



Food
Authority

Egg Food Safety Scheme

Periodic review of the risk assessment

Contents

| | |
|---|----|
| Executive summary | 2 |
| Introduction | 3 |
| Update of the 2009 assessment | 4 |
| <i>Salmonella</i> Enteritidis..... | 4 |
| Microbiological hazards | 4 |
| Prevalence of <i>Salmonella</i> in Australian eggs..... | 6 |
| Chemical hazards | 9 |
| Baseline evaluation of the NSW Egg Food Safety Scheme | 10 |
| Microbiological survey of egg farms in NSW | 10 |
| Survey of NSW egg industry practices and processes..... | 11 |
| Conclusion..... | 13 |
| References | 14 |

Executive summary

The previous risk assessment (NSW Food Authority, 2009) of the Egg Food Safety Scheme was published in March 2009. The risk assessment was part of a comprehensive review of food safety schemes undertaken during the remake of Food Regulation (2004). This review updates the 2009 assessment.

NSW continues to be free of transovarian *Salmonella* Enteritidis. This status is important for the egg industry and public health.

Eggs are a common vehicle for foodborne illness. In particular mayonnaise, desserts and sauces that contain raw egg have caused many outbreaks.

Two recent Australian surveys of *Salmonella* in eggs have implied prevalence rates higher than anticipated and higher than used in a previously published risk ranking.

Chemical contamination of eggs is low and does not present a risk to consumers.

There are opportunities to improve biosecurity practices, stock food protection, water testing, egg grading practices, crack detection and egg cleaning on some farms. Strategies are in place to address this.

Introduction

The previous risk assessment (NSW Food Authority, 2009) of the Egg Food Safety Scheme (the Scheme) was published in March 2009. At that time the Scheme was still under development. The risk assessment was part of a comprehensive review of food safety schemes undertaken during the remake of Food Regulation (2004). At the completion of this process a simplified and refined Food Regulation (2010), which included the Egg Food Safety Scheme, was made.

Following the completion of the 2009 assessment the NSW Food Authority completed a baseline survey of the NSW egg industry. The objective of the baseline survey was to assess the conditions prevailing in the industry prior to the introduction of regulation. The effectiveness of regulation is gauged against the baseline. The survey also provided valuable information for the risk assessment.

In preparation for this review the scientific literature was scanned for emerging issues and data presented in the 2009 assessment is updated in this report. Poultry science is tightly focused on the impact of transovarian *Salmonella* Enteritidis (SE) on laying flocks. This has the effect of masking information relevant to Australia where transovarian SE is not endemic. Some useful local papers were identified.

Update of the 2009 assessment

This update focusses on more recent information and any issues that have emerged since the release of the 2009 assessment. Recent egg literature has been scanned for issues and relevant data has been updated.

Salmonella Enteritidis

International egg literature is dominated by reports of transovarian/transovarial *Salmonella* Enteritidis (SE). SE prevalence in chickens and the human population rose abruptly during the 1980s and quickly became pandemic. There is evidence that SE became endemic in the parental breeder flocks which lead to a rapid spread of the infection to most parts of the world (Martelli & Davies, 2012). This is supported by the observation that SE did not become endemic in Australian laying flocks, most likely because of strict rules on importation of animal products.

Taylor et al (2012) reported the concurrent emergence of a strain SE in humans and poultry in British Columbia in 2008–2010. Between 2001 and 2006 the rate of SE was stable between 2.2 and 3.8/100,000 population. In 2010 the rate of SE reached 12.3/100,000 population and SE accounted for 49.0% of all *Salmonella* isolates. Epidemiological investigations implicated eggs which in many cases were found to be ungraded and illegally distributed. This report illustrates the significance of Australia's freedom from transovarian SE to the egg industry and public health.

OzFoodNet (2012) conducts enhanced surveillance of locally-acquired infections of SE in humans to monitor the emergence of this strain in Australia. During 2010 OzFoodNet sites reported 835 cases of SE infection. Travel histories were obtained for 94.9% of cases in 2010 (792/835). Of those cases where travel status was reported, 92.9% (736/792) had travelled overseas and cases often reported visiting several countries.

In their 2010 Annual Report OzFoodNet (2012) states that *S. Enteritidis* is not endemic in Australian layer flocks. Animal Health Australia (2011) reports that there have been no detections of *S. Enteritidis* in a S.E. accreditation program since it commenced in 1996. The program covers 70% of the layer chickens in Australia.

Microbiological hazards

Tables 42, 45 and 46 of the 2009 assessment provide information on microbiological hazards of eggs. Table 45 provides information on foodborne illness outbreaks from 1995 to 2008 that were attributed to eggs. OzFoodNet¹ reports spanning 2009 to March 2012 list 490 outbreaks in total and 86 outbreaks (17%) where it was plausible that eggs were the vehicle. Of the 86 outbreaks, 84 were thought to be caused by *Salmonella* and for two the cause was unknown. The evidence² used to support the attribution to eggs varies in strength. For 28 outbreaks there was microbiological evidence of *Salmonella*. For 16 outbreaks the attribution was supported by analytical epidemiology. For 50 outbreaks the evidence was described as descriptive.

¹ OzFoodNet reports may be accessed at <http://www.ozfoodnet.gov.au/internet/ozfoodnet/publishing.nsf/Content/reports-1>

² OzFoodNet descriptions of evidence: Descriptive evidence implicating the vehicle; Analytical epidemiological association between illness and vehicle; Microbiological confirmation of aetiology in vehicle and cases.

More specific egg-related food vehicles were often identified and a number of types of products were commonly reported:

- Raw egg salad dressings, mayonnaise and similar: 28 outbreaks – including nine associated with Vietnamese rolls
- Raw egg desserts, tiramisu, mousse and similar: 27 outbreaks – including nine associated with fried ice cream
- Raw egg sauces, Hollandaise and similar: 5 outbreaks

Foodborne illness investigations conducted by the NSW Food Authority in the period from 2009 to November 2012 were reviewed for the *Baseline evaluation of the NSW Egg Food Safety Scheme* (NSWFA 2013A, B). Eggs were a credible vehicle in 37 of 74 investigations (50%). In this case the quality of the evidence is good but not all reports of foodborne illness can be investigated. Outbreaks that are investigated tend to be larger and involve people from more than one household. As such they cluster in commercial or event settings. Epidemiological investigations are less effective in cases of sporadic illness or where members of only one household are involved.

More specific food vehicles could be identified in 73% of outbreaks:

- Raw egg dressings: 16 outbreaks – including seven associated with Vietnamese rolls
- Raw egg desserts: 10 outbreaks – including six associated with fried ice cream
- Raw egg sauces: 1 outbreak

Other contributing factors were mostly unknown but cross-contamination and undercooking were mentioned in a few cases.

Table 47 of the 2009 assessment is based on the work of Daughtry et al (2005). The table is a risk ranking of eggs based on their characteristics. It is a prediction of the annual number of *Salmonella* cases dependant on egg and process variables such as: commercial or non-commercial eggs; cracked or entire shells; yolk mean time³ (YMT) resolved or YMT not resolved; and the effectiveness of the *Salmonella* control step (no effect or provides moderate, substantial or reliable elimination of *Salmonella*). The egg characteristics leading to highest number of predicted *Salmonella* illnesses from shell eggs are:

- Commercial eggs, intact shells, YMT resolved, *Salmonella* growth in egg commenced, lightly cooked with a moderate *Salmonella* reduction: 772 cases
- Commercial eggs, intact shells, YMT resolved, no *Salmonella* reduction (such as raw egg drinks and cold desserts): 643 cases
- Non-commercial eggs, intact shells, YMT resolved, no *Salmonella* reduction: 198 cases
- Non-commercial eggs, intact shell, YMT resolved, lightly cooked: 79 cases
- Non-commercial eggs, cracked shell, YMT resolved, no *Salmonella* reduction: 66 cases

³ *Salmonella* growth in an egg occurs after the membrane surrounding the egg yolk breaks down. This takes a considerable period of time but is more rapid at warm temperatures.

Commercial eggs rank so highly because of the sheer number of eggs—estimated to be 392 million dozen in 2011 (AECL undated)—produced commercially each year. The greatest risk on a per serving basis is for non-commercial eggs⁴, cracked shell, YMT resolved and no *Salmonella* reduction with a prediction of 400 cases per million serves.

The analysis of foodborne illness reports above points to the significance of eggs served raw in mayonnaise type products and desserts. The dominance of eggs with YMT resolved in the risk ranking suggests this is likely to be a key factor in those outbreaks. Cross contamination coupled with temperature abuse is also plausible because ambient storage of food containing raw eggs was reported in some outbreaks.

Contaminated mayonnaise or dessert served to many people is likely to result in multiple illnesses (an outbreak) and come to the attention of regulatory authorities. A single illness from the service of one contaminated egg is less likely to be reported.

Prevalence of *Salmonella* in Australian eggs

Table 46 of the 2009 assessment provides data from an Australian Egg Corporation Limited (AECL) reports on the prevalence of *Salmonella* in a pilot study Australian eggs. No detections of *Salmonella* were reported and the estimated prevalence was low, up to 0.3% on ungraded shell eggs and 0.06% on graded shell eggs. Three studies published since the release of the 2009 assessment that examine *Salmonella* contamination of Australian eggs have been identified.

Chousalkar et al (2010) sampled 500 visually clean farm eggs for *Salmonella* by swabbing the shells, testing the shell crush after surface disinfection and testing the internal contents. All samples were negative for *Salmonella*.

Fearnley et al (2011) collected 199 retail samples—each containing one dozen eggs—for *Salmonella* testing of the external surface and the contents of the eggs. Cracked eggs were excluded. Seven samples (3.5%) were positive for *Salmonella* on the outside of the egg. No egg contents were positive for *Salmonella*. The positive samples were mainly cage laid eggs (6/113 samples; 5.3%). One of 62 samples (1.6%) of free range eggs was also positive. The rate of *Salmonella* positive samples for cage laid and free range eggs was not statistically significant. With 3.5% of pooled samples of 12 eggs positive the implied prevalence⁵ on eggs was 0.30%. The isolation rate and implied prevalence are both higher than the estimate for graded eggs in the AECL risk ranking study.

Chousalkar and Roberts (2012) sampled 1560 visually clean and intact eggs from the cage fronts of 26 commercial layer flocks, and tested the eggshell rinsate, eggshell crush after surface disinfection and internal contents in pools of 6 eggs for *Salmonella*. Six *Salmonella* Infantis isolates and one *Salmonella* serotype 4, 12:d isolate were obtained from the eggshell rinse. The number of positive samples was not stated but clearly 5–7 of 260 samples ($\leq 2.7\%$) were positive. *Salmonella* was isolated from 5 of 26 (19%) flocks. Assuming 2.7% of pooled samples of 6 eggs were positive the implied prevalence on eggs was 0.45%. The isolation rate and implied prevalence are both higher than the estimate for ungraded eggs in the AECL risk ranking study.

Table 1 provides includes international prevalence figures for comparison. Given Australia's SE status, prevalence figures of 0.30% and 0.45% seem high.

⁴ Ungraded eggs from non-commercial farms and backyard operations

⁵ Calculated using simple binomial probability

Table 1: Salmonella prevalence on and/or in eggs

| Country* | Egg type | Samples | Positive | Positive % | Pool size | Implied egg prevalence % |
|-------------------|-----------------|---------|----------|------------|-----------|--------------------------|
| Ireland 2005–06 | | 1169 | 0 | 0.00% | 6 | 0.000% |
| USA 1993–94 | At washing | 180 | 0 | 0.00% | 1 | 0.000% |
| Japan 2004–06 | Supermarket | 9010 | 3 | 0.03% | 10 | 0.003% |
| Ireland 2005–06 | | 5018 | 2 | 0.04% | 10 | 0.004% |
| Japan 2004–06 | Soiled | 1799 | 30 | 1.67% | 90 | 0.02% |
| Japan 2007–08 | Catering | 2030 | 5 | 0.25% | 10 | 0.02% |
| Japan 2004–06 | Processed clean | 11280 | 116 | 1.03% | 40 | 0.03% |
| UK 2003 | UK/Retail | 4753 | 9 | 0.19% | 6 | 0.03% |
| UK 2003 | Catering | 5686 | 17 | 0.30% | 6 | 0.05% |
| UK 2006 | Catering | 1588 | 6 | 0.38% | 6 | 0.06% |
| N Ireland 1996–97 | | 2090 | 9 | 0.43% | 6 | 0.07% |
| UK 2003 | Positive flocks | 13652 | 92 | 0.67% | 6 | 0.11% |
| UK 1991 | British | 2510 | 18 | 0.72% | 6 | 0.12% |
| UK 1991 | British | 7075 | 65 | 0.92% | 6 | 0.15% |
| UK 2002 | Catering | 726 | 7 | 0.96% | 6 | 0.16% |
| UK 1995–96 | UK | 13970 | 138 | 0.99% | 6 | 0.17% |
| USA 2006 | Restricted | 180 | 2 | 1.11% | 6 | 0.19% |

| Country* | Egg type | Samples | Positive | Positive % | Pool size | Implied egg prevalence % |
|---------------------|---------------------|---------|----------|------------|-----------|--------------------------|
| UK 1991 | Imported | 8630 | 138 | 1.60% | 6 | 0.27% |
| Australia** 2008 | Supermarket | 199 | 7 | 3.52% | 12 | 0.30% |
| UK 1996/97 | Imported | 1433 | 29 | 2.02% | 6 | 0.34% |
| Australia*** C2011 | Farm | 260 | 7 | 2.69% | 6 | 0.45% |
| Uruguay 2000–02 | | 620 | 58 | 9.35% | 20 | 0.49% |
| UK 2002–04 | Outbreak associated | 2102 | 88 | 4.19% | 6 | 0.71% |
| Hawaii 1989 | | 106 | 10 | 9.43% | 12 | 0.82% |
| France 2008 | Positive flocks | 4200 | 44 | 1.05% | 1 | 1.05% |
| UK 2005–06 | Imported | 1744 | 157 | 9.00% | 6 | 1.56% |
| Iran 2008 | Retail | 250 | 4 | 1.60% | 1 | 1.60% |
| North India 2006–07 | Farm | 260 | 10 | 3.85% | 1 | 3.85% |
| USA 1993–94 | At washing | 180 | 8 | 4.44% | 1 | 4.44% |
| North India 2006–07 | Market | 300 | 17 | 5.67% | 1 | 5.67% |
| South India 1997–98 | | 492 | 39 | 7.93% | 1 | 7.93% |

Notes: * Results, other than those noted, are from Martelli and Davies (2012)

** Fearley et al (2011)

*** Chousalkar and Roberts (2012)

Chemical hazards

Table 43 of the 2009 assessment provides information on agricultural product residues in eggs from the National Residue Survey (NRS). Nicarbazin was detected in five of 215 samples taken from 2004–05 to 2006–07. As no MRL is defined for nicarbazin in eggs the residues were contraventions. Nicarbazin is used as a coccidiostat in broiler chickens. It is not registered for use in egg-laying or breeding chickens.

NRS reports⁶ for 2007–08 through to 2010–11 and the 23rd Australian Total Dietary Study (FSANZ, 2011) also report the detection of violative residues of Nicarbazin in eggs. There was only one other residue detection in eggs in the four NRS reports. That detection was at a level below the MRL. The source of nicarbazin was thought likely to be cross-contamination during feed manufacturing or transport. Reported levels of nicarbazin are low, typically less than 1% of the MRL for nicarbazin in chicken skin/fat.

The European Food Safety Agency (EFSA, 2008) has investigated cross contamination of non-target feeding stuffs by nicarbazin. The report notes 'that under practical conditions during the production of mixed feeds, a certain percentage of a feed batch remains in the production circuit and these residual amounts can contaminate the subsequent batches'. The EFSA panel concluded 'that there is no indication of an appreciable risk to consumers' health from the ingestion of nicarbazin residues in products from animals exposed to cross contaminated feed up to a hypothetical level of up to 10% of the maximum authorised level'.

Nicarbazin has adverse effects on egg production at high levels of use (EFSA, 2008) and cross-contamination between broiler and layer hen feed appears to be a more likely explanation of the residues than off-label use of the product. This issue appears to be beyond the control of egg producers and outside the scope of the Egg Food Safety Scheme. Feed millers might be able to better segregate layer and broiler feeds.

⁶ NRS reports are available online at <http://www.daff.gov.au/agriculture-food/nrs/nrs-results-publications>

Baseline evaluation of the NSW Egg Food Safety Scheme

Microbiological survey of egg farms in NSW

The NSW Food Authority evaluates the effectiveness of interventions imposed on food businesses. This process includes assessment of the conditions prevailing at the initial stage of the intervention. A microbiological survey of egg farms in NSW was undertaken between 1 December 2010 and 30 November 2011 as part of the baseline evaluation of the NSW Egg Food Safety Scheme (NSWFA 2013A, D).

More than 380 environmental (boot/cage swabs and faecal material) and farm input (stock feed and drinking water) samples were collected from 49 farms. For each farm, samples were collected from a maximum of four sheds. From each shed, a set of four samples was collected comprising boot/cage swab, faecal material, feed at point of consumption and hen drinking water. For farms with less than four sheds, each shed was sampled as described. If available, samples of bulk stored feed and drinking water source samples were also taken from each farm. Participation in the survey was voluntary. To ensure state-wide coverage, proportionate numbers of farms were randomly selected from twelve regional areas in NSW.

All samples were analysed for serovars of *Salmonella*. Some water samples were also tested for *E. coli*. Overall *Salmonella* prevalence was calculated for farm/shed inputs (stock feed and water) and egg laying environment.

Survey findings are summarised as follows:

- Of the 49 egg farms in the survey, just under half (22/49) were positive for *Salmonella*. Specifically, 20% (10/49) of farms were positive for *S. Typhimurium*. No farm in the NSW survey was positive for *S. Enteritidis*.
- Overall, *Salmonella* prevalence was higher for egg laying environment samples (boot/cage swabs and faecal material) than samples of farm/shed inputs (stock feed and drinking water).
- Farm level inputs:
 - For bulk stored feed, 11% (3/27) samples were positive for *Salmonella*. *S. Typhimurium* was not detected in any bulk stored feed sample.
 - For bulk stored feed, *Salmonella* prevalence of self-produced feed was similar (14%, 1/7) to purchased feed (11%, 2/18).
 - None (0/20) of the drinking water source samples (reticulated and non-reticulated) were positive for *Salmonella*, but half (5/10) of the samples (all non-reticulated water) that underwent additional analysis contained detectable levels of *E. coli* indicating faecal contamination.
- Shed level inputs:
 - Due to increased risk of cross contamination from the shed environment, higher *Salmonella* prevalence was found in feed at point of consumption and hen drinking water than for bulk stored feed and water source samples.
 - In total, 17% (17/101) of feed at point of consumption and 6% (3/46) of hen drinking water samples tested positive for *Salmonella*.
- Egg laying environment:
 - In the egg laying environment, sample analysis found that just over one-quarter (26/99) of boot/cage swabs were positive for *Salmonella* and prevalence of *S. Typhimurium* was 10% (9/99).

- *Salmonella* prevalence for faecal material was lower (17%, 15/90) compared with boot/cage swabs (above). In total, 9% (8/90) of all faecal material samples were positive for *S. Typhimurium*.
- In total, seventeen serovars were isolated across the *Salmonella* positive egg farms in the survey. *S. Typhimurium* was the predominant serovar accounting for 30% (39/130) of all the *Salmonella* positive samples, followed by *S. Infantis* (19%, 25/130).
- In 2011 there were two serovars that were common to both farms and notified human salmonellosis cases: *S. Typhimurium* and *S. Infantis*.
- In total, six *S. Typhimurium* phage types were identified from the surveyed egg farms in NSW. Four out of the five most frequently isolated phage types in notified human cases in 2011 were also identified on the egg farms in this survey.
- *S. Typhimurium* MLVA analysis of egg farm samples identified seven MLVA types. Two types were common to notified human cases. *S. Typhimurium* MLVA 3-9-7-13-523 was the most frequently detected MLVA type, both in this study and isolated in humans, in NSW in 2011. *S. Typhimurium* MLVA 3-9-7-15-523 was the only other MLVA type in common.

Salmonella was detected on close to half of the farms surveyed. Many of the *Salmonella* types that predominated on farms also predominate amongst isolates from humans. While there is sufficient evidence in the scientific literatures to show that the presence of *Salmonella* in the egg laying environment does not automatically infer a high prevalence on whole eggs offered for sale, it does highlight increased risk associated with cross contamination of *Salmonella* from the environment to whole eggs.

Survey of NSW egg industry practices and processes⁷

Authority officers observed selected farm operating practices (biosecurity, egg handling and packing methods) and the management of certain system inputs (stock feed and water) as part of the baseline evaluation study (NSWFA 2013A, C).

- Biosecurity – about three-quarters (104/139) of businesses indicated that they had adopted a minimum level of biosecurity management. These were mostly limited to restricting access to farms (usually to staff only), followed by insisting on a 48 to 72 hours delay in between farm visits. A small number of businesses had adopted additional practices such as vehicle wheel wash, sanitised foot baths and hand wash at the entrance to each laying shed. There is potential for increased levels of industry awareness and adoption of practices identified in the National Farm Biosecurity Manual and the NSW biosecurity guidelines for free range poultry farms.
- Stock feed – just over 80% (87/106) of egg businesses purchased stock feed from a manufacturer or supplier while the remainder indicated they assembled dry mash or pelleted feed on site. Almost 90% (54/61) of businesses were observed to adequately cover their stock feed to prevent contamination from rodents and birds.
- Water sources and current levels of testing – just over half (73/139) of egg producers were using non-reticulated water (bore or dam water) for their hen drinking water. Approximately one-third (45/73) of the businesses using non-

⁷ The standards against which the industry was assessed are available on the Food Authority website: <http://www.foodauthority.nsw.gov.au/industry/industry-sector-requirements/eggs/>

reticulated water exceeded the requirements by routinely testing water for indicators of faecal contamination (*E. coli*). In addition, almost 60% (43/75) of egg producers/graders used non-reticulated water as their primary water source but only six (14%) monitored their water for *E. coli*. Grading facilities that do not 'wet wash' eggs are not required to test non-reticulated water.

- Egg grading – that just over 60% (72/116) of egg businesses undertook egg grading within 24 hours of collection. About one-quarter (29/116) of businesses stored eggs for up to 48 hours before grading, with the remaining 12% (14/116) storing their eggs from 49 to 96 hours before grading.
- Crack detection – under the Egg Regulation, egg producers/graders must check eggs for cracks using candling or an equivalent demonstrated method. Visual crack detection without a backlight is not acceptable. For nearly 15% (11/60) of egg businesses in the study, crack detection practices were limited to checking for visible cracks only (no backlight).
- Egg pulp handling – less than one-fifth (17%, 13/77) of businesses handled cracked eggs/pulp for further processing either by selling cracked eggs to a licensed processor (14%) or collecting pulp themselves (3%) and then selling it.
- Egg cleaning – approximately two-thirds of the businesses (68%, 60/88) manually cleaned dirty eggs using either a damp cloth (27%, 24/88) or another abrasive material/tool (44%, 36/88). Wet washing was practised by the remaining 32% (28/88) of businesses. About 20% (6/28) of wet washers did not add sanitiser to wash water. A small number of businesses (14%, 4/28) were identified as having adopted unusual wash water treatment practices. These included using boiled water to wash the eggs, sanitising wash water with vinegar or adding dishwashing detergent. One business was observed soaking eggs in wash water (an unacceptable practice).

A risk management project to address the identified deficiencies has commenced.

Conclusion

There is good evidence that transovarian *S. Enteritidis* is not endemic in Australia. This status is vitally important to the egg industry and public health. The egg industry can contribute in a small way to staying SE free by maintaining high level biosecurity on the farm. However, the primary defence is import controls over animal products. The main burden falls on quarantine authorities with animal health agencies having a combat role should there be a break in quarantine.

Raw egg mayonnaise, desserts and sauces continue to cause significant outbreaks of foodborne illness in NSW and Australia-wide. Modelling suggests that eggs and egg products are a significant cause of community illness.

Two recent studies of *Salmonella* in eggs have generated prevalence rates on the external surface of the eggs higher than used in the development of the AECL model of egg-borne illness. The results are contrary to expectations in that they are quite high compared to results for developed countries where SE is endemic in laying flocks. The results suggest there now may be value in scoping a large survey of *Salmonella* prevalence in eggs. As outlined in Table 2, testing rinse samples from pools of 6 or 12 eggs could produce sufficient positive results to firm up estimates of prevalence.

Table 2: Salmonella prevalence on eggs and proportion of sample pools positive

| Prevalence | Pool of 6 eggs | Pool of 12 eggs |
|------------|----------------|-----------------|
| 0.05% | 0.30% | 0.60% |
| 0.10% | 0.60% | 1.19% |
| 0.15% | 0.90% | 1.79% |
| 0.20% | 1.19% | 2.37% |
| 0.30% | 1.79% | 3.54% |
| 0.40% | 2.38% | 4.70% |
| 0.50% | 2.96% | 5.84% |

Chemical contamination in eggs is low. The main issue has been the coccidiostat nicarbazin and the risk to consumers is low. The problem is thought to originate from the feed milling industry and cross contamination between broiler feed and layer hen feed.

The microbiological survey of egg farms in NSW and the survey of industry practices and processes underpin the introduction of regulatory food safety measures in NSW. *Salmonella* was detected on close to half of the farms surveyed. There are opportunities to improve biosecurity practices, stock food protection, water testing, egg grading practices, crack detection and egg cleaning on some farms.

Overall this review is a simple extension of the 2009 assessment. It supports the use of food safety programs to control risks. The next periodic assessment should have the benefit of a second round of evaluation studies. Further local work would be welcome to overcome the dominant influence of endemic SE on poultry literature.

References

- AECL (undated). Australian Egg Corporation Limited Annual Report 2011 // 2012. Retrieved 7 March 2013 from <http://www.aecl.org/system/attachments/583/original/Annual%20Report%202012.pdf?1353999180>
- Animal Health Australia (2011). *Salmonella* Enteritidis infection in poultry. Retrieved 27 February 2013 from <http://nahis.animalhealthaustralia.com.au/pmwiki/pmwiki.php?n=Factsheet.154-2?skin=factsheet>
- Chousalkar, K. K., Flynn, P., Sutherland, M., Roberts, J. R., & Cheetham, B. F. (2010). Recovery of *Salmonella* and *Escherichia coli* from commercial egg shells and effect of translucency on bacterial penetration in eggs. *International Journal of Food Microbiology*, 142(1-2), 207-213.
- Chousalkar, K. K., & Roberts, J. R. (2012). Recovery of *Salmonella* from eggshell wash, eggshell crush, and egg internal contents of unwashed commercial shell eggs in Australia. *Poultry Science*, 91(7), 1739-17414
- Daughtry, B., Sumner, J., Hooper, G., Thomas, C., Grimes, T., Horn, R., Moses, A. & Pointon, A. (2005). *National food safety risk profile of eggs and egg products*. A report for the Australian Egg Corporation Limited (AECL) Publication No 05/06 Project SAR-47.
- EFSA (2008) Opinion of the Scientific Panel on Contaminants in the Food Chain on a request from the European Commission on cross-contamination of non-target feedingstuffs by nicarbazin authorised for use as a feed additive. *The EFSA Journal* (2008) 690, 1-34. Retrieved 5 February 2013 <http://www.efsa.europa.eu/en/efsajournal/doc/690.pdf>
- Fearnley, E., Raupach, J., Lagala, F., & Cameron, S. (2011). *Salmonella* in chicken meat, eggs and humans; Adelaide, South Australia, 2008. *International Journal of Food Microbiology*, 146(3), 219-227.
- FSANZ (2011). *The 23rd Australian Total Diet Study*. Retrieved 27 February 2013 from http://www.foodstandards.gov.au/srcfiles/FSANZ%2023rd%20ATDS_v8.pdf
- Martelli, F., & Davies, R. H. (2012). *Salmonella* serovars isolated from table eggs: An overview. *Food Research International*, 45(2), 745-754.
- NSW Food Authority (2009). *Food Safety Risk Assessment of NSW Food Safety Schemes*. Retrieved 27 February 2013 from http://www.foodauthority.nsw.gov.au/Documents/science/Food_Safety_Scheme_Risk_Assessment.pdf
- NSW Food Authority (2013A). *Evaluation of the Egg Food Safety Scheme*. Retrieved 27 February 2013 from <http://www.foodauthority.nsw.gov.au/science/evaluating-what-we-do/egg-food-safety-scheme/>
- NSW Food Authority (2013B). *Baseline evaluation of the NSW Egg Food Safety Scheme – results summary report*. Retrieved 27 February 2013 from http://www.foodauthority.nsw.gov.au/Documents/science/egg_baseline_evaluation_results_summary.pdf

NSW Food Authority (2013C). *Baseline evaluation of the NSW Egg Food Safety Scheme Survey of NSW egg businesses – industry profile and observed practices*. Retrieved 27 February 2013 from http://www.foodauthority.nsw.gov.au/Documents/science/egg_baseline_evaluation_onsite_report.pdf

NSW Food Authority (2013D). *Baseline evaluation of the NSW Egg Food Safety Scheme – microbiological survey of egg farms in NSW*. Retrieved 27 February 2013 from http://www.foodauthority.nsw.gov.au/Documents/science/egg_baseline_micro_survey.pdf

OzFoodNet (2012). *Monitoring the incidence and causes of diseases potentially transmitted by food in Australia: Annual report of the OzFoodNet network, 2010*. Retrieved 27 February 2013 from [http://www.health.gov.au/internet/main/publishing.nsf/Content/cda-cdi3603-pdf-cnt.htm/\\$FILE/cdi3603a.pdf](http://www.health.gov.au/internet/main/publishing.nsf/Content/cda-cdi3603-pdf-cnt.htm/$FILE/cdi3603a.pdf)

Taylor, M., Leslie, M., Ritson, M., Stone, J., Cox, W., Hoang, L., . . . Outbreak Investigation, T. (2012). Investigation of the Concurrent Emergence of *Salmonella* Enteritidis in Humans and Poultry in British Columbia, Canada, 2008–2010. *Zoonoses and Public Health*, 59(8), 584-592.

NSW Food Authority
6 Avenue of the Americas
Newington NSW 2127
PO Box 6682 Silverwater NSW 1811
Phone 1300 552 406
Fax 02 9647 0026
www.foodauthority.nsw.gov.au