing arrangement. This does not preclude the consideration of compensation within an affected jurisdiction.

The report in 2003 concluded,

> *Despite the potential impact of SE if it became established in egg-laying flocks, it is not included in the new cost-sharing arrangements for emergency animal diseases in Australia. Without inclusion of SE in this agreement, any costs of control or eradication of SE in infected poultry flocks remains the responsibility of the industry or State/Territory Government initiating the response. In addition, there is no national agreement or structure under which to manage the response to the detection of SE in poultry, adding to uncertainty for egg producers*.

As a consequence of this absence of an SE Response Plan, Australian Eggs Limited (AE) commissioned the development of the "*Salmonella* Enteritidis Response Plan" published in June 2017. It was this plan that was used by the state responsible authorities as a foundation guide for their SE response activities during the 2018–2019 outbreak.

Australia does have a voluntary national SE accreditation program - the National *Salmonella* Enteritidis Monitoring & Accreditation Program (NSEMAP) that is coordinated through the NSW DPI with the take-up of this program by both the chicken meat and egg layer sectors. This is particularly to assist them in meeting export requirements into some countries and particularly Singapore where poultry imports are only allowed where there is evidence of a government-based SE accreditation program.

As there are no expectations that SE will become recognised as an EAD by the Commonwealth and have a formalised response program under EADRA, the poultry industry, State governments and the Commonwealth are aware of the need for national coordination and documentation regarding a *Salmonella* Enteritidis Response Plan, as well as the necessary legislative framework to allow the implementation of this response plan. The different state jurisdictional structures around food safety legislation will require modification for the adaptation of such a national program in each state. In order to entrench the fundamentals of the response plan in each of the states, a legislated biosecurity and food safety frameworks will be required.

National and State government programs are being based on existing legislation, particularly relating to biosecurity, and will be generic in nature. It is necessary for AE to develop a more prescriptive and applied response plan and thus the "*Salmonella* Enteritidis Operational Response Plan", which will replace the preceding AE "*Salmonella* Enteritidis Response Plan" 2017. The new operational response plan will in effect provide the Standard Operating Procedures (SOP) and Work Instructions (WI) for the industry to implement in an attempt at achieving the containment and eradication of future SE outbreaks.

1.2 SE in commercial layers

Among the greater than 2,500 known *Salmonella* serotypes, *S. enterica* subsp. *enterica* serovar Enteritidis is one of the most commonly reported causes of human salmonellosis in most industrialised countries. Shelled eggs were a major vehicle for transmission (Deng et. al, 2014). The observations today are still consistent with those of Hogue et. al in 1997 who reported that more effort is needed to control SE at every stage of the egg continuum, from production through to consumption. A risk-reduction

approach, with barriers to the introduction and multiplication of the pathogen throughout the farm-to-table continuum is the most practical method for reducing human illness from SE in shell eggs at present. An effective long-term solution will require interdisciplinary efforts involving government, industry, consumers, and academics.

Like paratyphoid *Salmonella*, SE can enter the egg through faecal contamination of the shell, but SE can also contaminate the internals of the egg via the ovum or a 'vertical' route, although the ability of SE strains to do the latter vary. The control of dirty eggs alone will not provide mitigation against eggs being contaminated with SE. Thus, unlike with current Australian salmonella, e.g. *S.* Typhimurium, layers infected with SE can produce internally contaminated eggs despite having clean and intact shells.

SE, under the O antigen classification, belongs to *Salmonella* Group D, unlike *S.* Typhimurium which belongs to Group B. While there are other salmonellae belonging to Group D other than SE, the rapid O antigen grouping test allows an early indication of a possible SE isolation until more detailed typing excludes or confirms its presence. There is also available an ELISA Group D test that can act as a rapid flock screen. The ELISA test is not specific for SE but all Group D salmonellae, and thus confirmation would require microbiological isolation and genomic characterisation.

Final confirmation is now normally being achieved by polymerase chain reaction (PCR)[1] preceding other biochemical or genomic tests. For more information on SE the readers of this report can review the copious amount of material on the web or other peer reviewed literature.

1.3 Industry *Salmonella* monitoring

A significant percentage of the Australian layer industry is involved in the regular monitoring of *Salmonella* either through NSEMAP (https://www.dpi.nsw.gov.au/animals-and-livestock/poultry-and-birds/health-disease/national-salmonella-enteritidis-monitoring-and-accreditation-program), independently, or because of the compliance requirements of food safety authorities.

Based on bird numbers, it is estimated that about 85% of Australian layers are currently subject to *Salmonella* monitoring. All results under the NSEMAP are available for viewing by the scheme administrator and the CVO of the state of origin of the monitoring samples. Under any formal or informal monitoring program all positive results are referred to the *Salmonella* reference laboratories and thus by default are available to government. Environmental monitoring is not selective just for SE but isolates and identifies all salmonellae types.

The type of housing and bird type covered by this monitoring includes cage, barn, layer, caravan and organic in all states. It does not capture the nonaligned producers[2].

[1] **PCR**: DNA Polymerase Chain Reaction. A genomic test for identifying unique DNA sequences.

[2] **Nonaligned producers**: these are egg layer producers that do not normally participate or interact in any formal Quality Assurance program whether this be industry or retailer based.

2 Industry SE Operational Response Plan (SEORP)

2.1 Industry SE Operational Response Plan

The aim of this project is to produce an operational response plan that can be used by industry and government as a working document.

The foundation of this plan is consistent with the recommendations of the RIRDC report in 2003, and its objectives are to:

- rapidly identify and contain the infection on infected farms;
- recall and destroy, or divert to processing, any potentially contaminated eggs;
- rapidly determine the extent of infection in the industry; and
- eliminate the infection from infected farms.

3 SE incidence/identification

3.1 SE food poisoning outbreak (cluster of cases or incident notification)

At this stage it will be necessary for the responsible food authority/health department/agriculture department to undertake epidemiological investigations as to the possible sources of the SE.

- SE strain and the history of international travel indicates infection acquired overseas.
- Trace back to food source other than eggs.
- Trace back to eggs or egg product.

3.2 SE food poisoning outbreak traced to egg laying farm

At this stage, the epidemiological investigations undertaken by the responsible State authorities have established at least a highly probable linkage between the food poisoning cases and eggs/egg product suppled from a particular source/infected property (IP).

Detailed below is an outline of the activities conducted under the SEORP; the specific details and explanations are covered in **Section 4** of this report.

Response Activities

Impose a Quarantine Notice (QN) (**Section 4.1**) on the farm restricting the movement of all livestock, eggs, feed, manure, equipment/hardware and disposables for a period as determined by the Chief Veterinary Officer (CVO).

- Extensive monitoring (**Section 6**) is undertaken of the suspect site in an attempt to isolate SE and includes shed and litter/manure environmental swabs, pulped, cracked and dirty eggs, packer/grading floor, transport vehicles, rodent stations and fomites.
- On recovering an SE from the farm site further ancillary laboratory testing including typing and genomic analysis is undertaken to confirm the linkage of the SE isolate between the food poisoning cases and eggs/egg product
- Traceability (**Section 4.2**) commences on all eggs on the site with enhanced traceability of eggs from the positive shed/entire farm site. Plus traceability on movements of people, equipment etc .
- Voluntary recall (**Section 4.2**) of all eggs from the positive shed/entire farm site.
    - If required this recall can be enforced by the responsible food authority, health department or CVO as per the legislation in each particular jurisdiction.
    - If the husbandry and egg handling on the farm is not best practice the Food Authority can request all eggs from the farm site and high-risk contact sites are recalled.
- Eggs from all the sheds on the site sent for pulping and pasteurisation in a secure manner (**Section 4.3**) and at a destination site approved by the CVO. Movements by permit.
- Any birds leaving the site to be killed by mass destruction (**Section 4.4**) and rendered or buried under a secure transportation protocol at authorised site/s as determined by the CVO and relevant responsible authority. Permit required.
- Only secure vehicular movements are permitted.
- Washing and disinfection of all in contact equipment and vehicles (**Section 4.4.4**)

- Secure waste removal of disposable material. Permit required.

- Undertake an epidemiological investigation.
  - This may involve the microbiological testing of staff (by Health if agreed).
  - Farm history including source of any livestock onto the farm or eggs onto the grading floor.
  - Assessment of biosecurity procedures.

3.3 Isolation of SE from an egg laying farm during passive surveillance

There will be no specific response to the isolation of a Group D salmonellae other than the precautionary actions for any *Salmonella* of a high-risk consideration. This would involve the enhanced traceability of the eggs from the suspect donor flock, and the pre-emptive decision of the producer or authority of containment of the eggs until confirmation of freedom from SE. All such findings of Group D salmonellae should be expedited by ancillary laboratory tests such as SE specific PCR and/or through reference laboratories for confirmatory characterisation.

It is noted that private laboratories will often have a confirmatory result back about the status of the farm in a shorter timeline than the regulator. When the preliminary result is negative, this delay can cause extended business disruption times for the producer who has to wait for the 'official' response to come back from the regulator.

Any positive SE identified by a private laboratory is mandatorily reported to the state CVO.

3.4 Laboratory confirmation of SE

Currently most private laboratories have the capability, via a number of technologies, to confirm if a strain of *Salmonella* is SE before confirmation by one of the *Salmonella* reference laboratories. While there are some legislative requirements for the CVO to have the SE officially confirmed by culture and to place the farm under quarantine to manage the biosecurity risk, the egg producer is required under the SEORP to immediately quarantine the site.

It is to be recognised that the positive environmental status of a farm does not automatically mean that the layers are positive, or the farm is producing eggs that are positive for SE.

Limited environmental positive SE isolations from the rodent bait stations, grading floor and/or amenities may and can exist without the layers being positive or contributing to any significant numbers of eggs being positive for SE internally.

The National SE Response Plan provided the following case definitions:

1a. A flock is **infected** with *Salmonella* Enteritidis when:
   i. *Salmonella* Enteritidis has been detected by culture in bird(s) OR
   ii. *Salmonella* Enteritidis has been detected by culture in environmental sample(s) from poultry manure, eggs or swabs collected from the housing/range area.

1b. A flock is **potentially infected** with *Salmonella* Enteritidis when:
   i. *Salmonella* Enteritidis has been detected by PCR(s) OR
   ii. *Salmonella* Enteritidis has been detected by PCR(s) from poultry manure, eggs or swabs collected from the housing/range area.

Follow up actions:

- Undertake extensive environmental monitoring of the manure/deep litter in all sheds. Repeat two weeks apart.
- Clean and disinfect rodent bait stations and increase baiting activity.
- Clean and disinfect grading floor and amenities.
- Undertake further SE monitoring of previously positive sites. All sheds.
  - Sample multiple external egg-shell surfaces using a 3M applicator swab. The actual statistical quantitative numbers of egg surfaces to be covered is dependent on the incidence of SE infection on-farm, which is unknown at the time of testing. To optimise the likelihood of SE detection, the following approach is recommended:
    - As shelled eggs in fillers are stacked on pallets, two rows during stacking are entirely surface swabbed with 3M swabs; the same swab can be used for the entire pallet.
    - If the pallet contains eggs from a number of sheds this needs to be recognised, as otherwise shed traceability will be compromised and not possible.
    - As all eggs contact the egg belt, packing table and anaconda, the 3M surface swabbing (or equivalent) of these surfaces will be a sensitive detection of the presence of SE.
    - Where there is a grader present on-site, swabbing multiple surfaces of the grader will also provide an additional sensitive detection method for SE.
- Undertake microbiological testing of pulped, cracked and dirty eggs from all sheds.
  - This will provide an assessment of the likelihood of egg contamination.
- Demonstrate SE positive status or proof of freedom.

The finding of SE on internal shed infrastructure, slats, deep litter, manure, and facilities such as egg and manure belts though is highly indicative of the status of the laying birds being positive for SE. The farm site and birds are now considered positive for SE, and the state CVO will take action under their legislation to manage the biosecurity risk,, and the site is classified as an Infected Property (IP).

Follow up actions:

- Repeat with more extensive environmental monitoring.
- Undertake 3M surface swabs of large numbers of eggshells.
  - Positive status confirms layer SE shedding.
- Undertake microbiological monitoring of pulped cracked and dirty eggs.
  - Repeat in two (2) weeks.
  - A negative result indicates that the level of internal egg contamination is negative or low.
  - A positive result indicates that the level of internal egg contamination is moderate to high.
- These findings will impact on actions around traceability and recalls.

4 Operational activities of the SEORP

4.1 Quarantine[3]

Once a site has been quarantined either voluntarily or under appropriate state government legislation, through implementation by the State CVO, then all movements (in and out) of livestock, products, vehicles, personnel, waste, equipment, etc, become restricted and can only occur with written authority of the regulator.

A Quarantine Notice (QN), or an appropriate State government equivalent, is an Order that is normally implemented by a Department of Agriculture Stock Inspector and details the 'quarantined area', which is typically identified by the Shire, Parish, Allotments and Address. The notice details the prohibitions and restrictions regarding movements. It is an offence under the Act for a person to contravene any provision of the QN. This includes, for example, that a person must not without written authority remove from a quarantine area any livestock products, fodder or fittings, or any soil, sand or any other material. These notices are normally directed at the employee who legislatively is seen as the responsible entity to ensure compliance with the QN (or an appropriate State government equivalent) this could be the site manager, company director or owner. Penalties may be imposed, including imprisonment for those who deliberately contravene the Order.

It is expected that site managers may come under pressure from a number of entities to contravene or not be compliant with the QN (or an appropriate State government equivalent). This can arise for the following reasons:

- commercial pressures to maintain business continuity
- senior management/owner directions
- a belief that the QN (or an appropriate State government equivalent) is an unfair and unnecessary impediment to the business
- a cultural non-acceptance of authorities and regulation
- an uninformed knowledge of what constitutes quarantine
- misguided good intentions
- financial incentive
- poor communications between management, staff, contractors and clients.

The above dots points are adapted from actual reasons given for QN (or an appropriate State government equivalent) contravention. Responsible site mangers are to ensure that they are aware of their obligations and seek support from responsible industry members when subjected to any of the above.

There is also the overall responsibility to the poultry industry as a whole, in order to protect and ensure its long-term favoured status and sustainability.

Where site managers believe they are not adequately capable in liaising with regulators and completing the necessary paperwork, which can be arduous, it is important that they seek support within their organisation or appointees who are familiar with the process.

[3] **Quarantine**: Isolation of animals and infected premises to control the spread of disease.

Because there is normally both industry and community awareness of notifiable disease events and the implementation of a QN (or an appropriate State government equivalent), it may be necessary for the site manager also to seek the support of someone who can act in the role of public liaison officer. This is particularly important to ensure that the correct messages are provided to the public and clients with consideration of returning to normal business.

Actions: Farm sites quarantined for a positive status of SE must be compliant with the QN (or the appropriate State government equivalent) and seek the necessary support and direction to ensure the QN (or the appropriate State government equivalent) is enabled effectively and with the best practice understandings of biosecurity.

4.2 Recalls and traceability

4.2.1 Egg and egg product recalls

Egg and egg product recalls are aimed at mitigating ongoing or potential food safety episodes attributable to an SE infected farm site. Recalls can be voluntary where a producer believes it is in the best interests of the business and is good risk assessment, or they can be directed by the responsible food authority or health department.

Such recalls are carefully considered with regards to the seriousness of an existing outbreak, the practicality of what can be achieved, specific traceability to the destination of the marketed eggs, and the findings on the infected farm in respect of the level and duration of SE infection, and the on-farm monitored status of eggs.

Regulators are generally aware of the negative impact that a recall has on a business and the industry overall, and thus a mutually cooperative approach will have a better outcome than a confrontational approach. Where authorities lack confidence in the information provided by a producer and where they encounter uncooperative attitudinal behaviour, it is more likely that the regulator will undertake a more conservative and risk minimisation recall.

Where there are good records of egg movements, the regulator may allow a withdrawal or trade recall to achieve a minimal impact on the business but still allow the regulator to have confidence in limiting the risk of a food safety episode. Where there is limited traceability as to where the eggs are sold and to what clients, and this particularly applies to the farmer's market sales, the regulators may have no other option than to specifically name the producer in a full branded and public notice recall. Additional media statements may be released by a regulator to assist with protection of public health.

Actions: Recalls are to enable the mitigation of an ongoing food safety event or to prevent one occurring. The effectiveness of a recall, and the minimisation of its impact on the operation of the business, is dependent on identification of the potentially infected eggs and their point of sale destination(s).

4.2.2 Traceability

One of the most important factors involved in the identification of SE on-site due to a food safety trace back or passive surveillance, is the containment of the infection to the original site. This containment is firstly dependent on sound and effective biosecurity.

The other pivotal control point is the traceability of egg and egg product movements. It was these relatively uncontrolled movements that resulted, through various horizontal contacts, in the spread

of the Australian SE strain on IP1 to multiple farms in NSW and Victoria during the 2018 and 2019 outbreak. The containment of an infectious disease is impeded by the failure to adequately, and in a timely manner, identify through traceability In Contact (IC) premises that may be potential new IP.

For commercial reasons, the egg industry has a complex web of egg movements that food safety regulators and epidemiologists have to deal with when addressing egg related food poisoning outbreaks. Egg producers who only maintain limited records of production numbers and sales details limit the ability to properly trace and contain the spread of an infectious agent like SE.

The reasons that traceability can be difficult in some areas of the egg industry include:

- egg stamping not done properly
- the failure to identify eggs correctly, or at all, as to their origin point of lay
- the sale of unlabelled 'B Grade' eggs into the food catering sector
- minimal or no record keeping as to egg production numbers from a site and/or different production systems on a site
- Undocumented/poorly recorded movement of eggs (labelled and unlabelled) from multiple sources into egg distributors.
- movement of eggs into central grading floors used by other producers, with limited or incorrect traceability and egg identification
- buying of (often unstamped) eggs on the open market and repacking in third party cartons
- labelling or identification of eggs not consistent with the production system in which they were produced
- pulping of 'B Grade' eggs from multiple sources, producing egg product of uncertain origin
- cash egg box market and/or door sales without any records
- swapping of eggs between producers to limit the traceability of production systems.
- sale of spent hens to traders and the general public without keeping any records.

The dot points above are also adapted from actual egg industry marketing and sales practices, which make effective traceability difficult for regulators and hinder the containment of the spread of infectious disease, in this case SE food poisoning outbreaks.

These factors make it necessary for regulatory authorities to implement existing legislation or Orders, to allow access to farms in order to undertake active surveillance. This is a time consuming, costly and highly resource dependent activity. Instead of containment and eradication there is the potential for SE to become endemic, as seen internationally in the majority of countries. For Australia, this loss of SE negative status would increase production costs, necessitate a change in the handling of egg storage conditions, and reduce some of our export advantages.

Action: Producers to keep good records of production, sales, visitor logs and stamp all eggs properly to enable regulators to trace movements of contaminated eggs and infected birds in a timely manner

4.2.3 Requirements

It is required that egg producers keep detailed records of the following:

- bird numbers and hen housed production figures for each house[4]
- identification of production system for each house
- traceability of eggs from the house to the grading floor
- all eggs as required by legislation are to be stamped (labelled) with the identification of the production house in which the eggs were produced
- eggs being graded at a central location with multiple house/producer inputs are to have a system in place so that eggs can be identified as to their site and house of origin
- egg cartons are to be labelled consistent with their contents
- graded eggs supplied to egg distributers are to be labelled with the farm of origin if to be packed for the shelled egg market
- unlabelled eggs supplied to egg distributers are to maintain traceability if on sold to a third party for grading and packing, and must have a stamp consistent with the farm source of eggs
- unlabelled and ungraded 'B Grade' eggs for pulping are to maintain traceability until at the destination of the Liquid Egg Processing (LEP) plant
- all shell egg sales, both carton and box market, are to be documented and recorded with a delivery docket containing information detailing the source of eggs and the destination
- all 'B Grade' eggs for pulping and pasteurisation or supplied to caterers (where treatment by an equivalent process to pasteurisation is mandated) must be recorded with a sales docket.
- maintain records of all spent hens sold and their destination.

It is a requirement for auditors and regulators to:

- request records detailing bird numbers and hen housed production figures
- confirm housing system and facilitation is consistent with label claims
- request records of all egg sales and reconcile with on-farm stocks and production records (or, in lieu of these, layer numbers)
- review grading floor traceability of input eggs, consistency of egg stamping with site of origin and the stamping of all graded and packed eggs
- ensure that the historical movement of potentially contaminated shell eggs and egg products is obtained to identify high risk IC properties.
- Ensure that the historical movements of potentially infected spent hens is obtained to identify high risk IC properties

The above requirements are essential to enable best practice in regard to egg and egg product traceability and the movement of potentially infected spent hens, and to ensure the timely and efficient identification of potentially infected eggs and hens and their containment.

1. During an audit by regulators of an IC site or site under a QN (or the appropriate State government equivalent) the failure to provide accurate records and the full disclosure of all egg movements should result in a QN (or the appropriate State government equivalent) being immediately applied to the IC? site, and for an existing QN (or the appropriate State government equivalent) site to have increased surveillance and a contravention notice served.

2. Where incidental findings of a breach of the Truth of Labelling legislation are identified the matter should be referred to the Australian Competition and Consumer Commission (ACCC).

[4] **House**: where there are a number of adjacent houses of similar age birds and production systems, these can be linked as a single unit; and will be treated as a single unit under a disease investigation.

Points 1 and 2 above: Egg producers who are Australian Eggs members and/or Egg Standards of Australia certified should show cause why their membership and/or certification should not be revoked.

Actions:

- Producers are required to have a formalised recall procedure in place and to be implemented voluntarily or as directed, to reduce the risk of contaminated eggs entering the community.
- Producers are required to keep layer production records, meet the compliance requirements for egg labelling, and maintain records of egg sales and movements.
- Traceability of egg movements should include historical movements from the IP to identify high risk IC properties.
- Producers should keep records of spent hens sold, for a better traceability.

4.3 Secure movements of eggs, egg product, waste and materials

Under a QN (or an appropriate State government equivalent) movements from the IP site can only occur under permit with written approval incorporating conditions. The common things that are involved are shell eggs, feed, normal domestic waste, poultry waste including litter and manure, carcases of culled birds and personnel.

4.4 Farm depopulation

Under the SEORP it is a requirement for IP's to be depopulated of laying stock. As SE is not covered under an EADRP cost sharing agreement there is no compensation for the stock or associated depopulation costs. In some states the responsible authorities can enforce the destruction of stock. The movement and outcomes of eggs and material leaving the farm site can be enforced through the QN (or an appropriate State government equivalent).

For birds to remain on an IP site is not allowed under the AE SEORP, as it would formally remain a positive SE status and potentially provide a source of SE infection through horizontal contacts such as rodents, flies, dust, aerosols and potentially noncompliance activity to the rest of the Australian poultry industry.

It is recognised that situations may arise where the IP may not be a member of AE. Due to financial limitations or attempts to seek financial support, an IP may not be able to depopulate the farm. It is pivotal under these situations that AE, industry and government look for expedient and pragmatic outcomes.

4.4.1 Depopulation methodology

As the layers from the IP farm cannot be processed for meat, the only option is mass destruction. For small numbers of birds this can be undertaken by cervical dislocation and for large numbers of birds using carbon dioxide (or equivalent) mass destruction. The Poultry Cooperative Research Centre (CRC) publication – Development and Extension of Best Practice for On-Farm Euthanasia of Spent Layer Hens (2015) – provides the necessary guidelines.

Site managers are to be aware of the sensitivities of some personnel when undertaking mass euthanasia and are to provide support where required.

4.4.2 Depopulation logistics

To undertake the logistics of mass destruction the following requirements need to be considered:

- supervisors and experienced personnel who have been inducted in the procedure
- suitable equipment
- secure vehicles for dead bird removal
- an approved disposal site.

4.4.3 Experienced personnel

In the intensive animal industry there are significant shortages of workers, in particular those involved in the demanding activities involving wash down, vaccination and depopulation crews. As a consequence of this, crews often work with a number of companies. In the case of an EAD or notifiable disease, poultry industry members are concerned about biosecurity and the horizontal contacts of working crews. This results in conflicts where crews may lose their contract status with clients if they participate in activity involving IP sites.

The challenge of getting experienced crews for depopulating IP sites can be significant. There is a need for industry cooperation and support in such situations, and to establish procedures that provide confidence to industry members. This involves the establishment of contract agreement conditions and work instructions that enable the necessary experienced or supervised workers to undertake mass euthanasia in a bio-secure manner while maintaining the animal welfare code. The contract for such an agreement should include the following provisions:

- All workers have been inducted in the mass euthanasia procedure by a qualified person.
- All workers have been mentored and inducted on the principles of biosecurity.
- The worker crew is designated only to work on the IP site for the required period.
- Optimally there are shower facilities for shower on and off
  - if shower facilities are not available, then there needs to be a change into site protective clothing and footwear, only to be used on the farm site.
- Workers outside of work hours are to ensure that they have no contact with other poultry workers (including family members) unless they have showered and changed into clean clothing and footwear
  - for crew workers undertaking the activity at a distant locality, designated housing should be arranged.
- Vehicles being used by the contractor crew are to be parked off the site but are still to be considered as contaminated vehicles, particularly when used by workers operating on sites without shower facilities.
- After completing the required works, workers are to stand down for a minimum of 72 hours (3 sleeps) before undertaking work on another poultry site. Organisations will have their own stand down times that may exceed this. It is important to appreciate though that time is not the only factor, and that all ancillary items associated with personnel must also be considered – including clothing, vehicles, tools and sundry personal items. All clothing needs to be securely laundered, and footwear manually cleaned and disinfected.

One issue to consider when looking for available staffing resources is that the personnel obtained may be inexperienced and lack the necessary aptitude and ethos for the job. This can result in worker conflict on the site and also a breach of animal welfare codes. It is mandatory that procedures are in place to ensure such activities are supervised at all stages.

This can be further complicated by the involvement of animal activists particularly when there is publicity about the farm site and business involved.

4.4.4 Equipment

During the process of a mass euthanasia, equipment needs to be brought on to the farm. It may be necessary to consider options for this equipment for both objective and perceived reasons, the latter being where producers at other sites may be unwilling to accept equipment that has previously been used on an IP.

- Equipment is left on-site and purchased by the processor.
  - Includes bird euthanasia bins, forklifts, technical and ancillary items.
  - Carbon dioxide facilities will need to be returned to the supplier, with approval under the QN (or an appropriate State government equivalent).
- Equipment is detergent-washed and disinfected (and tested for freedom from the infectious agent) on-site before removal to an interim site for a repeat disinfection and storage. Testing for freedom is repeated.
  - Such off-site movements will require approval by the responsible authority while the IP is under a QN (or an appropriate State government equivalent).

4.4.5 Dead birds

Contingencies will be made for the removal of dead birds. As with appointing worker crews, difficulties may be experienced in initially finding external parties willing to accept the dead birds, and then obtaining approval of these sites for bird disposal. Options Include:

- Composting
  - there are a variety of composting methods but whatever one is used must be secure and quarantined, not a horizontal risk contact to other poultry establishments, and achieve operating conditions that inactivate the pathogen, SE, which is validated by microbiological testing.
- Burial is a secure option but will require approval in addition from the Environment Protection Authority (EPA), local council and the catchment authority, particularly to ensure that there is no contamination of the leachate with ground water.
- Movement to landfill approved by the regulator.
- Rendering is a preferred method but will depend on the acceptability of the plant processor/owner to experience business interruption while handling and treating mortalities from the IP.

4.4.6 Cartage vehicles

Cartage vehicles will be required to meet strict conditions regarding biosecurity, routes taken, restrictions on carting other materials, and supervised wash down and disinfection procedures.

Drivers will work under the same conditions as contractor crews.

Actions: Mass euthanasia of layers must be supervised by individuals and crew members inducted in the procedure as outlined in the AE Development and Extension of Best Practice for On-Farm Euthanasia of Spent Layer Hens, 2015, and consistent with the Code of Animal Welfare. Contingencies will be required for equipment and disposables.

Industry cooperation is required to facilitate the employment of experienced contractor crews who work under prescriptive conditions involving biosecurity and animal welfare.

The disposal of layers also requires industry and third-party cooperation in their transportation to a secure and appropriate facility.

5 Farm clean-up, wash down and disinfection[5] (CWD)

The aim of a farm clean-up, wash down and disinfection (CWD)[6] is to eliminate the presence of SE entirely from the farm site. Awareness of the numerical quantity of *Salmonella* organisms contaminating the site and infrastructure, and the bacteria's ability to sustain itself within the environment for long periods of time makes its eradication difficult.

The concurrent probable contamination of passive carrier hosts such as rodents (mice and rats), foxes, wild birds, flies, litter beetles, avian ectoparasites, environmental invertebrates, and domestic livestock and pets further adds to the complexity of eradication of SE. This is particularly the case recognising that many of these passive hosts are mobile and may move from the site to where they are not subject to identification and treatment, before returning back to the farm site at a later stage. Farm personnel should also be considered as a potential source of recontamination or a new *Salmonella* contamination, an aspect that elite breeder companies consider seriously and require *Salmonella* monitoring of staff and visitors working with poultry.

The likelihood of the failure to eradicate SE from a site should be considered as a significant possibility and thus, before monies are spent in repopulating the farm, a risk assessment should be undertaken evaluating the commercial aspects. This would in particular apply to older cage facilities, modified and upgraded broiler farms used as egg layer facilities, or where the layer population is small and there is the option for alternative clean egg layer production sites.

5.1 Gross dry clean-up

This involves the removal of manure, litter and other fomites[7] associated with the farm operation. It will also involve the removal of materials that cannot be adequately cleaned and disinfected with confidence, which may include packing material, feed and other supplementary items that are made of perishable material. Facilitation like paper-based evaporative cooling pads should also be removed and disposed of particularly if their useful life is well advanced, as these are difficult to clean and disinfect.

The removal of all the above materials will require approval and a permit from the office of the CVO when operating under a QN or an appropriate State government equivalent. It is recognised, as discussed above (**Section 4.3**), that the contingencies for the off-site removal of these materials can provide challenges that require cooperation from industry, government regulatory bodies including

[5] **Disinfection**: is the inactivation and elimination of microbial contamination on inanimate materials, compared to **Sanitation** which is the reduction of microbial contamination/load on animate surfaces.
[6] **CWD**: the reader is referred for further detail to the AE Farm Clean-up, Wash down and Disinfection SOP in the Appendix.
[7] **Fomites**: inanimate objects or materials that are likely to carry infection.

State agricultural departments, food authorities and the EPA.

Experience indicates that after a notifiable disease incident and the displaying of a QN or an appropriate State government equivalent, that the public awareness can result in concerns from neighbouring properties and other sensitive sites. Such concerns can result in complaints to responsible authorities and the impendence of CWD activities on the infected site. It is recommended that farm managers and property owners use the responsible authorities and their own relationships with neighbours to communicate and allay concerns and perceptions about possible health and welfare outcomes.

Activities for both the concerns of neighbours and to limit the spread of the infectious agent within the site should be undertaken with the minimisation of dust and aerosols. Bacteria, when attached to dust particles, are known to be able to travel for great distances. It is important to keep the internals of the sheds as contained a possible, avoid days of high ambient air movements (winds), and use dust suppression methods including the employment of light water wet-down or vegetable or white oils[8].

The generation of odours with the disruption of manure, litter or composted materials may result in initiating neighbour complaints, which are heightened by the concerns about their personal health and wellbeing. Ensuring that these activities are undertaken when wind directions are favourable, when inversion layers are less likely, and not at times when neighbours are home for extended times like evenings and weekends needs to be considered. This should be done in combination with liaising with residents at potential sensitive sites. The EPA and councils are obligated to respond to neighbours' complaints and, despite the affected producer(s) undergoing commercially difficult and stressful times, they are advised to respond in a fair and reasonable, objective manner and not be confrontational. Where producers believe they do not have the temperament and/or technical ability to respond and cope with such objections they are strongly advised to appoint a responsible third party to act as their negotiator.

Operation of noise producing equipment, vehicular and personal movements need also to be undertaken within the conditions of the existing planning permit and in a manner so as to not unfavourably affect the local amenities.

5.2 Wet detergent wash down

It is necessary to remove organic load prior to disinfection if the latter is to be efficient. As well as organic build-up there can be inorganic material with mineral deposits, particularly in facilities that are using bore water with high Total Solids and Total Dissolved Solids (TDS)[9]. The removal of organic material is aided by the inclusion of a detergent in the wash down water, this being by low volume high pressure application. The inclusion of proteases[10] in detergents also aids in the removal of difficult to remove proteinaceous material. For removing mineral deposits from the shed infrastructure and surfaces, an acid detergent is required. While there may be amenity issues with mineral deposits it is unlikely that their presence supports the survival of *Salmonella*.

The effectiveness of the detergent is also enhanced by its application as a foam. This is because there

[8] **White Oil**: any of various highly refined, colourless hydrocarbon oils of low volatility and a wide range of viscosities; used for lubrication of food and textile machinery.

[9] **Total Solids:** is a measure of all suspended, colloidal and dissolved solids in a sample of water. This includes dissolved salts such as sodium chloride, and solid particles such as silt and plankton.
Total Dissolved Solids (TDS) comprise inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides, and sulfates) and some small amounts of organic matter that are dissolved in water.

[10] **Proteases**: an enzyme that breaks down proteins.

is the sustained presence of detergent collapsing on to the surface over time, allowing the active chemicals to access the organic material for an extended period thus enhancing its degradation.

Chemical suppliers will make available the simple equipment and suitable detergent that enable foaming application. As detergents are in their own right an important part of the disinfection program in that they impact on the cell membrane of the microorganism and aid in the removal of any protective organic coat assisting the environmental survivability of *Salmonella*, their inclusion in a decontamination program is essential.

The washing and disinfection of earthen (dirt) shed floors has major limitations in regard to decontamination of poultry pathogens, and this is a significant factor in the poultry industry's moving, where possible, to concrete floors; these are mandated in all new broiler sheds.

When considering the disinfection of the range in free range egg production this has even less plausibility for an approach to pathogen reduction by classical disinfection methodologies.

The approach to *Salmonella* decontamination of earthen floors (dirt) is discussed in **Section 5.4.**

5.3 Disinfection

Disinfection should only commence after all potential cross contaminating material such as litter is removed from the site and all surfaces have been disinfected effectively to remove organic material and biofilm[11]. The surface should be allowed to dry or near dry so that the applied disinfectant will not be diluted, and its efficacy compromised.

There are many disinfectants available and producers will be supplied with copious materials from suppliers promoting the benefits of their particular product. There are limited groups of products that are commercially available and approved for cost effective use. These include the aldehydes, the quaternary ammoniums or QUATS, oxidises, halogens and Virkon™ S[12] (oxone (potassium peroxymonosulfate), sodium dodecylbenzenesulfonate, sulfamic acid, and inorganic buffers).

All the above chemical groups have advantages and disadvantages but in the scope of this document are only considered for their activity against *Salmonella* and, in particular, SE.

- The halogens (in particular sodium hypochlorite (refer Oxidisers below) are effective but provide little residual activity and are only efficacious under conditions of low organic loads. There may be concerns about affecting the deterioration of metal surfaces.
- The aldehydes such as formaldehyde and glutaraldehyde are efficacious under conditions of moderate organic load but their use, particularly of formaldehyde, needs to consider OH&S requirements. Glutaraldehyde is a technically cost-effective disinfectant used widely in the poultry industry.
- Only the third- and fourth generation QUATs are suitable for efficacious use in the poultry industry and producers should be cautious in purchasing lower cost QUATS, which may in fact be the older style less effective first-generation products. They are considered very safe to use and are environmentally friendly as they are rapidly degraded. Their ability to accommodate

[11] **Biofilm**: a community of bacteria and other microorganisms that are embedded in a matrix of material produced by the microorganism.
[12] **Virkon™ S**: a multi-purpose disinfectant. It contains oxone (potassium peroxymonosulfate), sodium dodecylbenzenesulfonate, sulfamic acid, and inorganic buffers. Dupont®

for organic loads is limited although improved with the 3rd and 4th generation combination products.

  - Their activity is synergistically enhanced by the inclusion of biguanide[13].
  - The Trimethoxysily1 QUATS[14] are QUATs with a silane base that attach to the surface and are claimed to provide increased residual activity on the surface to which the disinfectant is applied. Their application is relatively easy, with the advantage that they physically adhere and are bound to the surface.

- Oxidisers[15] or oxidising disinfectants include peracetic acid, hydrogen peroxide, sodium hypochlorite, and also include chlorine dioxide, which is a particularly strong oxidiser with broad microbial activity. While their ability to inactivate microorganisms is good by reacting with the cellular components of the bacteria, their deficiency is that they react with all the associated organic material thus reducing their overall activity. Chlorine dioxide is less affected and can cope with a moderate organic load.
  - Virkon™ S is a well-recognised formulated product that oxidises sulphur bonds in proteins and enzymes disrupting the function of the cell membrane causing rupturing of the cell wall. For its optimal effectiveness organic load should be minimised.
- Other disinfectant product categories are not included because of their cost, unavailability for use in large commercial situations or because they are not considered adequately efficacious against *Salmonella*.

5.4 Earthen/dirt floor *Salmonella* decontamination

The inactivation of microorganisms on dirt floors is limited because of the physical and mechanical nature of the surface, the high organic load and potential mass density of the material to be treated.

Salmonella on dirt floors is protected against inactivation due to a number of reasons:

- its physical protection by the organic material providing a substrate and a moisture level to support its survival
- the presence of its own biofilm
- its penetration depth into the floor avoiding disinfectants and desiccation
- its ability to survive and even replicate at ambient temperatures using available nutrient sources.

Despite these above attributes *Salmonella* can be inactivated over a period of time, meaning days to weeks, on dirt floors using a well-recognised, old methodology. That is by using hydrated lime[16], which can be used as a disinfectant, producing a dry and alkaline environment in which bacteria do not readily survive or multiply. When applied to earthen floors, walkways and around the immediate perimeter of the poultry shed range area it is the most effective product in reducing *Salmonella* contamination compared to normal disinfectants. There are OH&S considerations when handling the product.

Another alternative where there are smaller areas to cover, including concrete floored amenities, grading floors and storage sheds and where there are safe workplace considerations, is using

[13] **Biguanide**: Polyhexamethylene biguanide (PHMB) is a widely used biocide for numerous applications and commonly used as a disinfectant. Its activity is on the bracteal cell membrane.
[14] **Zoono Z-71®**: Silane based molecule with a QUAT.
[15] **Oxidisers**: Oxidising disinfectants attack all cellular material and stop the micro-organism from functioning.
[16] **Hydrated lime**: also called calcium hydroxide and slaked lime, hydrated lime is highly caustic and can burn skin and eyes. It is used in cement and mortar, and to kill various microorganisms and parasites when applied to surfaces and soil.

commercially available powdered products containing chloramine-T combined with mineral sulphates and oxides[17]. These products are relatively low cost and can be purchased in large quantities.

5.5 Vermin, livestock and invertebrate control

5.5.1 Rodents (rats and mice)

The programs instigated must be for the total eradication of any vermin activity on the site. Attractants such as food sources must be removed as well as any potential housing sources for nesting, such as rubble and vegetation, prior to the attempted knockdown of rodent activity.

The use of contactors or in-house trained personnel is not the important consideration but the technical expertise in which the activity is undertaken. This requires a critical appraisal of the vermin involved – rats, mice or both – and the species involved such as *Rattus rattus* and *Rattus norvegicus*, as their behaviours and lifecycles vary. There is a need to establish their tracking movements to decide where to concentrate baits, as uniformly spatially arranging baiting around sheds is erroneous.

Baiting needs to be undertaken within and around the facilities, and also zonally around the property boundaries to stop the ingress of new populations. Baiting can also be undertaken in normally prohibited areas like grading floors and cool rooms. The types of baits to be used should be third-generation anticoagulants and other alternatives such as vitamin D based baits. The critical aspect is the physical form of the bait that ensures there is acceptance of its consumption by the vermin. This will include blocks, soft baits and grains. It may also be necessary to use tracking powders and drinkable bait sources. Traps should also be used concurrently, particularly in elevated positions.

The consideration of pet safety, native fauna and occupational health and safety (OH&S) are of paramount importance in any baiting program.

The failure to reduce or maintain control of rodents to a point of elimination means an immediate total review of the program and not just the 'dogma' approach of a change of baiting material.

5.5.2 Flies

Flies around poultry sheds have been identified to carry SE and thus flies are an important vector for the spread of SE. For the control of 'flies', knowing the species is important because they have different food sources and lifecycles. The common *Musca spp.*, including the common housefly (*Musca domestica*), do breed in poultry litter while other fly species may not.

Generally though, the commonality is they all breed in decomposing vegetation, carcasses and organic matter, as well as in stagnant water and other food sources. So, the major part of a control program is removing all of this type of material off-site and ensuring that it does not reoccur. Thus, an effective fly control program cannot occur until all the poultry litter and manure is removed off-site.

The control of flies is undertaken using four (4) activities:

- Removal of breeding grounds
  - needs to be recognised for each particular fly species.
- Use of fly baits strategically positioned throughout the farming site

[17] An example **Staldren™**: chloramine-T, iron oxide, sodium chloride, calcium carbonate, copper sulphate, ferrous sulphate.

- control the ingress of flies from breeding sites off the property.

- Use of residual surfaces sprays that contain fly attractants
  - provides sustained and rapid knockdown of both residual flies breeding on the site and those originating from off-site.

There are numerous products available on the market and most approved for use in and around poultry and working areas.

- For layer farms in production, the seasonal use of in-feed registered products[18] that control lifecycle development of the fly
  - their early use in the season leads to a significant control of the fly population on the site and, for *Musca domestica* breeding in poultry litter/manure, almost total control.

5.5.3 Livestock and domestic animals

Livestock and domestic animals can be asymptomatic carriers of *Salmonella* and thus they must be removed from the site and prohibited entry. In the case of grazing ruminants that are within the boundaries of the property these will require faecal culture testing prior to approval to remove from the site. It is highly recommended the same should be applied to domestic animals that have frequented the IP.

Fences should be secure to limit livestock entering the property, and feral cats and dogs should be trapped and humanely euthanised. Although it is recognised that the latter are actually a good component of vermin control and thus the proper maintenance on the property. They similarly can be faecally cultured to ensure their negative *Salmonella* status near the conclusion of the farm decontamination program.

5.5.4 Foxes

These need to be controlled using the standard methods of approved control, including baiting and shooting. Permits/licences will or may be required. Keeping foxes outside of the property boundary can prove very difficult unless the correct fencing is used. The most effective fence involves the burying of a lower part of the fencing wire netting and flop-over outward, projecting upper aspect of the fence netting. Where the gates and posts are situated, these need to be securely facilitated and designed to prevent entry.

5.5.5 Wild birds

The control of free flying wild birds is difficult. They key components involved are the removal of attractant vegetation and flora and ensuring that there are no food sources. Removing nesting places and activity through active surveillance, and the limiting of perching and roosting areas are to be undertaken. The latter can be achieved by using secure netting or deterrents such as anti-perch spiking wire or the use of a viscous industrial grease smeared on perching areas.

5.5.6 Litter beetles and avian ectoparasites

Litter beetles (*Alphitobius diaperinus*), lice (*Menopon gallinae*, *Menacanthus stramineus*), and mites (Northern Fowl mite {*Ornithonyssus sylviarum*} and Red Mite {*Dermanyssus gallinae*}), are all potential

[19] **Exzolt™**: Fluralaner, MSD Animal Health

passive hosts of *Salmonella*.

Litter beetles can persist in the infrastructure of the shed and earthen floors for long periods, and the flying stage can spread disease agents around the farm and off-site. Lice and Northern Fowl mites are obligate parasites and cannot live off the host for extended periods, unlike the Red Mite which can live off poultry for many months without a blood meal.

Litter beetle control will be influenced by historical use of insecticides on the site and resistance patterns, and this should be assessed. Control will be more difficult in sheds with spray-on foam insulation and earthen floors. Residual insecticides should be applied after the CWD, ensuring coverage of all the infrastructure and floors. Where there is insulation foam and earthen floors, it will be necessary to heat the shed up in an attempt to establish activity and egress of beetles out of hiding places. Multiple applications of insecticides will be required.

Treatments to eradicate Red Mite from houses will be adequate for lice and Northern Fowl mite. The difficulty is that Red Mites reside in cracks and crevasses within the house and also outside the shed in amenities and other areas where there is debris such as stumps, timber, iron sheets, etc. These latter areas must be cleaned up. The application of residual insecticides is required within and outside the shed and in all amenities areas. Getting chemical access to these hiding mites is difficult as they are only stimulated to leave the hiding place when poultry are available for another blood meal. There is the need for the application of a residual approved insecticide mixed with white oil throughout the infrastructure of the depopulated shed and the use of registered products like Exzolt™ [19] for control of the Red Mite when active on the layer during the production period. It is pivotal to treat the shed facilities' environment where mites are hiding, including during the nymphal stages, to ensure eradication of the Red Mite as we are seeking a qualitative outcome of eradication and not just a quantitative reduction in numbers.

The above treatments will also eliminate other insects that reside in the house. It is important to note that insecticides must be applied after the CWD and that they must not be applied in combination with other chemicals including detergents and disinfectant, as many of these products will impede the activity of the insecticide and also affect its effective concentration. Contractors are to be directed in this sole application of insecticide and are to be supervised for compliance in mixing and application. Expedited chemical application at reduced cost can result in ineffective outcomes and prove to be false economy.

5.5.7 Invertebrates

Invertebrates include earthworms and slugs, can be passive carriers of *Salmonella*. There is limited capacity to control these on range areas. It is both difficult and counterproductive to good environmental farming. Removal of areas of pondage and reduction of moisture levels in the range area will help to reduce the quantitative levels. The application of hydrated lime (**Section 5.4**) will also help in reducing levels, and actually aid in controlling environmental contamination with *Salmonella*.

[19] **Exzolt™**: Fluralaner, MSD Animal Health

6 Monitoring program

This monitoring program refers to five (4) scenarios:

1) Suspect site due to traceability from a food safety incident.
2) IC site being tested to determine SE status – this site
   a. will still be populated with birds.
   b. may be under voluntary quarantine, or a QN or an appropriate State government equivalent until proof of freedom.
3) IP site being tested to determine proof of freedom before repopulation.
4) Enforced ongoing monitoring by the authorities responsible for ongoing testing of IC and repopulated former IP sites.

The reader is referred to the AE *A Synopsis of Salmonella Incidence Response Plan July 2018* for the details on *Salmonella* monitoring (SOPs 1 to 8), or the *Salmonella Incidence Response plan May 2017* (SOPs 1 to 12).

Monitoring for *Salmonella* must factor in the consideration that the procedure is able to detect a low incidence of contamination and shedding of *Salmonella*. The operational procedures need to be objective and complete, and not be restrained by limitations of resources including number, competency and time. *Salmonella* monitoring, environmental swabbing and bird testing requires initial sampling material preparation, coordination with personnel and on-farm activities, and a significant time commitment to take samples and deliver them to the laboratory

The following specific areas need to be considered in particular:

- Preparation of adequate testing material and disposables such as drag swabs, surface swabs, needles, syringes and plain blood tubes, sample jars and accession sheets.
- Visit the farm/grading floor at a time when there is no restriction to access of any area that needs to be tested.
- Coordinate the operational procedures and time required for the sampling to be completed.
  - For example, with modern cage facilities it is necessary to test all rows and all tiers of the cage facility to ensure that the sensitivity of the testing is optimised for detecting *Salmonella* at a low incidence rate. The random swabbing of portions of the belt and floor areas is not acceptable.
    - : The visit needs to be coordinated with the biweekly programmed running of the manure belts.
    - : The visitation should enable the setup of the swabs according to the SOP prior to the running of the manure belt.
    - : The sampling should occur in all sheds and be ongoing for the entire period it takes to run the manure belts.
    - : Acceptance that work activity will need to be conducted outside normal working hours when considering travel, set up, sampling duration and returning samples to the laboratory.
    - : Prior arrangements need to be made with the laboratory for the receipt of samples.

Monitoring has potential regulatory and legal aspects, and the formality of completing, witnessing and traceability of samples is a mandated requirement.

The regulatory authorities may not provide details of the findings when positive to the whole industry due to concerns of legal due process. In general, an open cooperative approach from producers with authorities will result in a more open response from authorities than will a confrontational response.

The pre-emptive involvement of lawyers by the producers will invariably result in a restricted and limited information flow from the authorities due to their need and instruction to apply precautionary legal principles.

6.1 Specificity of testing

Particularly for Scenarios 2, 3 and 4 mentioned in Section 6 – Monitoring program, there is a requirement for considerable ongoing testing, which may be as frequently as weekly and thus there will be resource and laboratory cost considerations.

There will be a need to have trained and responsible designated staff to do the monitoring tests and to ensure that their other duties do not impede this. In regard to laboratory costs, these can be reduced by only testing positive *Salmonella* isolates specifically for Group D and subsequently SE PCR, as required.

The pooling of swabs for floors and various infrastructure will be adequate and a cost saving as one is only looking for a qualitative result – yes or no. That is the presence or absence of any SE on the site. The testing can be refined where more specific locality information is required.

6.2 Monitoring suspect site – potential IP

In this scenario, monitoring will invariably be undertaken by the responsible authority or a formally delegated third party. This may include the State Health Department, Food Safety Authority, State Agriculture Department, CVO, or an appointed technical consultant.

With regard to monitoring, it is important at this stage to ensure that:

- Visitors and responsible authorities meet the necessary biosecurity requirements.
- The producer recognises that the CVO or relevant responsible authorities have the right to enter a farm where there is suspicion of a notifiable disease or food safety causal association.
- The producer/company owner recognises that it is the site farm manager who is deemed the responsible entity in the eyes of the authorities, and thus the appropriate guidance and support should be provided.
- The monitoring procedures are sensitive and need to be consistent with best practice protocols (e.g. ***AE Salmonella Incidence Response Program***).
- The producer seeks expert technical assistance to undertake concurrent but independent testing
  - where producers believe their aptitude and technical knowhow, other commitments or temperament suggest they are not the ideal person to deal with the authorities they should appoint and notify all parties of who the responsible delegate is.

Monitoring will normally involve environmental swabs of the housed poultry environment including manure, litter, slats, nest boxes, manure belts, floors, and amenities.

In addition to this, where present, grading floors will be monitored environmentally including surface swabs of unwashed eggs. The monitoring of the internal contents of a limited number of eggs is

considered insensitive and not best practice.

Where SE is identified (unlike other salmonellae where other testing would be required to confirm linkage between the food safety episode and the *Salmonella* on the farm) the farm would immediately, on receiving a formal notification of an SE positive status, be served with a QN or an appropriate State government equivalent.

Actions: Monitoring activity undertaken by the responsible authorities.

- Positive SE status QN or an appropriate State government equivalent served.
- Negative SE status farm returns to normal operations but may need to undertake ongoing surveillance for a period of time.

6.3 IC site

In this scenario the site has contact with an IP site and thus the authorities and/or producer wish to confirm the SE status of the farm. It is recognised that normally no QN or an appropriate State government equivalent can be enforced until confirmation of an SE positive status.

Responsible producers though, may wish to voluntarily introduce due diligence procedures to contain any possible SE positive status eggs or product, taking into account business considerations and consumer safety. This would include holding eggs on-site until SE status is determined and possibly a voluntary recall.

The monitoring procedures and response activities would be as for **Section 3.2**, with the inclusion of layers from all sheds on the site being bled and subject to a Group D *Salmonella* ELISA test. The testing level is to achieve a 99% confidence of detection of a 5% prevalence of disease. It is assumed that after infection positive seroconversion would occur in 21 days. This can provide the status of the sheds in less than 24 hours. This will provide an indication of past exposure but not the window of recent exposure.

The environmental testing and blood testing would need to be repeated in 3 weeks time to eliminate the possibility of an early incursion and the inability to detect SE at the first testing activity.

During this period between tests on IC sites where the first test was negative for SE, all eggs are to be stored or secured prior to sale for a minimum of 28 days (3 weeks of testing plus 7 days for the return of laboratory results). Noting that testing is not real time, this approach provides confidence for both the responsible authority and producer that a window of positive eggs going to the consumer will be avoided. This is considered a responsible approach and required by AE of its members.

Actions: Monitoring activity undertaken by the responsible authorities.

- Positive SE status QN or an appropriate State government equivalent served.
- Negative SE status farm returns to normal operations.

6.4 IP site being tested to determine proof of freedom before repopulation

Sites demonstrated to be positive for SE operate under a QN or an appropriate State government equivalent for a prescribed period, which is 2 years. If producers wish to repopulate their property then proof of freedom would be required before the sale of eggs. Because of the high capital cost of replacement pullets, a producer with due diligence considerations would not wish to repopulate the

farm until there was strong confidence that the site was environmentally and vector (flies, litter beetles, rodents, etc.) free of SE.

Monitoring for freedom of SE would only be considered after all birds, litter, fomites and disposables had been removed from the site, and the site was subject to an assertive hygiene program involving cleaning & disinfection, and a vertebrate and invertebrate control program.

An extensive environmental monitoring is required, and this would include the monitoring of the following:

- all shed infrastructure including floors.
- all equipment within and external to the shed.
- amenities and storage facilities.
- packing and grading facilities.
- cool rooms and transport vehicles.
- silos and feed.
- rodents and rodent bait stations.
- flies and fly fomites.
- personnel.

Actions: Monitoring activity undertaken by the producer or engaged technical services.

- Positive SE status – QN or an appropriate State government equivalent maintained.
- Negative SE status
  - Responsible authority notified, which may undertake further testing to confirm negative status.
  - Producer to progress consideration of restocking farm.

This section is further expanded and detailed at **Section 7 – Farm proof of freedom from SE**.

7 Farm proof of freedom from SE

Before considering the repopulation of a farm the producer needs to first examine the business aspects of the decision, which will be influenced by the facilities' expected productive life, the type of facility (cage, barn, free range, organic), likely financial returns, other options for the site (development and subdivision), the ongoing requirement for a high level of biosecure operation and monitoring, and to weigh these up against the risk assessment of the site returning to a positive SE status. Importantly, there are also the human aspects of emotions, and stress of the challenges and uncertainties to be faced going forward.

Also importantly, this is not a time for substandard husbandry and operational short cuts. Producers need to decide if they have the demeanour, ethos, technical know-how and support to sustain what is required going forward.

Particularly if there is ongoing non-compliance, support from the industry and the responsible authorities will be absent, and it is possible that enforcement notices will be applied. There are also the matters of the consumer and responsibilities relating to food safety.

7.1 Environmental monitoring

This has been covered above and particularly in **Section 6**. There is a need to ensure that the environmental monitoring is done with sensitivity, so as to be able to detect low and sporadic levels of SE contamination. All areas of the shed environment, facilities and infrastructure, amenities and other work areas, storage, bait stations, and invertebrates all need to be examined. For confidence after the first completely site negative SE test, this testing would need to be repeated entirely again after three (3) weeks or as advised by govt authorities.

At this stage the producer may request an independent third party to come in and repeat the testing. This could be done by the responsible authority and at its cost.

It is recommended at this stage that all salmonellae mitigation activity is reviewed to ensure that it is optimised, including vermin and fly control, biosecurity, and onsite staff reinforcement.

It is recommended that one further round of disinfection is undertaken within the sheds and amenities and other work areas. In some of these areas it may be feasible to use other forms of aerosol or a vaporisation form of disinfection (formaldehyde, chlorine dioxide or ortho-phenylphenol (OPP) bombs[20]) – although a wet surface covering with a residual disinfection is preferred.

7.2 Sentinel chickens

As discussed previously the capital outlay for a farm repopulation is high, and with the risk of a return to an unfavourable positive SE status a realistic concern. An additional optional conservative approach is to employ sentinel birds, as is done in an EAD proof of freedom, and use the host species (the layer chicken) to act as a sensitive indicator of the farm status.

In this case spent layers tested for freedom from *Salmonella* can be placed on the farm in numbers to cover all the infrastructure and shedding adequately to be exposed to any possible source of SE

[20] **Fumagri®:** bactericidal and fungicidal disinfectant with ortho-phenylphenol (OPP).

residing on the farm. These birds can be maintained out of lay on a maintenance ration for a period of approximately two (2) months on the site.

While there are arguments about having these spent layers vaccinated for *Salmonella*, and to provide feed containing additives for *Salmonella* control to inhibit *Salmonella* colonisation and thus replication and shedding of SE, it is proposed that having a host more sensitive to SE for this limited period is the preferred option. This is because when the farm is eventually populated with commercial flocks they will be on-site for periods extending over a year, and therefore will have the time and opportunity to be exposed to any SE even if it exists on-site at a low level.

These sentinel birds would have their litter and manure environmentally monitored mid-way through their residency and at the end of placement, and also be serologically tested using an SE ELISA to provide another method of identifying any flock exposure (refer **Section 6**, and use the SOPs as provided in the **AE *Salmonella* Incidence Response Program**). The number of birds required to be blood tested to ensure adequate sensitivity to detect a low level of infection would be approximately 60 in each shed group of sentinels.

At depopulation, if the spent hens are negative it should be able to be reasonably argued with the responsible authority that these birds can be depopulated and disposed of under less restrictive and costly conditions.

The next move to the commercial placement of chickens on the site is the producer's responsibility and risk, and does not involve the responsible authority in regard to SE as a notifiable disease. The responsible authority though will invariably impose a rigorous and mandatory SE monitoring program on the farm site before allowing eggs and egg product to move off the farm for sale.

8 Farm repopulation

Farm repopulation needs strategic organisation and will vary depending on the nature of the facilities, the presence or intention to rear on-site, buying-in contract off-site reared point of lay (POL) pullets, the cash flow available, and the level of risk aversion.

There will be the need for some in-depth planning and evaluation before repopulating, and this is to be done objectively and without emotion. It is strongly advised that third party assistance is sought covering technical, financial, sales and marketing, and business risk assessment before progressing with the decision.

The pullets will need to be vaccinated against *Salmonella* and fed rations containing additives aimed at aiding the control of *Salmonella* colonisation in the layer. Below are some of the possible repopulation approaches.

8.1 Force moulted layers

Placing force moulted spent layers is a low-cost input and a way to establish some return with minimal capital outlay. The layers will still need to be vaccinated for *Salmonella* (**Section 8.4.1**) and utilise feed containing additives (**Section 8.4.2**).

The limitations with this approach are the reduced market for the eggs (with most retailers not accepting eggs from force moulted flocks), average production levels, and relatively rapid decline and reduced 'A grade' egg recovery.

If an effective and quality force moult is undertaken, and husbandry is optimised, this initial low and risk averse approach can be feasible. Current market prices of table eggs and eggs for product will have a determinant influence.

8.2 Rearing on-site

If there is considerable distance from the production sheds, rearing on-site provides an option to expedite the process back into commercial production once the production sheds have demonstrated a proof of freedom. There is the assumption here that the rearing sheds were always negative for SE and that the level of biosecurity is optimised.

These pullets would need to be monitored for SE multiple times throughout rearing and prior to transfer. It is important to recognise that the testing for *Salmonella* is a point in time activity and does not reflect the real time *Salmonella* status of the flock.

The commercial risk here though is that if the farm has not established freedom from SE by the time the pullets are at POL then there will be regulatory considerations of what to do with these birds. Remaining on-site and in production would mean that eggs could only go off-site for pulping and pasteurisation, and the presence of the live birds would be a significant impediment of the CWD on the site. In Australia, there are limited pasteurisation facilities and not all will accept potentially high-risk eggs.

It may be possible to demonstrate that these POL birds are SE free and obtain a permit to allow them to move off-site to another location. Invariably there will be a risk assessment undertaken and this would be influenced by the nature of the recipient site, an isolated site with one or two sheds being

more acceptable than a large complex. Ongoing monitoring of these flocks for SE would be required. It is also a requirement in most states that any farms with layer production on-site must be licensed with a responsible authority in that state.

Finding an accepting third-party producer will also be required if the IP producer has no other operating sites.

Contingencies for the above need to be established prior to the placement of day-olds. Including in this is the willingness of the day-old supplier to have a horizontal contact with a site under a QN or an appropriate State government equivalent during the delivery of these day-olds in hatchery transport vehicles.

8.3 Rearing off-site

Rearing off-site is a simpler scenario, with the only consideration being the capital outlay and having a contingency for the POL pullets to be able to go to another production site if the IP remains positive. Movement of pullets vaccinated with an autogenous SE vaccine to another unintended/unconnected site is not strictly compliant with the conditions of an autogenous vaccine permit. However such a movement would not present any SE control risk. It would be an acceptable necessary and practical variation with approval of the Australian Pesticides and Veterinary Medicines Authority (APVMA) and State CVO.

8.4 Vaccination, feed additives and environmental probiotics

8.4.1 *Salmonella* vaccination

The pullets being reared for layer production need to be vaccinated against *Salmonella*. The most effective combination is the use of a live *Salmonella* Typhimurium vaccine and killed adjuvanted bacterin SE vaccine in a combination program. Australia currently has no registered or available live SE vaccines. This is because Australia is not endemic for SE of egg layer significance, as confirmed by the active surveillance program and because the May 2018 outbreak has been contained. As such there are no requirements for a live SE vaccine, and in particular one that has lifelong colonisation characteristics. This situation would be revisited if Australia's current favourable export trade status changed and it became endemic for SE in the poultry industry.

Australia does have two (2) live *Salmonella* Typhimurium vaccines[21] both being derived from the same candidate vaccine, STM-1 an Aro A minus deletant mutant[22] of *Salmonella* Typhimurium PT 44. Studies have shown that this live vaccine candidate does have a significant level of colonisation control approaching 30% to 60% for non-typhimurium *Salmonella*, including approximately 50% for SE; comparable to that afforded against *S.* Typhimurium with the STM-1 vaccine.

Utilising the current *Salmonella* vaccines available in Australia, the optimal SE *Salmonella* vaccination program is STM-1 at the hatchery by coarse aerosol spray (or at around day of age), STM-1 by drinking water at 4–6 weeks of age then followed by an autogenous SE bacterin by intramuscular injection at

[21] **Vaxsafe ST**: Bioproperties Pty Ltd. Australia; **Poulvac ST**: Zoetis Australia.
[22] **Aro A**: gene in the Shikimate biochemical pathway of some bacteria and involved in the production of aromatic amino acids and folic acid.

around 8 weeks, and repeated at 12 weeks of age[23]. Readers are to seek technical advice from their veterinarian for prescriptive details as to their preferred *Salmonella* vaccination program.

It is pivotal to understand that *Salmonella* vaccination is one of many tools that aid in the control of *Salmonella* in egg layers and vaccination alone will not provide complete protection against this well adapted bacterium.

8.4.2 Feed additives for *Salmonella* mitigation

There are numerous feed additives commercially available that are used as an aid in *Salmonella* control in-feed and in the layer.

The product categories include:

- organic acids24 (short and medium chain fatty acids)
- prebiotics25
- probiotics26
- phytogenics27.

In combination these products are referred to as synbiotics. There is a plethora of these products on the market with claims regarding their benefits amongst other things of controlling *Salmonella*. Most of these products do not have registered label claims but depend on what is referred to in the peer reviewed literature and in-house studies.

The majority do, to various degrees, aid in the control of *Salmonella* in-feed, and the colonisation and shedding of *Salmonella*. This may be by a direct mechanism or by promoting a gut microflora with a balance and diversity more favourable to the bird's health and less to bacterium such as *Salmonella*. There is a need also to consider both the positive and negative interactions that feed additives may have on the application and efficacy of live *Salmonella* vaccines.

The reader is referred to the suppliers of these products, veterinarians and nutritionists and general industry knowledge to decide on the most technically robust and cost-effective products and programs.

As for *Salmonella* vaccination, feed additives are another tool for producers to use as an aid in *Salmonella* mitigation.

8.4.3 Probiotics

The aim of probiotics is to assist in the establishment and maintenance of a layer of intestinal microbiota that is beneficial to its general health, and the ability to limit the colonisation of undesirable bacteria like *Salmonella*. As the microflora of a layer is considered to be predominantly

[23] **SE Vaccination Program**: the program of several live ST followed by two SE bacterins was determined by research work undertaken by Australian Eggs Limited to be the preferred program using available Australian vaccines, and demonstrated the highest reduction in caecal colonisation and 100% protection against ovarian colonisation after challenge with SE 7A.

[24] **Fatty Acids**: carboxylic acid with a long aliphatic chain, which is either saturated or unsaturated. Most naturally occurring fatty acids have an unbranched chain of an even number of carbon atom.

[25] **Prebiotic**: are compounds in food that induce the growth or activity of beneficial microorganisms such as bacteria and fungi.

[26] **Probiotic**: are live microorganisms with claims that they provide health benefits when consumed by improving, altering or restoring the gut microflora.

[27] **Phytogenics**: a group of natural growth promoters or non-antibiotic growth promoters used as feed additives, derived from herbs, spices or other plants.

predetermined in very early life, the most advantageous time to apply probiotics is as a day-old spray at the hatchery. This procedure is recognised and undertaken at hatcheries for producers who request it.

Another alternative or additional approach is to use probiotics that have been specifically developed for the environment that the day-old chickens are placed in. These products are used after a shed clean down, terminal disinfection and the decline of the residual disinfectant activity, when they are then sprayed on the surfaces of the otherwise 'sterile' shed environment with the aim of providing favourable microflora to establish, or at least impact on, the young bird's intestinal microbiota.

9 Repopulation of a former IP: way forward

Repopulation can take place once an IP has achieved provisional proof of freedom and there is confidence to repopulate or partially repopulate the farm as discussed in **Section 7**.

It is expected that producers with a previously IP site now back in production, and operating under formal compliance requirements, may experience or be subject to enhanced negative perceptions from segments of the industry, the retail sector, and other traders. AE will support producers experiencing such pressures where they are demonstrating full compliance with regulatory requirements and direction.

As for IC sites, and as discussed in **Section 6.3**, during this earlier period of production producers are required to store eggs for a minimum of 28 days (3 weeks of testing plus 7 days for the return of laboratory results). This conservative approach, while affecting cash flow and cool room storage capacity (which technically could be off-site, which may require approval of the regulator), provides for increased confidence from the authorities and the end consumer. It also supports the business risk mitigation of potential food safety issues and the management of repercussions arising from this.

The adoption of a conservative approach to repopulation is particularly important if eggs are sold into farmers' markets, or by door sales or cash box market sales. In the event of a food safety issue, any lack of final consumer traceability will mean a mandated recall of all eggs by the responsible food authority rather than a narrowly focused voluntary recall.

As the monitoring results continue to report as negative then this period of egg retention can be shortened. 'B grade' eggs can go off for immediate pulping and pasteurisation at any stage.

9.1 *Salmonella* monitoring

During this early stage of repopulation, the QN or an appropriate State government equivalent will still be in force in most situations. The exception possibly being if the 2-year period since the original QN or an appropriate State government equivalent had expired. It will invariably be a requirement of the responsible authority that monitoring of the layers will be required initially weekly, and similarly on the grading floor, with a reduction of the frequency of testing over time as repeat negative results are obtained. This testing may be allowed to be done in-house, provided that technical competency is demonstrated, and all the monitoring samples are sent to a NATA accredited laboratory, and the results are copied into the CVO.

The monitoring program outline is to include the following actions:

- All sheds drag swabbed for *Salmonella* weekly until otherwise directed by the CVO. This should include rodent bait stations, flies and all drinking and cooling water storage.
- Cracked and dirty eggs from all sheds sampled and tested for *Salmonella*
  - sixty (60) eggs from each flock weekly until otherwise directed by the CVO. This period being determined by the outcome of the epidemiological investigations and monitoring outcomes.
- Swabbing of egg packers and/or grading floor where present.

9.2 Recording, reporting and traceability

It is mandatory that all records are kept of production performance and egg sales, and the prescriptive

traceability of these eggs sales. The records should be of a standard acceptable to industry QA programs and State food safety authorities.

External eggs brought on to the site must be clearly traceable and stored in an identified manner, and, if graded, stamped with the identification of the farm of origin. The supplier of those eggs must have a current and active *Salmonella* monitoring and mitigation program.

Similar conditions apply for the introduction of new livestock.

9.3 Compliance activity and best practice farming

It is recognised that the producer is moving to a status of SE freedom but has come from the status of an IP, which means in most cases that the producer had not been operating under best practice conditions. It is important for producers not to forget this and to ensure that the opportunity is taken to sustain all of the necessary husbandry, biosecurity, egg handling and marketing practices that have been necessary to re-establish their operation. Avoid the tendency to pull back on the fundamentals of *Salmonella* mitigation and maintain the use of vaccination, feed additives, monitoring and controlling horizontal contacts.

One area of concern that has increasingly emerged within the Australia layer industry is producers selling spent layer hens to traders who through social networks onsell these birds to back yard producers. While there are some financial gains for a normally cost neutral or even cost loss activity in the disposal of spent laying hens, the biosecurity risks of dealing with these traders is high because of the number of horizontal contacts they have with high disease status poultry. The movement of SE associated with the activities of these traders is recognised resulting in food safety issues from the consumption of contaminated backyard produced table eggs. As this area of traders and backyarders is non-compliant in regard to best practice and traceability, it is a likely repository to establish SE as endemic in Australian poultry industry.

Appendix – Standard Operational Procedures for eliminating *Salmonella* Enteritidis (SE) from contaminated sites

Introduction

There are many potential sources to introduce *Salmonella* into the poultry operations environment. Strategies for eradication from contaminated sites and the prevention of future incursions require the sustained implementation of comprehensive risk reduction procedures. The aim is to significantly reduce environmental salmonellae to a level that will not lead to colonisation of housed birds or egg surfaces in the grading floor. This can be challenging due to the epidemiology of *Salmonella*, including the ability of it to survive in the environment, and animal and insect vectors for extended periods. Therefore, effective cleaning and disinfection, and insect and rodent control are paramount to eliminate and prevent site recontamination.

This document aims to provide guidelines to Australian egg producers about how to eradicate and prevent recontamination of *Salmonella* Enteritidis (SE) from contaminated production sites and grading floors.

This document does not consider what chemicals are permitted for use on a farm populated with birds where restraints may apply, and the reader should refer to the APVMA Pubcris web site for more prescriptive details.

This document is not intended for those egg producers operating under certified organic farms, who are advised to contact their responsible auditing body for technical advice.

Identification of an SE contaminated site

Sites are considered as positive for SE if the environmental swabs or, in some cases, the layers themselves and/or eggs are positive. These results will indicate the extent of the site contamination. Consideration of the nature of the site and its commercial value will determine if the economics coupled with risk assessments will support attempts to decontaminate the site or decommissioning it.

This document is applicable to all layer production systems, packing and grading floors, amenities, and ancillary items such as vehicles. On production sites, all activities are preceded by the humane destruction of the layers, and then their secure removal off-site. As SE is a Notifiable Disease, all activities involving the movement of livestock, eggs, litter, waste, materials, and equipment off-site and its subsequent destination can only occur with the written approval of the Chief Veterinary Officer (CVO) or a nominated responsible entity.

Dry clean

This involves the removal of manure, litter and other fomites associated with farm operations.

- Remove all materials that cannot be adequately cleaned and disinfected, e.g. packing material, feed and other supplementary items that are made of perishable materials. This may also include items such as cooling pads.

- Equipment used for dry cleaning includes hand scrapers, brooms, brushes, shovels, skid-steers, and compressors. Using an air compressor with a minimum airflow of 250 cfm (0.12 m^3/sec) is recommended.
- All gross dust, soil and dry organic material must be removed from the shed.
- Where feasible, undertake removal activities when wind directions are favourable to minimise off-site amenity issues.
- Remove all feed from all silos and feed delivery systems (augers, hoppers, pans), and move them off-site.
- Drain all water holding tanks, medication tanks, cooling water reservoirs and drinkers.
- Physically clean all on-site vehicles, including floor wells and equipment.
- Clean or dispose of farm protective clothing and footwear.
- All equipment, including forklifts, trailers, tractors, and sundry tools should be cleaned and disinfected, and remain on-site.

Wash down

At the start of wash down, all equipment and some infrastructure must be disassembled as far as is practicable. It is important that the detergent and subsequent disinfectants that are used are able to make physical contact with all surfaces. Wash down includes both production sites and grading floors, and involves:

- all nest box infrastructure
- components of the feeder and drinker equipment
- slats and support infrastructure
- egg collection tables
- egg trolleys, pallets and egg handling systems
- blackouts
- live bird crates
- manure belt dryers
- plenum heat exchangers
- rodent bait stations
- all covers on grading equipment
- all waste materials and rubbish from amenities and range areas, including excessive vegetation.

After a dry clean is completed, a wash down is required to remove the remaining gross contamination from the building infrastructure and equipment. To aid the removal of organic material, a detergent must be use in the wash down. The detergent selected must not subsequently impede the activity and efficacy of the disinfectant. There are two methods of detergent application, including high-pressure low volume spraying or foaming. Using foam is more efficacious as it allows constant surface contact with the active detergent chemical over an extended period, thus aiding the removal of the embedded organic load. As the foam collapses, the surface is repeatedly treated with fresh active detergent. If liquid detergent is used, a high-pressure low volume application is recommended, ideally with a minimum of 3,000 PSI at 12 L/minute. Some detergents contain proteases (for the breakdown of proteins) to assist in the cleaning activity. Prior to a wet wash down, electrical inputs to the shed should be isolated, and sensitive equipment such as controllers must be covered for protection against water damage. It is essential that these items are subsequently hand cleaned and disinfected.

- Wash sheds systematically from top to bottom to prevent clean areas from being contaminated.
- Treat all surfaces, including: ceilings, walls, flooring/slats, trusses and purlins, nest system, nest pads (to be removed and cleaned), egg and manure belts and covers, curtains, perching equipment, cages, blackouts, mini vents, fans and covers, feeder and drinker lines. Follow the chemical manufacturer's directions for dilution and application rates.
- Adequately dry clean and, where feasible, wet wash and disinfect hard to access areas and equipment such as ceiling plenums, heat exchangers, manure drying systems, ridge extraction fan cowlings, cooling pad tunnels, etc. In some scenarios, other options will need to be implemented regarding terminal disinfection (refer to section on Disinfection).
- Lower the feeder and drinker lines to knee height and pressure wash, including the top of the lines.
- Disassemble, and wash and disinfect slatted floors at a designated secure location on the site, with drainage control.
- For caged systems, wash one row at a time from top to bottom, focus on removing organic residue from cages, drinkers, feed troughs and manure belt and supports. Run manure belts while they are wet to remove organic matter and water from the belts. Finish by washing the floor and under the cage system, start from the centre and work towards the side walls. Finally, flush the water into the manure pit or drainage holes, ensuring the destination of the drainage is contained and secured.
- Purlin (ceiling support beams) designs that retain debris and wash down materials will require special attention.

Disinfection

Disinfection should only commence after all potential cross-contaminating material such as litter is removed from the site and all surfaces have been treated with detergent to effectively remove organic material. Disinfection has to be done separately and NOT MIXED at the same time as the application of detergents and insecticides. Producers must ensure that contrary practices are prohibited by contractors. The surface should be allowed to dry or near dry so that the applied disinfectant will not be diluted, and its efficacy compromised. Detergents that require a post surface rinse prior to disinfection are not practical for shed clean downs. A broad-spectrum disinfectant, such as those listed in Table 1, should be used with a pH buffer when required as per the manufacturer's directions. All surfaces need to be treated with the terminal disinfectant. It is adequate just to wet, and not saturate surfaces.

The choice of the disinfectant will be determined by the following:

- The type of surfaces being treated, and the level of organic load and other encrusted deposits such as uric acid and scale.
- The correct equipment to allow foam application.
- The operational time gap between the detergent wash down and terminal disinfection. It is preferable to allow all surfaces to dry prior to the terminal disinfectant, to avoid reducing the concentration of the applied disinfecting chemical.
- Compatibility with the subsequent disinfectant being applied.
- Quality of the water, particularly its hardness.
- Not corrosive on infrastructure and equipment.
- Material Safety Data Sheets (MSDS) are available. Seek objective support and technical advice from the chemical supplier**.**

Special situations

Concrete floor supplementary disinfection

Chloramine-T combined with mineral sulphates and oxides (e.g. Staldren™)

- establishes long term contact with surfaces under moderate organic loads to effect pathogen reduction
- can also be used for smaller areas and amenities, including grading room floors.

Dirt floor treatment

The inactivation of salmonellae on dirt floors is limited because of the physical and mechanical nature of the surface, the high organic load and potential mass density of the material to be treated. As such, the aforementioned broad-spectrum disinfectants used to treat the shed will have limited efficaciousness on dirt floors.

The most effective product for treating dirt floors is hydrated lime, which should be applied to earthen floors, walkways and around the immediate perimeter of the poultry shed range area. Application rates 0.5 to 1 kilogram per m^2 should be used to ensure that the surface is adequately covered with lime. There are OH&S considerations when handling hydrated lime.

Medication tank disinfection and drinker sanitation

Flush drinker lines for 1 minute for every 30 m of water line, to reduce organic load before treatment. Drain medication tanks and manually remove any build-up of biofilm or organic load. Fill tanks with enough water to flush the entire drinking system using an appropriate additive/disinfectant[28], which aids in the removal of minerals, biofilms and deposits from medication and supplements. Using the selected product, fill the entire drinking line system and leave in situ for the period specified by the manufacturer, generally at least 30 minutes. Where drinker lines have a heavy mineral and biofilm build-up repeat the procedure.

Water tank disinfection

After drainage of the water tank and gross removal of sediment and organic material, disinfect and refill the tank using chlorine. For every 10,000 litres of water, use 400 ml of 12.5% sodium hypochlorite. For other sanitisers follow the manufacturer's directions. The tank must be securely sealed.

Silo disinfection

Empty and wash out silos using detergent, then treat them with a disinfectant or fumigate with an approved and suitable product. This may include two treatments, one to remove microbiological contamination such as *Salmonella*, and the use of an insecticide to remove potential vectors.

[28] **Water Line Treatment**: includes products containing organics acids, peracetic acid, sodium hydrogen sulphate (PKA™, Animal Science Products) and oxidising compounds such as hydrogen peroxide or chlorine dioxide.

Footbaths

Either foam mats or dipping baths can be used. Soiled boots will not be adequately disinfected due to the high level of organic matter. Boots must be clean prior to dipping into the footbath. The product of choice should be effective under conditions of moderate to high organic loads. Footbaths have limitations, so it is better to change footwear or to use protective covers over boots when entering a shed, site or facility.

Disinfectants

Table 1 is a list of disinfectants, which is confined to those that are suitable for agricultural use based on their efficacy, availability, useability and cost. For a full list of disinfectants, please refer to the APVMA website for products. Manufacturer's directions for each product should be followed particularly in regard to dilution rates, methods of application, impact on equipment and surfaces, OH&S, methods of disposal, and environmental protection.

Table 1 Disinfectants

Type of broad-spectrum disinfectant	Active ingredients	Areas for use	Safety considerations	Organic load	Characteristics and application information	Efficacy			
						Viruses	**Bacteria (*Salmonella*)**	Fungi	Spores
Quaternary ammonia compounds (QUATS) 2nd generation, single Chain	Substituted Benzalkonium Compounds, e.g. Alkyldimethylbenzyl Ammonium Chloride	All surfaces	Low	Poor	• Wide application and safe to use • Moderate speed of action	+	+	-	-
Quaternary ammonia compounds 3rd and 4th generation (Twin, double or Dual Chain QUATS)[29]	Dialkyl Quats, e.g. Didecyldimethyl Ammonium Chloride (DDAD or a C10/C10)	All surfaces	Low	Moderate	• Wide application and safe to use • Moderate speed of action	++	++	+/-	-
Aldehydes	Formaldehyde Paraformaldehyde Glutaraldehyde	Whole cleaned shed except dirt flooring	High	Moderate	• Formaldehyde • Need temperatures above 20°C for penetration and a pH of 7–7.5 • Spray or fumigation • Fumigation has poor penetration	++	+	+	-
Halogens: Chlorine	Sodium hypochlorite	Whole cleaned shed except dirt or concrete flooring and water treatment	Moderate	Poor	• Can be corrosive to plastics and metals, unless rust inhibitors are used • Broad-spectrum • Inactivated by QUATs • Fast-acting	++	++	++	+

[29] **Double Chain QUAT combined with Biguanide**: this combination product has improved microbiological fungicidal activity.

Halogens: Bromide	Bromine	Water treatment	Low	Poor	•	Fast-acting	++	++	+	++
Halogens: Iodine	Iodine	Water systems, foot dips and general disinfection	Low	Moderate	•	Fast-acting	++	++	+	++
Oxidisers (e.g. Virkon™ S)	Sulphamic acid, hydrogen peroxide, peracetic acid, potassium peroxymonosulfate	Water storage and tanks, drinker lines	Low/Moderate	Moderate	• • •	Can be corrosive to metals Poor ability to penetrate Fast acting	++	++	+	++
Halogen Complex	Chloramine, Iron Sulphate, Copper	Concrete flooring	Low	High	•	Sustained long-term action	++	++	++	+
Hydrated Lime	Calcium hydroxide	Around the shed infrastructure and dirt floors	Moderate	High	•	Sustained long-term contact	++	++	++	++
Phenolics	Ortho-phenylphenol	Sheds Amenities Silos	Moderate	Moderate	•	Foot Baths/Fumigation	+	++	++	-

++ = effective; + = variable efficacy, - = not effective

Insects and other invertebrates, including flies, mites, lice and litter beetles can spread, and passively carry *Salmonella* and contaminate the environment or poultry directly. It is a necessity to remove these vectors, as some can survive in the shed and infrastructure after birds have been depopulated.

Fly control

Flies are recognised as a vector of SE. Effective control cannot commence until all litter, decomposing vegetation, carcasses and organic matter including stagnant water are removed.

The control of flies is undertaken using four (4) activities:

- Identification of fly species involved, e.g. the common housefly (*Musca domestica*).
- Removal of breeding grounds for the identified species.
- Strategically position fly baits throughout the farming site.
- Use of residual surface sprays that contain fly attractants.

Once sheds are repopulated, ongoing fly control is required to avoid recontamination. Control programs should include a combination of in-feed insect growth regulators in the feed, fly traps and fly baits and minimising habitats by removing organic matter, including manure where feasible.

Insecticide spraying

- Insecticides must only be applied after the detergent wash down and terminal disinfection. Applying insecticide in combination with other chemicals including detergents and disinfectants will impede the activity of the insecticide and limit its effectiveness.
- Follow all OH&S guidelines of the products when used. PPE should include gloves, protective overalls, safety goggles and masks.
- Ensure that the insecticide adequately wets the surfaces.
- Begin from the top of the shed and work down the walls to the floor area, from one end of the shed to the other.
- Repeat application after 7–10 days.

Table 2 Insecticides*

Chemical class of insecticide	Active ingredients	Form	Safety considerations
Pyrethroids, Pyrethrins	Permethrin Cyhalothrin Beta-cyfluthrin	Spray Powder Fog Mist	Low/Moderate. Poisonous if swallowed. Irritant to eyes, nose and throat. Do not inhale spray mist. Use PPE including overalls, face shield or goggles, and elbow-length PVC gloves.
Organophosphates	Maldison Azamethiphos Trichlorfon Dichlorvos	Spray Paint	High. This class of chemical is poisonous if absorbed by skin contact, inhaled or swallowed. Repeat minor exposure may have a poisoning effect. A high level of PPE is required, including overalls buttoned to the neck and down to the wrists, elbow-length PVC gloves, respirator, and face shield.
Insect growth regulator	Cyromazine Triflumuron	In-feed additive	Low. Can be poisonous if ingested. Wash hands after use.
Neonicotinoids	Thiamethoxam	Pallets Spray Paint	Moderate. Can be an irritant for skin and eyes. Use PPE including overalls, mask, gloves and goggles.

***Insecticides**: it is to be noted that insecticides can only be used for the purpose intended as detailed on the product label. That is, insecticides cannot be used off label without formal approval from the regulatory authority, the APVMA.

Rodent control

Control of rodents is paramount as they are vectors that carry SE and can lead to recontamination.

- Food sources must be removed.
- Housing sources for nesting such as rubble and vegetation must be removed.
- Identify the vermin involved – rats, mice or both – and the species involved.
- Track rodent movements and strategically concentrate baits in highly frequented areas, instead of their uniform spatial placement. Tracking can be achieved through tracking baits or visual assessment of droppings and nesting areas.
- Place baits zonally around the property boundaries to stop the ingress of new populations of rats and mice.
- Determining if baits are being consumed by vermin is paramount. It may take multiple trials with different forms of baits, e.g. hard baits, soft baits and pellets, until vermin acceptance is accomplished.
- Traps should be used concurrently, particularly in elevated positions.
- Consider pet safety, native fauna and OH&S in any baiting program.
- Rats demonstrate family behaviour and an aversion to the presence of other unrelated rats. Thus, bait stations should be clean and washed on occasion to remove detracting odours.
- First-generation rodenticides, including warfarin, are slow acting, require multiple feeds and many now have resistance due to long-term use. They are therefore not recommended for use in *Salmonella* mitigation programs. The newer rodenticides are second- and third-generation anticoagulant rodenticides and only require a single feed. Vitamin D rodenticides contain an active form of vitamin D Vitamin D3/cholecalciferol, which can be toxic in a single feed.

- Pre-baiting describes the process whereby rodents are attracted to the bait and bait stations by feeding them non-toxic bait with an attractant, prior to the placement of the toxic baits.

Table 3 Rodenticides

Class of rodenticide	Active ingredients	Form	Safety considerations
Second-generation anticoagulant rodenticides	Bromadiolone Brodifacoum Difenacoum Difethialone Flocoumafen	Bait, liquid concentrate, pellet, sachet, bait concentrate, soft block and wax block	Risks to humans, pets and wildlife through accidental poisoning. These chemicals persist in the organs of poisoned rodents and present a risk to non-target animals that feed on poisoned animals or carcasses.
Vitamin D rodenticides	Cholecalciferol (Vitamin D3)	Soft bait Pellets	Primary poisoning of non-target animals can occur, however, a larger quantity of bait is required than second-generation anticoagulants to cause toxicity. Scientific studies have shown that target animals that have ingested a lethal dose of Vitamin D3 do not present a high-risk secondary hazard.

Other vertebrates

All vertebrates can act as vectors for *Salmonella* and must be removed from the site. These include foxes, livestock, dogs, cats and wild birds, and if domestic animals must remain on-site, they must be tested for *Salmonella* by faecal sampling. Humans can, and have been recognised to, contaminate poultry sites with *Salmonella* including SE.