Ministry for Primary Industries
Manatū Ahu Matua

Discussion Paper: Options for Verifying *Salmonella* Control in Broiler Chickens under the Animal Products Act 1999

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by the Animal Products Group

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Growing and Protecting New Zealand

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OPTIONS FOR VERIFYING *SALMONELLA* CONTROL IN BROILER CHICKENS UNDER THE ANIMAL PRODUCTS ACT 1999

This discussion paper provides options for the verification of *Salmonella* control for chickens under the Animal Products Act 1999. The current requirements for the verification of *Salmonella* control in chickens are specified in Animal Products (National Microbiological Database Specifications) Notice 2015 (effective 31st August 2015) (MPI[2], 2015). Ministry for Primary Industries (MPI) emphasises that the views and recommendations outlined in the paper are preliminary and are provided as a basis for consultation with stakeholders.

MPI will analyse submissions and amend the National Microbiological Database specification given due consideration to feedback received. Once the amendment is finalised it will be issued by MPI and posted on the MPI website. Hard copies will be available on request.

SUBMISSIONS

MPI welcomes written submissions on the proposals contained in this document. All submissions must be received by MPI no later than 4 December 2015

Written submissions should be sent directly to:

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Ministry for Primary Industries
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25 The Terrace
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Wellington 6140

or emailed to: nmd@mpi.govt.nz

RELEASE OF SUBMISSIONS

MPI expects to release all submissions. If you have specific reasons for wanting to have your submission or personal details withheld, please set out your reasons in the submission. All submissions are also subject to the Official Information Act 1982 and can be released (along with the personal details of the submitter) under the Act. MPI will consider those reasons when making any assessment under the Act.

1 Executive Summary

Regulatory monitoring requirements for the verification of *Salmonella* controls on broiler chickens at the end of primary processing have been included in the Animal Products (National Microbiological Database Specifications) Notice (National Microbiological Database or NMD) since mid-2001. The *Salmonella* Performance Standard requirements are based on the 1996 United States Department of Agriculture Food Safety and Inspection Service (USDA FSIS) requirements for *Salmonella* on carcasses of young chicken which specifies that *Salmonella* may be detected in no more than 12 of 51 consecutive poultry samples.

This *Salmonella* Performance Standard for broiler chickens in the NMD programme has not been evaluated since it was introduced and it is timely to initiate a review given that:

- In July 2011, the USDA FSIS reviewed and updated its *Salmonella* requirements for young chicken to a maximum of 5 out of 51 carcasses with *Salmonella*, and
- In April 2014, The Poultry Industry Association of New Zealand (PIANZ) asked MPI to review the *Salmonella* Performance Standard (SPS) for whole broiler chicken carcasses at the end of primary processing.

PIANZ (May and June 2014) also requested that other types of poultry should be included within the NMD programme and proposed that a *Salmonella* Performance Standard should be introduced for ducks and turkeys. An assessment of the options for the verification of the control of *Salmonella* at the end of primary processing for ducks and turkeys is addressed in a separate document.

MPI has sought information and views from the poultry industry to inform the review process; the feedback from the poultry industry has assisted in the development and assessment of options presented in this paper.

MPI's preferred position is to retain the requirements for primary processers to monitor *Salmonella* in broiler chickens within the NMD programme. With respect to the *Salmonella* Performance Standard, MPI's preferred position is to adopt the 2011 USDA FSIS standard and include the further amendment from April 2015. This is because there is a very low level of *Salmonella* detected in the New Zealand broiler chicken industry. In addition, MPI is also proposing that the recommended actions following the detection of *Salmonella* in chickens at the end of primary processing is updated to reflect the current industry practice. It is proposed that the NMD Specification is amended to take account of these changes.

This document is one of a package of discussion documents that provide proposals from MPI to amend the poultry NMD programme. Two other documents cover the introduction of ducks and turkeys to the poultry NMD programme and an amendment to introduce other types of chickens processed for meat into the NMD programme, including breeder and end-of-lay chickens processed for human consumption. The poultry NMD programme will also be amended following a consideration of the submissions received to the consultation on the *Campylobacter* Performance Target in May 2015 (MPI[2], 2015).

2 Introduction

This review of the monitoring requirements for the verification of *Salmonella* controls on broiler chickens at the end of primary processing forms part of the Ministry for Primary Industries (MPI) risk management strategy for *Salmonella*.

2.1 ISSUE AND CONTEXT

Regulatory monitoring requirements for the verification of *Salmonella* controls on broiler chickens (poultry) at the end of primary processing have been included in the Animal Products (National Microbiological Database Specifications) Notice (National Microbiological Database or NMD) since mid-2001. This established a *Salmonella* performance standard for broiler chickens where *Salmonella* may not be detected in more than 12 out of 51 consecutive poultry samples. This was based on the requirements from the Food Safety and Inspection Service of the United States Department of Agriculture (USDA FSIS). The regulatory monitoring programme for *Salmonella* and broiler chickens has not been reviewed during the 13 years of operation in New Zealand.

In April 2014, the Poultry Industry Association of New Zealand Incorporated (PIANZ) asked MPI to review and revise the *Salmonella* Performance Standard for broiler chickens at the end of processing in the NMD programme. PIANZ suggested that the performance standard should be amended to that of the revised USDA 2011 standard, where *Salmonella* may not be detected in more than 5 out of 51 consecutive poultry samples. It was suggested that amending the New Zealand *Salmonella* standard would permit a comparison with the current USA standard. In April 2015, the USDA FSIS issued a further amendment to the standard whereby the *Salmonella* Performance Standard applies to a continuous moving window of 51 samples rather than to consecutive samples collected as part of a discrete sample set.

MPI has received a further request from PIANZ to introduce a *Salmonella* Performance Standard for whole duck and turkey carcasses at the end of primary processing (these are types of poultry not currently included in the NMD programme). This has been considered in a separate discussion document.

2.2 NMD AMENDMENT

MPI has been working towards an amendment of the NMD programme requirements since March 2014. The proposed amendments are intended to both simplify and harmonise the requirements for the different species where possible. One of the amendments proposed is to clarify the requirements in response to the detection of *Salmonella* for poultry. Any options proposed as part of this discussion document should also be considered in conjunction with the consultation on the other proposed NMD amendments.

2.3 SCOPE

2.3.1 Inclusions

This paper considers:

- Chickens primarily produced and processed for meat currently covered by the scope of the NMD programme at the end of primary processing,

- Those types of *Salmonella* that do not cause foodborne salmonellosis.

2.3.2 Exclusions

This paper does not consider:

- *Salmonella* that cause human typhoid and paratyphoid fevers,
- The microbiological verification for *Salmonella* controls at the end of secondary processing[1] for broiler chickens (portions, comminuted poultry meat, etc.) and further processed products, such as ready-to-eat poultry products,
- A review of the good operating practices and control measures for *Salmonella* during the primary production and processing of broiler chickens.

Additional papers consider options for the following amendments to the NMD programme:

- Other species of poultry that are primarily produced and processed for meat, and
- Other classes of chickens not covered by the scope of the NMD programme such as poussin, end-of-lays (spent hens) and breeder stock (i.e. chickens primarily produced for purposes other than for human consumption).

2.4 RISK MANAGEMENT QUESTIONS

MPI are seeking to address the following risk management questions in the review of the *Salmonella* performance standard for broiler chickens in the NMD programme:

1. Has the current *Salmonella* Performance Standard in the NMD programme for broiler chickens provided any improvement to public health in terms of a reduction in the number of foodborne salmonellosis cases since its introduction in 2001?
2. Has the inclusion of broiler chickens in the NMD programme assisted the poultry industry to gain access to overseas markets?
3. Is the current target, the *Salmonella* Performance Standard, for whole broiler chicken carcasses operating at the right level of prescription and robustness to provide confidence in the control of *Salmonella* at the end of primary processing?
4. Is the sampling frequency specified in the NMD programme sufficiently robust to provide a timely picture of what is occurring in slaughtered NZ poultry flocks?
5. Are the sampling and analytical methods for whole broiler chicken carcasses and *Salmonella* providing an appropriate level of confidence in the robustness, sensitivity and specificity of these?

[1] In the USA there is evidence of a higher prevalence of Salmonella at the end of secondary processing (chicken portions, minced chicken and mechanically separated chicken meat).

3 Background

3.1 THE NEW ZEALAND POULTRY INDUSTRY

There are sixteen registered risk management programmes (RMPs) for the primary processing of broiler chickens for human consumption. This represents 11 different poultry companies (processing broiler chickens and/or turkeys or ducks) of which eight are members of PIANZ (as at 23rd April 2015). A lot of the larger companies are vertically integrated and manage all aspects of poultry meat production within their separate companies from feed production to breeding, primary production, primary processing and (secondary and further) processing of value-added products.

The New Zealand poultry industry has indicated that it is committed to controlling *Salmonella* during primary production and processing of broiler chickens and is an advocate for the continued monitoring of broiler chickens and for *Salmonella* in the NMD programme.

To help inform the review of the poultry NMD programme for *Salmonella*, MPI prepared a questionnaire to gather descriptive information about the poultry industry and in particular husbandry practices, numbers and species of birds processed and additional microbiological testing conducted. Ten RMP operators responded to the questionnaire covering chickens, ducks, turkeys and/or other types of poultry

Eight of the ten primary broiler chicken processors responded. Of the seven that provided data in a consistent format the proportion of broiler chickens 89% of the broiler chickens are barn raised and free range makes up the remaining 11%. The proportion of free range chickens processed is expected to increase due to market demands. This may result in a different microbiological profile or the more frequent detection of *Salmonella* due to a greater exposure to potential microbiological hazards.

3.2 LEGAL REQUIREMENTS

The current legal requirements for the poultry *Salmonella* regulatory testing programme are found in the Animal Products (National Microbiological Database Specifications) Notice 2015 (MPI[2], 2015) and its associated Schedule. Refer to:

http://www.foodsafety.govt.nz/elibrary/industry/animal-products-national-nmd/nmd-notice-amended-includes-schedule-2015.pdf

3.3 PURPOSE OF THE *SALMONELLA* PERFORMANCE STANDARD

The NMD programme for the broiler chicken industry was developed in mid-2001. The monitoring programme included more frequent sampling for *Salmonella* rather than seasonal sampling requirements for the red meat programme. The higher frequency for testing was to ensure the provision of a robust monitoring programme. It also provided the regulator and industry with data to show the level of *Salmonella* present at the end of primary processing.

The requirements for New Zealand's red meat export programme were based on the *USDA Pathogen Reduction; Hazard Analysis and Critical Control Point (HACCP) Systems, Final Rule*[2]*.* In the absence of other international monitoring programmes, the Ministry of Agriculture and Forestry (MAF) Food and the poultry industry decided to model New Zealand's poultry monitoring programme from the same reference source: Table 2 Federal Register/Volume 61, No. 144 page 38867. This introduced the *Salmonella* performance standard: '*Salmonella* may be detected in no more than 12 of 51 consecutive chicken samples'.

These criteria were accepted by the poultry industry into the NMD programme (2001) and this became a New Zealand Standard in April 2005. These criteria remain the current New Zealand standard.

[2] USDA Pathogen Reduction; Hazard Analysis and Critical Control Point (HACCP) Systems, Final Rule. Ed. Department of Agriculture, Food Safety and Inspection Services: Federal Register,1996. Vol. 61.

4 Effect on Public Health

4.1 SALMONELLOSIS

The *Salmonella* bacterium is the second most common bacterial cause of foodborne illness in New Zealand. Cases of salmonellosis are associated with a wide range of different foods although there are also non-food sources. Symptoms of illness are usually self-limiting, but people may require treatment for dehydration or complications, such as reactive arthritis.

An assessment of the burden of common foodborne diseases reported in New Zealand ranked salmonellosis as fifth according to the number of Disability Adjusted Life Years (DALYs) (Cressey and Lake, 2014) (after norovirus infection, campylobacteriosis, STEC infection and listeriosis). The study estimated a total of 74 foodborne DALYs for salmonellosis which represents 62.1% of the total 121 DALYs, where the foodborne percentage being derived from an expert consultation process.

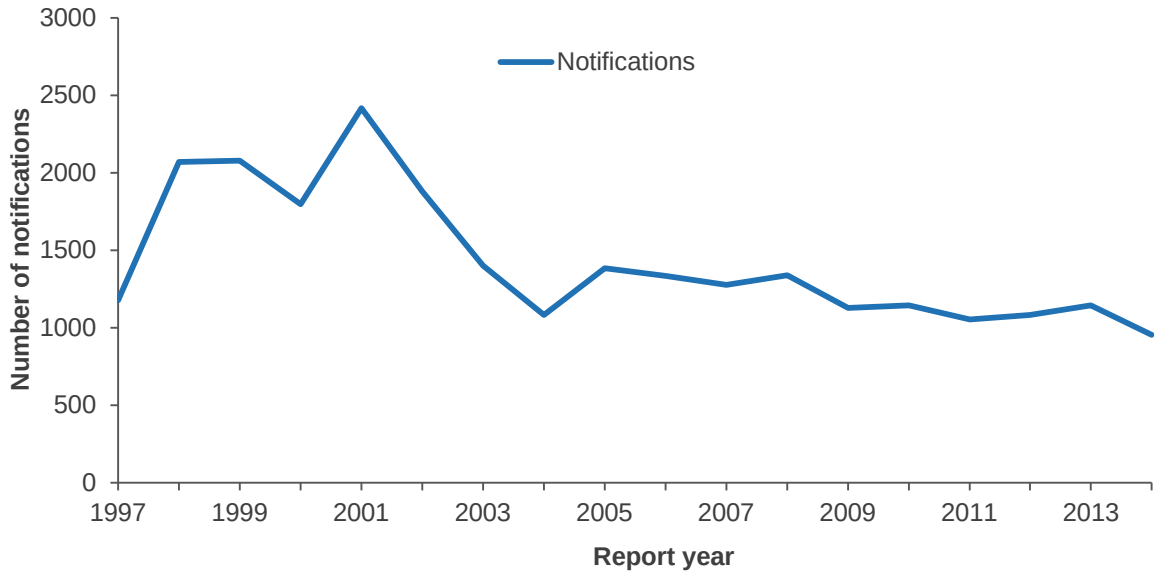
MPI (then known as the New Zealand Food Safety Authority (NZFSA)) initiated the *Salmonella* Risk Management Strategy in 2008 as part of a suite of activities to reduce the prevalence of foodborne illness in New Zealand.

4.2 HUMAN SALMONELLOSIS CASES

In 2014, there were a total of 954 (21.2 per 100,000 population) notified cases of salmonellosis, of which it was estimated by expert consultation that 62.1% (95th percentile credible interval: 35.2% to 86.4%) of salmonellosis incidence is due to foodborne transmission (592 cases per 100,000 population) (Horn *et al.*, 2015). Further information on the cases, outbreaks and case control studies relating to *Salmonella* is available in Appendix 1.

The notification of salmonellosis cases peaked during 2001 in New Zealand. Annual notifications were stable between 2009 and 2013, but decreased in 2014 to the lowest level since the notification system was implemented as shown in Figure 1.

Figure 1: Salmonellosis notifications, 1997-2014



4.2.1 Salmonella serovars isolated from human cases

Isolates from 958 cases infected with *Salmonella* were typed by the ESR Enteric Reference Laboratory during 2014 (Horn *et al*., 2015). Of these cases, 392 (40.9%) were *Salmonella* Typhimurium. The most common serotypes identified in 2014 were *S*. Typhimurium phage type 56 variant (prior to 2012 known as RDNC-May 06 (72 cases), *S*. Infantis (56 cases) and *S*. Typhimurium phage type 101 (41 cases).

4.3 POULTRY AS A SOURCE OF HUMAN SALMONELLOSIS

Salmonellosis is associated with a number of different sources, foodborne and non-foodborne. An MPI - commissioned expert consultation (2013) estimated that 62.1% (95th percentile credible interval: 35.2% to 86.4%) of all the cases were food-related. It was further estimated that approximately 19% of foodborne transmission acquired domestically was due to transmission via poultry.

In 2014 the most commonly reported risk factors for salmonellosis cases was the consumption of food from retail premises (50.8%) and travelling overseas during the incubation period (37.8%) (Horn *et al*, 2015). Results from outbreak investigations and case-control studies of infections with specific serotypes have also found epidemiological and microbiological evidence for poultry as a vehicle for infection (Appendix 1).

An attribution study (French *et al.*, 2013) collected a total of 939 non-typhoidal *Salmonella* enterica isolates from separate samples from May 2011 to April 2012. Attribution models estimated that 16% (95% Confidence Interval 1-44%) of human salmonellosis cases were attributable to *Salmonella* strains previously associated with poultry sources. However this study only investigated the source rather than the pathway of infection and did not investigate the role that the consumption of poultry meat played in human foodborne salmonellosis.

A presentation at the 2014 New Zealand Microbiological Society provided two case studies where the detection of *Salmonella* had a measurable effect on public health. In 2003, low levels of *Salmonella* Typhimurium DT1 were detected in dust collected from the bottom of a wheat silo; the wheat had been added to finished poultry feed with no heat treatment. The prevalence of *S*. Typhimurium DT1 detected increased in both the broiler flocks (from 12% to 53%) and in the whole carcass rinse samples (from 5.5% to 23%). Prospective analysis was able to detect *S*. Typhimurium DT1 in 7% of poultry samples produced by this operator and an analysis of the human health statistics demonstrated that there was unexpected increase in the number of human cases of this particular serotype. A second example tracked *Salmonella* Typhimurium pt101 from the hatchery flocks through to human cases. The levels of *S*. Typhimurium pt101 peaked in the broiler chicken flocks at 60% and company-own testing mirrored the picture observed in the NMD programme until 2008. In addition the pattern of human salmonellosis cases followed those observed in the poultry flocks. In 2008, additional interventions were introduced to minimise the levels of *Campylobacter*. Whilst *S*. Typhimurium pt101 continued to be observed in the broiler flocks, it was not frequently detected in the carcass rinse samples and yet there continued to be human cases. The presentation surmised that this may be due to the effect of the additional interventions for controlling *Campylobacter* that may affect the sensitivity of the analytical method for *Salmonella*. This impact was unknown prior to the introduction of the intervention.

4.3.1 Salmonellosis outbreak data

A summary of the *Salmonella* outbreaks associated with the consumption of poultry meat is provided in Table 1 for the years from 2006-2014 (King et al. 2011; Lopez *et al.,* 2012, Lim *et al*., 2013, Horn *et al*.,

2014, Horn *et al*., 2015). An analysis of the association between the consumption of poultry meat and individual cases of salmonellosis has not been undertaken.

Table 1: *Salmonella* outbreaks / cases associated with poultry meat (from 2007)

Public Health Unit	**Month / year**	***Salmonella* serotype**	**Suspected vehicle**	**Exposure setting**	**Preparation setting**	**No. ill**
Nelson	October 2012		Chicken	Takeaway	Takeaway	23C
Waikato	December 2010		Chicken curry	Restaurant/café	Overseas, Tonga	3C
Nelson	March 2008	S. Mbandaka	Poultry, eggs	Home, Supermarket, Takeaway, Café	Home, Supermarket, Takeaway, Café	34C
Wellington	October 2007	S. Montevideo	Chicken, lamb or vegetarian kebabs	Takeaway	Takeaway	10C
	2007	S. Typhimurium 156	Chicken, taro, chop suey, sweet and sour mince, egg fu yong	Fundraising event	Fundraising event	11C, 8P
	2007	S. Typhimurium 160	BBQ chicken bacon pizza	Takeaway	Takeaway	1C, 1P

C = Confirmed cases P = Probable cases

4.3.2 Recalls

Between 2001 and August 2015 there were no New Zealand recalls issued for contamination of poultry products with *Salmonella* species. Recalls are usually related to ready-to-eat products. The New Zealand poultry industry estimated that approximately 14% of poultry would reach the consumer in a pre-cooked form (Lake *et al*., 2008a).

4.4 THE ROLE OF NMD PROGRAMME AND EFFECT ON THE NOTIFICATION OF HUMAN CASES OF SALMONELLOSIS

The number of salmonellosis notifications reached a peak in 2001 (refer to Figure 1). The reduction in the number of cases occurred at a similar time to the introduction of monitoring for *Salmonella* in broiler

chickens in the NMD programme following discussions between the poultry industry and the Ministry of Agriculture and Forestry (MAF).

General controls introduced for *Salmonella* include good agricultural practices, good hygienic practice, good manufacturing practices and hazard analysis critical control point. The most effective hazard control measures for *Salmonella* have been applied at primary production. These include controls for the importation of breeding stock including vaccination; and strict biosecurity for breeding operations, hatcheries and on farm, and controls for poultry feed. A report by FSANZ (2005) provides further information on the effect of each process stage during slaughter and dressing on *Salmonella* contamination.

No work has been undertaken by MPI to determine whether the introduction of the NMD programme for poultry has had any consequential effects on the number of human salmonellosis cases. However Figure 1 shows that a reduction in the number of human cases of salmonellosis at about the same time (circa 2001) that the initial performance standard was introduced. Further the number of human salmonellosis cases may have been influenced by the changes brought about by the introduction of the MPI *Campylobacter* risk management strategy and development of the *Campylobacter* Performance Target in the NMD programme for broiler chickens. The poultry industry made significant improvements and interventions for *Campylobacter* control during the primary processing of broiler chickens. These interventions, are also likely to have made an impact on any *Salmonella* present on the carcasses resulting in a reduced prevalence or concentration of *Salmonella* at the end of primary processing. This hypothesis is supported by the trend in reported cases of human salmonellosis decreasing in line with the time frame for the introduction of the *Campylobacter* interventions.

5 International Perspective

Whilst the New Zealand poultry industry is predominantly a domestic focussed industry it is expanding into export markets. The value of chicken product exports has substantially grown in the last five years.

When the poultry industry asked MPI to conduct a review of the SPS in the NMD programme for broiler chickens they stated that a reason for doing this was that if the New Zealand reference standard was changed to that of the revised USDA 2011 standard, to the equivalent of 5/51, as this would permit comparison with the current USA standard.

This section summarises the key points of the monitoring systems in place in a number of overseas countries to verify the control for *Salmonella,* and what if any effect revising the NMD programme for *Salmonella* in broiler chickens would have for export purposes.

5.1 MARKET ACCESS IMPLICATIONS

One of the selling points for New Zealand chicken products is the country's disease free status for a number of important chicken diseases. Growing the exports of chicken products may require additional assurances about the microbiological status of poultry meat products including the particular serovars present and antimicrobial status. It is not known whether the low prevalence of *Salmonella* in the whole birds illustrated via the NMD programme has contributed to the growth of poultry exports. New Zealand poultry processors are currently exporting products to the Pacific Islands, Australia, Papua New Guinea, Hong Kong, the United Arab Emirates and Japan.

The NMD programme helps to support export assurances for the New Zealand red meat industry with the United States and the European Union having accepted the *Salmonella* sampling regime, as being equivalent. To date there has been no trade in poultry products between New Zealand and either the EU or US, and as such there has been no assessment of equivalency between the poultry NMD programme and the respective legislation and systems.

5.2 INTERNATIONAL POULTRY STANDARDS

A summary of the requirements for the verification of *Salmonella* control in the USA, Canada, European Union and Australia in their domestic industry including processing standards is provided in Appendix 2.

5.2.1 Emerging Issues

The review of international standards for the processing of broiler chickens identified a number of areas which whilst out of scope for this document may be indicative of future or emerging issues for MPI and the New Zealand poultry industry to consider:

- The continued review of the Food Standards Code 1.6.1 Microbiological Limits for Food may have implications for New Zealand produced poultry meat if additional process hygiene and/or food safety criteria are proposed.
- The USA and European Union require that regulatory sampling and testing is undertaken for *Salmonella* at the end of primary processing for chicken and turkey carcasses, and for a number of secondary processed products including minced poultry meat, meat preparations and mechanically separated meat. Whilst there are no microbiological criteria for these products in New Zealand, operators that export these types of products should be aware that there may

be additional requirements for secondary processed products that should be met and may be addressed by requirements in the OMAR.

- Regulatory and exploratory sampling conducted by the USDA FSIS has found significantly higher *Salmonella* prevalence in secondary processed chicken portions and products compared to whole chicken carcasses. A full and contemporary microbiological study of broiler chickens collected throughout the New Zealand supply chain has not been undertaken to determine whether there is a similar pattern of results. A survey would also help to determine whether the hazard profile in New Zealand poultry has changed. Previous surveys have focussed either at the stage of primary processing or to provide a snap shot of the microbiological status of whole chicken carcasses or parts available at retail.
- There is growing interest from regulatory authorities to develop microbiological criteria for *Salmonella* in poultry meat based on the application of quantitative and molecular methods to focus on those *Salmonella* serovars that are considered to have greater significance to human foodborne illness.

6 Review of the NMD programme requirements

The NMD programme provides a monitoring programme and a performance target for *Salmonella* in broiler chickens. This covers these aspects of the NMD programme and considers the methods for sampling and analysis. NMD results from 2014 show that *Salmonella* prevalence in broiler chickens at the end of primary processing was less than 0.5%. The industry has made improvements in control of *Salmonella* since the programme was introduced.

6.1 REVIEW OF THE MONITORING programme

A monitoring programme for *Salmonella* in broiler chickens was introduced by MAF in 2001 to verify the effectiveness of control measures for *Salmonella* contamination during the slaughter and dressing of chickens as part of the NMD programme. The results from the monitoring programme are in Figure 2, this shows that the annual mean prevalence for *Salmonella* on chicken carcasses peaked in 2005, where there was a mean of 3.5% (Figure 2) from a base of between 1 to 2% prevalence.

Figure 2: NMD National Profile Poultry Salmonella Prevalence for each year (2001-2014)

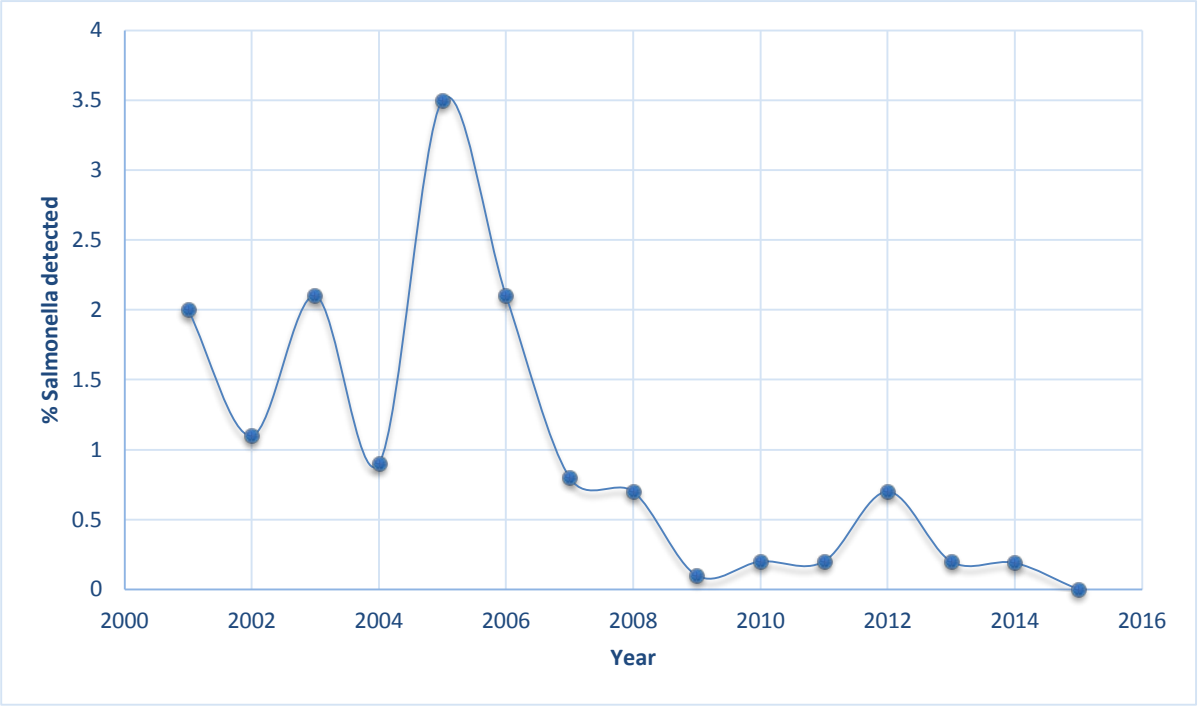


Table 2 shows the total number of samples tested for *Salmonella* in the NMD poultry programme and the number of in which *Salmonella* was detected from October 2005 through to 31st August 2015. In the 10 year period from 2005, there were 20,849 samples of which *Salmonella* was detected in 169 carcasses giving an overall *Salmonella* prevalence of 0.8%. During the 2014 processing year there were three detections of *Salmonella* in broiler carcasses processed at three separate premises.

Table 2: NMD results for *Salmonella* species on whole poultry carcasses, 2005-2015

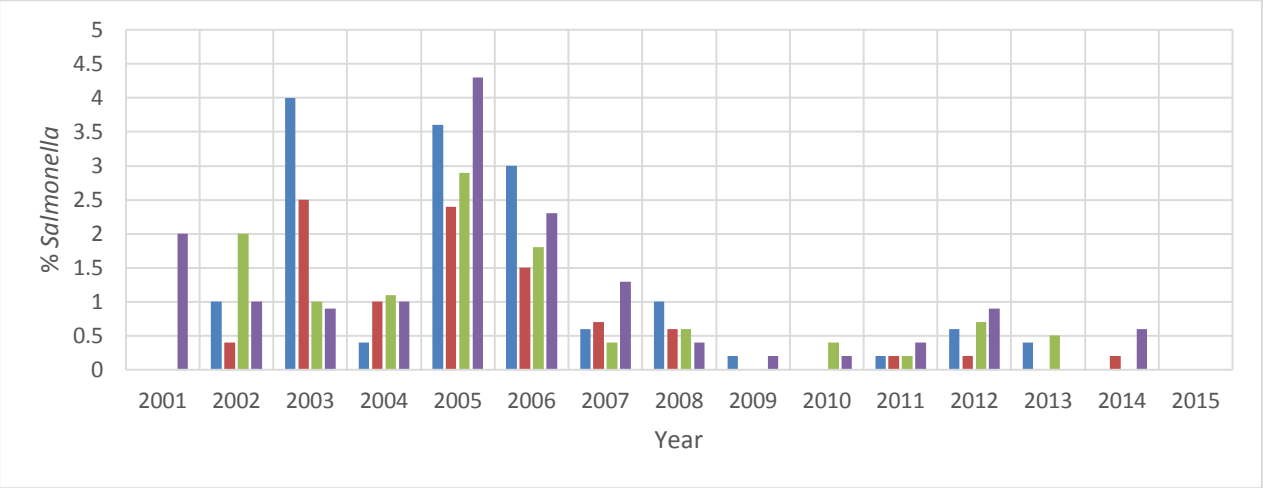
Year	Number of samples tested	Number of *Salmonella* positive samples (%)	*Salmonella* serotypes
2005	1,930	68 (3.5)	
2006	1,885	40 (2.1)	
2007	1,918	15 (0.8)	
2008	1,980	13 (0.7)	
2009	1,906	2 (0.1)	
2010	1,876	3 (0.2)	
2011	2,040	5 (0.2)	
2012	2,136	14 (0.7)	S. Thomson, S. Infantis, S. Derby, S. Thompson x2, S. Mbandaka*
2013	2,086	5 (0.2)	S. Mbandaka x2, S. Infantis x3
2014	2,129	4 (0.19)	S. Bovismorbificans x3, *Salmonella* not typed.
2015	1,684**	0* (0.0)	

* Full data set for 2012 was not available

** Data to 22nd October 2015

An analysis of the *Salmonella* prevalence in the NMD quarterly profile provides a similar picture (Figure 3) [3]. This indicates that there is no pattern between the detection of *Salmonella* and seasonality.

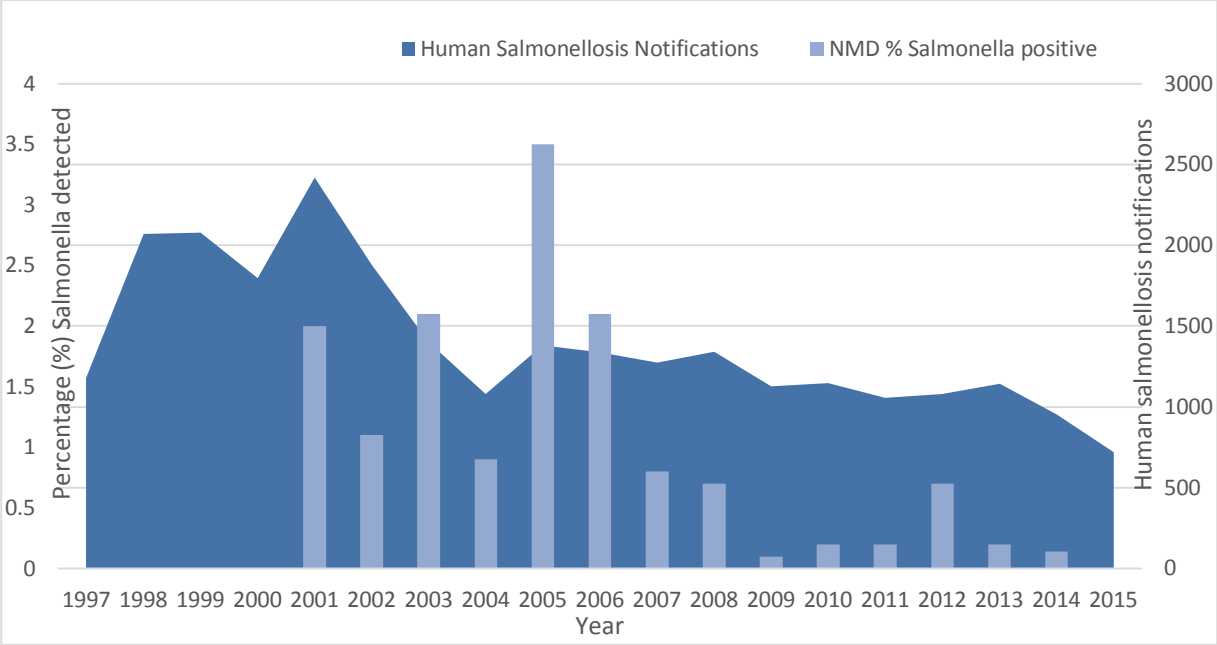
Figure 3: NMD Quarterly National Profile for Salmonella detected in chicken carcasses percentages (2001 to 2014)



[3] Data is reported in the NMD in years commencing in October of each year, hence the 2014 processing year runs from 1st October 2014 to 30th September 2015

The data for the human cases of salmonellosis and *Salmonella* prevalence detected in the NMD whole carcass rinse samples is provided in Figure 4. The data suggests that the introduction of the poultry NMD programme in 2001 corresponded with a reduction in the notification of human salmonellosis cases. The detections of *Salmonella* has reduced since the *Campylobacter* Performance Target was mandated in 2008, and the prevalence of *Salmonella* has been consistently less than 1% in whole carcass rinse samples from 2009. There has been no detailed analysis to determine whether the *Salmonella* target has had a direct effect on the number of human cases.

Figure 4: Number of human salmonellosis cases and percentage of Salmonella detected on chickens in the NMD



In a standard throughput premises (those poultry premises processing over 1,000,000 chickens per year) three whole carcass rinsate samples are randomly collected per processing day for *Campylobacter*, one of these samples is also analysed for *Salmonella*. The sporadic detection of *Salmonella* may be a result of isolated flocks or sheds becoming contaminated on farm and is reflected through the random sampling requirements of the NMD programme. It is not known whether increasing the number of samples analysed, e.g. to 3 per processing day, would assist in providing further information on the prevalence of *Salmonella* between flocks or sheds depending on how the sampling was conducted.

One key consideration for MPI is the performance of other animal species monitored for *Salmonella* as part of the NMD programme. The requirements for red meat and ratites in the NMD programme are different to those for poultry. Reviews of the *Salmonella* testing requirements for pigs and ovine resulted in these species no longer participating in the *Salmonella* NMD programme. MPI continues to undertake periodic reviews of the functioning of the NMD programme for all species covered to ensure that it remains fit for purpose.

The differences are in part due to the differing prevalence of *Salmonella* and because the New Zealand poultry industry has previously not exported chicken meat products to overseas markets and had to provide official assurances.

Periodic monitoring surveys to determine the prevalence of *Salmonella* in whole broiler carcasses may be an alternative to the NMD programme. These may be conducted to provide information on the whether the prevalence or serotypes of *Salmonella* have changed in the animals or food products to which consumers are exposed.

6.2 REVIEW OF THE *SALMONELLA* TARGET

MPI has reviewed the scientific information relating to the current *Salmonella* performance standard considering individual poultry premises performance against this target.

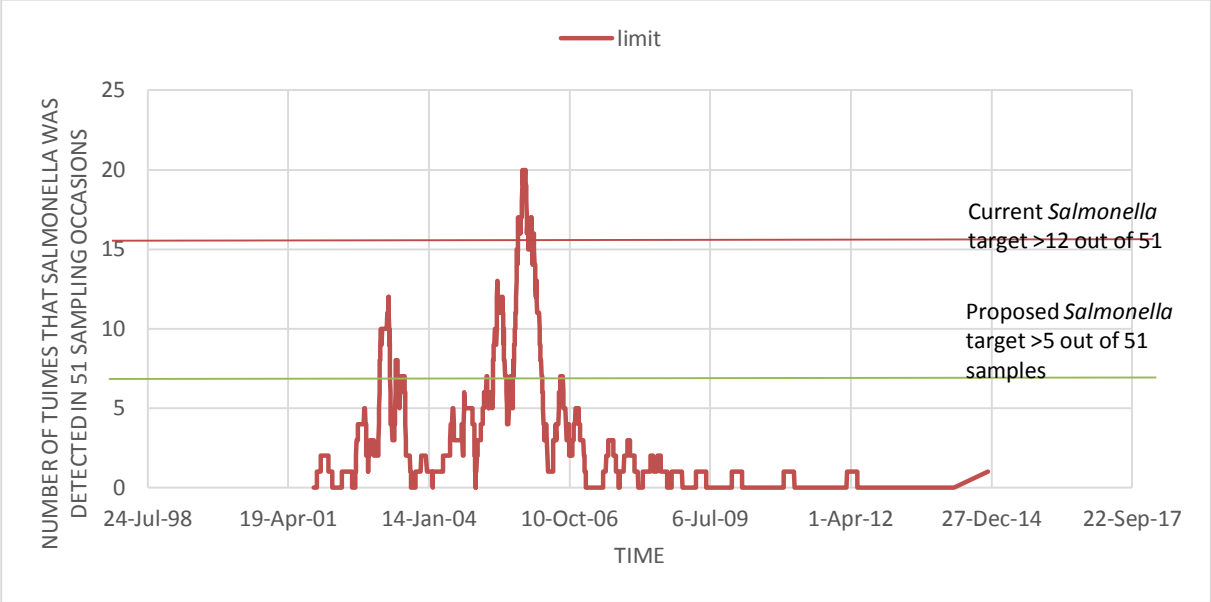
6.2.1 Compliance with the current *Salmonella* target

The current legal requirement for broiler chicken testing (*Salmonella* may be detected in no more than a maximum of 12 out of 51 consecutive samples) introduced in 2001 has been exceeded by a single operator. In a 12 month period to March 2006, there were 4 separate events when the *Salmonella* performance target was exceeded; the duration of one event exceeded four months covering 85 separate sampling occasions. Since March 2006 the target has not been exceeded by any of the New Zealand poultry processors, and there have been very few consecutive processing days or weeks in which *Salmonella* has been detected in the poultry NMD programme.

The NMD programme requires that poultry processors respond when the *Salmonella* performance standard is exceeded. The poultry industry has chosen to respond to each detection of *Salmonella* on broiler chicken carcasses by investigating the root cause and taking appropriate corrective actions as *Salmonella* is infrequently detected on broiler chicken carcasses.

The *Salmonella* results from the single poultry processor to have exceeded the Salmonella Performance Standard is presented in Figure 4. The data was compared against the current and proposed *Salmonella* Performance Standard over 51 consecutive sampling occasions.

Figure 4: Conformance of a poultry primary processor against the current and a proposed Salmonella Performance Standard in the NMD programme



The *Salmonella* target in the NMD programme appears to be functioning well in that the poultry industry is complying with the MPI pathogen control requirements. As a target it does not pose a challenge given the overall low occurrence of *Salmonella* detected by the New Zealand broiler chicken meat industry, however it may provide a useful benchmark for the growing proportion of organic and/or free range broiler chickens as these have a greater likelihood of exposure to microbiological hazards on-farm.

6.2.2 Proposed *Salmonella* Target

MPI determined the possible effect of the proposed *Salmonella* target (*Salmonella* may be detected in no more than 5 out of 51 consecutive samples) using the existing NMD data. Two of the poultry premises would have exceeded the proposed target, both prior to 2008.

The current and the proposed target have not been exceeded since the *Campylobacter* Performance Target (CPT) was introduced in 2008. Since the CPT introduction the detection of *Salmonella* in broiler chickens have been sporadic and rare events in the NMD.

6.3 ACTIONS FOLLOWING THE DETECTION OF *SALMONELLA*

When *Salmonella* is detected the Animal Products (National Microbiological Database Specifications) Notice 2015 requires that the operator takes action and responds. The responses for poultry and the red meat species are discussed.

6.3.1 Actions in the event that *Salmonella* is detected in broiler chickens

The current NMD specification section 6.7.2 Group 3 – *Salmonella* Performance Standard for Poultry of the NMD Schedule 1 recommends that on breaching the [US] *Salmonella* Performance Standard that the poultry operators immediately review the process and livestock *Salmonella* status to identify and document factors that resulted in breach of the performance standard. This may lead to modification of

process control programmes (pre-requisite and HACCP). There is evidence that the individual poultry processors (MPI VS, 2014) respond to this recommendation

A number of the larger poultry processors also collect information on the presence of *Salmonella* infections in the broiler flocks and use this information to adjust controls at the processing plant, e.g. the scheduling of positive flocks to be slaughtered and processed last on any day. In general the verification audit reports demonstrate that for broiler chickens there are very few *Salmonella* detections, but when detections are made, appropriate and effective follow up action is completed.

6.3.2 Actions in the event that *Salmonella* is detected in red meat

The actions taken by operators in response to the detection of *Salmonella* in red meat species within the NMD programme are more structured. If and when *Salmonella* is detected the operator must investigate the contributing factors and source of *Salmonella*. The NMD programme requires that processors take an escalating response to each detection of *Salmonella* and guidance and a checklist is available to assist operators *(*http://www.foodsafety.govt.nz/elibrary/industry/animal-products-national-nmd/nmd-salmonella-detections.pdf *)*. MPI has removed mandatory testing requirements for primary processors of some other animal product species (porcine, ovine) from the NMD programme which had a low prevalence of *Salmonella* detected.

6.4 REVIEW OF THE METHODS FOR SAMPLING AND ANALYSIS

The use of the current *Salmonella* sampling and testing method in the NMD programme has provided MPI and the poultry industry with a tool that has allowed a comparison of incidence over time and with important overseas markets. The results using this method have provided one of many strands of evidence to show that the occurrence of *Salmonella* on broiler chicken carcasses at the end of primary processing has reduced over time.

The current NMD programme requires that the birds are sampled after the last antimicrobial intervention during primary processing; this is typically after the immersion chiller. There is some evidence that testing that occurs at this point may not reflect the true presence of *Salmonella* as the detection may be higher following secondary processing (USDA FSIS). A number of different possible explanations have been suggested for the reduced occurrence at primary processing:

- That if the levels of *Salmonella* on the carcasses are high then the *Salmonella* is distributed during secondary processing, albeit at lower levels, when the product is minced (McEntire *et al*. 2014).
- That rapidly chilling the chicken carcass in chilled water may cause the feather follicles to constrict and the *Salmonella* bacteria are not released during the whole carcass rinse. The bacteria are then released during secondary processing when the carcasses are warmer and the follicles have relaxed.
- That any Salmonella present enter a viable but non-culturable state and cannot be detected by traditional microbiological analytical methods.
- That a systemic *Salmonella* infection would release any bacteria present in the chicken skeleton during secondary processing when various portions of meat are prepared.
- That some chemical interventions applied for the control of *Campylobacter* after 2006/7 may have a prolonged anti-microbial effect after application. The NMD programme requires that when a chlorinated antibacterial agent is used during primary processing that sodium

thiosulphate must be added to the carcass rinse diluent. The NMD programme also states that where non-chlorine based antibacterial agents are used as an intervention that a suitable non-antimicrobial neutralising additives must be determined and added to the carcass rinse diluent.

- That the sampling method may influence the detection of *Salmonella*. There have been improvements to both sampling and to the analytical methods since broiler chickens were included in the NMD programme (2001). As a result there may be alternative methods for the detection of *Salmonella* that would take account of these other points, e.g. sampling and testing the neck flap, or simply by analysing a greater volume of diluent from the whole carcass rinse, or through the use of molecular biology instead of culture methods.

MPI is currently considering whether a research project should be commissioned to help clarify these points providing further information on *Salmonella* during the processing of chickens which would help to address some of the risk management questions.

6.5 NEW ZEALAND RESEARCH AND SURVEYS

6.5.1 Risk Profiles

The Risk Profile: *Salmonella* in Poultry (King *et al*., 2011) provides a summary of the research and surveys undertaken in New Zealand to determine the prevalence of *Salmonella* in poultry products. The risk profile details at least seven surveys of poultry products in New Zealand which are summarised in Table 3. The survey results together with the low percentage of *Salmonella* detected in the NMD programme provide a picture of the prevalence of *Salmonella* throughout the poultry supply chain.

The most recent survey sampled 163 retail poultry carcasses in 2007 and *Salmonella* was not detected (Chrystal et al., 2008). A survey from 2003-2005 sampled minced, sliced and diced chicken meat found a higher *Salmonella* prevalence in the sliced, diced and minced chicken meat than for whole birds in 2007. Whilst these results are consistent with findings overseas the surveys were taken at different times and it is not possible to draw too many conclusions from the results.

Other studies have provided a snap shot of the prevalence of *Salmonella* in breeder, end-of-lay and broiler flocks; these are types of chickens not currently included within the scope of the poultry NMD programme. The results of the survey by Wong and Hudson (2006) indicate a higher prevalence of *Salmonella* (24.5%) than that recorded in the NMD. *Salmonella* was detected in 3.5% and 2.1% of broiler chicken carcasses in 2005 and 2006 respectively. Possible explanations for the difference between the types of chickens include the age of the birds at slaughter, the difference in biosecurity on-farm and whether whole sheds of birds are slaughtered at the same time.

Table 3: Summary of Poultry Surveys in New Zealand

Year	Location	Product	Number of samples	Number of *Salmonella* positive samples	Reference
Retail					
2007	Retail in Auckland, Wellington, Christchurch	Whole broiler carcasses	163	0 (0)	Chrystal et al., (2008)
2003 -2005	Butchers and supermarkets in Auckland, Hamilton, Wellington, Christchurch and Dunedin	Raw and minced, diced or cut into strips chicken meat	232	7 (3%, 95% C.I. 1.2-6.1)	Wong et al., (2007)
2003	Christchurch supermarkets, restaurants and a fast food outlet	Whole birds and portions	200 (100 whole birds and 100 portions)	14 (7%; 9 whole birds and 5 portions)	Wong, (2003); Cook et al., (2006)
2003 - 2004	Vertical chain survey	Chilled chicken portions (breasts, thighs, drums and wings/nibbles	610 (310 sampled at end of processing and 300 from retail outlets)	0 (0/300, 0%) retail 1 (1/310, 0.3%)	Wong, (2004).
Poultry Processing					
~2009	End of primary processing	Breeder and end-of-lay chicken carcasses	16 breeder flocks 13 end-of-lay flocks	0/16 breeder flocks (caecal contents and carcass rinse) 4/13 (31%) end-of-lay flocks (caecal contents and carcass rinse)	Wong and Chung, (2010)
2005 - 2006	Four commercial processing plants (two in the South Island and two in the North Island)	Broiler chickens immediately post-stunning and ex-sanguination, but prior to scalding	200	1 caecal swab 49 (24.5%) whole carcase rinse	Wong and Hudson, (2006).

In addition case studies have been able to trace the *Salmonella* contamination of poultry feed through to broiler chickens on farm and at processing to a subsequent spike in the number of human cases attributed to the specific *Salmonella* serovar.

6.5.2 Animal and Feed Surveillance

The MPI Surveillance report (MPI[1], 2015) summarises *Salmonella* serotypes cultured from feed sources, environmental swabs and poultry samples. The information in Table 4 is based on information received from poultry testing laboratories for 2014.

Table 4: Serotypes of *Salmonella* isolated from feed and broiler chicken samples during 2014

Salmonella isolates	Kauffman – White classification	Finished and feed sources	Broiler samples *
Agona	B		20
Anatum	E		123
Infantis	C		8
Livingstone			1
Montevideo	C	1	
Seftenberg	E		8
Species group C			7
Species group E			1
Total positive/total tested		1/1,538	168/3,770
	* Samples include environmental swabs and whole carcass rinse birds		

The majority of *Salmonella* serotypes isolated from feed, feed sources and from broiler chickens are *Salmonella* Species group E (132/168 isolates).

6.5.3 Comparison of *Salmonella* serovars isolated from animal and feed surveillance, the NMD programme and human cases

The serovars of *Salmonella* isolated during 2014 is available for the human cases (section 4.2.1), animal and feed sources and from the poultry NMD database at the end of primary processing. Whilst there were no poultry associated human cases of salmonellosis during 2014 it is possible to see whether there are any common serovars that occur in the feed, live animal environment, at the end of primary processing and human cases.

As there is no information as to where the live chicken samples were taken, e.g. environmental swabs inside and outside the poultry sheds, faecal samples or additional poultry rinse samples collected in addition to those included as part of the NMD programme, it is important not to draw too many conclusions about the results, whether the sampling programme is sufficient to detect *Salmonella* positive flocks or whether the serotype of *Salmonella* was responsible for causing illness in human cases.

As part of the NMD monitoring programme *Salmonella* was detected on 4 occasions in 2014 on broiler chicken samples. The *Salmonella* serotypes were reported as *S*. Bovismorbificans (3 out of 4 samples) and the fourth was not serotyped. Whilst *S*. Bovismorbificans was not reported in the MPI Surveillance Report, *S*. Bovismorbificans it is classified as a *Salmonella* species group C under the Kauffman-White

classification scheme for *Salmonella.* Group C *Salmonella* were detected from 7 broiler samples submitted by the poultry industry.

There were no common *Salmonella* serotypes that were isolated from the NMD programme or from human cases. *Salmonella* Infantis is a serotype that was detected in samples from broiler chickens (Table 4) and from cases of human illness. *S*. Typhimurium was the most commonly reported serotype typed by the ESR Enteric Reference Laboratory but was not isolated from the samples submitted from feed, feed sources, broiler chicken samples or on the whole carcass rinse.

7 Data gaps

Data gaps identified by this review and those identified in the ESR Risk Profile: *Salmonella* in Poultry (King *et al*., 2011) are:

ESR Risk Profile: *Salmonella* in Poultry (2011)

1. Representative sampling and testing for *Salmonella* in broiler farm inputs (feed) and environment;
2. Information on the impact of current processing practices in New Zealand on *Salmonella* prevalence and concentrations on poultry;
3. Information on the concentration of *Salmonella*e on poultry carcasses at the end of primary processing; and
4. Transmission routes for the majority of salmonellosis cases in New Zealand.

On-farm

5. There has been an increase in the numbers of free range flocks being processed. There is no contemporary data on the prevalence of *Salmonella* in broiler chicken flocks or whether there are any differences between free-range, free-range/organic and barn raised flocks.
6. Whilst the results in the NMD show a low occurrence of Salmonella in broiler chickens, it may be timely to review the on-farm and processing controls with the increased numbers of free-range and/or organic chickens processed.
7. A previous study included in the Risk Profile: *Salmonella spp*. in Animal Feed (Cressey et al., 2011) was unable to confirm whether *Salmonella* may be transferred from animal feed through to animal products. Part of this was due to a lack of data, and that which was available had been collected retrospectively following incidents. A prospective monitoring programme was proposed that may identify issues earlier in animal feeds which would allow the operators to put in place additional control measures for *Salmonella.*

Primary Processing

8. It is not known whether a similar situation exists to the recently published research and surveys from the USA has shown a higher prevalence of *Salmonella* contamination on poultry at the end of secondary processing, in particular portions, ground, comminuted products and mechanically separated meat (MSM) than at the end of primary processing.
9. How is the detection of *Salmonella* at the end of primary processing affected by the application of good hygienic practice, biosecurity, husbandry practices, the incoming loading, the point of sampling and testing, the method and interventions applied for *Campylobacter* control?
10. Whether the sampling methods are appropriate for the detection of *Salmonella* in broiler chickens.
11. Whether the interventions introduced by industry after the Campylobacter Performance Target was established in 2008 has reduced the prevalence of *Salmonella* in whole broiler chicken carcasses.

Secondary processing

12. Recent research published in the USA has shown a higher prevalence of *Salmonella* contamination on poultry at the end of secondary processing, in particular portions, ground, comminuted products and mechanically separated meat (MSM). There has not been any work in New Zealand to determine if a similar situation exists. There are many hypotheses for this including the trapping of *Salmonella* in feather follicles during primary processing, the occurrence of high numbers of Salmonella on a few broiler chickens which causes cross-contamination during secondary or further processing, a systemic infection through the bones, the possible masking effect of the thiosulphate, any prolonged antimicrobial effect of the final *Campylobacter* interventions, and sensitivity of the sampling and testing methods.

Retail

13. The last comprehensive retail survey in New Zealand was undertaken in 2006. It is timely to determine whether the microbiological food safety hazard profile of whole chicken, chicken parts and products has changed in the last 9 years and whether there are differences between barn-raised, free range and free-range/organic birds.

Supply-chain

14. There is limited information on the prevalence of *Salmonella* in other types of chickens and poultry species on farm, at primary and secondary processing, and at retail

8 Identification and Assessment of Options

The options identified and assessed are those that focus on the effectiveness of monitoring of *Salmonella* control in broiler chickens in the NMD programme. The pros and cons under the various options consider:

1. Whether *Salmonella* testing is an appropriate monitoring tool for broiler chickens, and
2. Whether the current *Salmonella* Performance Standard is appropriate, and
3. Whether a review of the required responses to the detection of *Salmonella* in the NMD programme for broiler chickens should occur (considered separately).

MPI have identified the following options which are provided:

Option 1 **No change – maintain the status quo**. Retain the requirement for *Salmonella* testing and the current performance standard. *Salmonella* may be detected in no more than 12 of 51 consecutive poultry samples

Option 2 **Maintain the requirement for *Salmonella* testing but remove any target** (*Salmonella* Performance Standard) for broiler chickens from the NMD programme.

Option 3 **Retain the requirement for *Salmonella* testing and introduce the revised 2011 USA standard**. Replace the current *Salmonella* Performance Standard with the revised 2011 USA standard. S*almonell*a may be detected in no more than 5 of 51 poultry samples

Option 4 **Introduce a tighter *Salmonella* Performance Standard at the end of primary processing**. Retain the requirement for *Salmonella* testing and introduce a tighter target to be more reflective of the current *Salmonella* prevalence.

A review of the responses to the detection of *Salmonella* will be addressed separately as this applies to all of the options and is part of the larger review of the poultry NMD programme.

8.1 OPTION 1: NO CHANGE – MAINTAIN THE STATUS QUO

8.1.1 Description

The *Salmonella* testing of broiler chickens continues to be included in the NMD monitoring programme, and the *Salmonella* performance standard remains as no greater than12 out of 51 consecutive samples with *Salmonella* detected as per the current requirements.

8.1.2 Pros

- There is no change to poultry premises protocols and no additional cost incurred through increased regulation.
- The status quo is likely to result in ‘no increase’ of broiler-derived human salmonellosis notifications.

- The maintenance of the current *Salmonella* Performance Standard will provide an incentive to new poultry processing operators to control *Salmonella*.
- Maintaining the status quo would allow the continued international comparison between the levels of *Salmonella* detected in broiler chickens. The poultry industry will continue to be able to provide data from a government monitoring programme for consumers of New Zealand produced chicken meat that demonstrates a low prevalence of *Salmonella* at the end of primary processing.
- The data set of *Salmonella* serovars collected from across New Zealand would continue to include isolates from poultry that would be useful in the event of public health concerns associated with *Salmonella.*
- The poultry industry has put in place a number of initiatives to reduce the occurrence of *Salmonella* at the end of primary processing following the introduction of requirements, the removal of *Salmonella* testing could result in the these initiatives ending, e.g. *Salmonella* vaccinations.

8.1.3 Cons

- The current *Salmonella* Performance Standard does not provide an incentive for industry to maintain current dressing standards let alone lead to improvement.
- There is not likely to be a reduction in human case notifications of salmonellosis.

8.2 OPTION 2: MAINTAIN THE REQUIREMENT FOR *SALMONELLA* TESTING BUT REMOVE ANY TARGET FROM THE NMD PROGRAMME

8.2.1 Description

This option removes the target, the *Salmonella* Performance Standard, from the NMD monitoring programme whilst retaining the requirement to test broiler chickens for *Salmonella*.

8.2.2 Pros

- The removal of the performance standard would still result in *Salmonella* being reported within the NMD monitoring programme for broiler chickens.
- The monitoring of broiler chickens for *Salmonella* will continue to provide regulatory information on the presence of *Salmonella* at the end of primary processing and enable the poultry industry to demonstrate that *Salmonella* is being managed.
- The target does not represent the low occurrence of *Salmonella* in the broiler chicken industry.
- This option recognises the proactive approach and activities taken by the poultry industry to reduce the level of *Salmonella* infection within their broiler chicken flocks, which is reflected in the NMD programme results.
- The continued inclusion of broiler chickens in the NMD programme provides data which may help determine an association between human salmonellosis and a particular food source. The provision of this data for public health purposes would not be affected by the removal of the target.
- A target is not required to be able to compare the occurrence of *Salmonella* on broiler chickens with other countries.

- It is assumed that the removal of the target will not have an effect on the level of *Salmonella* detected and on the numbers of human salmonellosis cases.

8.2.3 Cons

- The lack of a target may not act as an incentive for the industry to maintain current dressing standards or lead to improvement.
- Without a *Salmonella* Performance Standard it may be harder to support overseas market access.

8.3 OPTION 3: RETAIN THE REQUIREMENT FOR *SALMONELLA* TESTING AND INTRODUCE THE REVISED 2011 USA STANDARD

8.3.1 Description

This option maintains the requirement to test for *Salmonella* in broiler chickens in the NMD programme and to replace the target with the revised 2011, USDA FSIS *Salmonella* performance standard for young chickens. The current USA *Salmonella* standard (amended in 2015) is no more than 5 positive samples in any moving window of 51-samples.

8.3.2 Pros

- A revised target may either drive change or maintain the current low levels of *Salmonella* in the New Zealand poultry industry.
- May help to facilitate exports of poultry products based on the New Zealand standard.
- Should drive an improvement in the processing of any organic and/or free-range chicken flocks processed as these may have a greater rate of pathogenic bacteria carriage due to being farmed in an uncontrolled environment.
- There is unlikely to be any costs to industry associated with the introduction of a tighter *Salmonella* target as the sampling and testing plan within the NMD programme will not change and historic data indicates that most processors will meet the new target most of the time.

8.3.3 Cons

- The poultry industry is already achieving the proposed *Salmonella* target (it has not been exceeded in the last six years), meaning that it is unlikely that the target would impact on the number of human salmonellosis cases.
- Some cost may be occurred to MPI to implement the changes to the NMD database brought about by the introduction of the proposed target.

8.4 OPTION 4: INTRODUCE A *SALMONELLA* PERFORMANCE STANDARD THAT REFLECTS THE LOW LEVELS OF *SALMONELLA* IN NEW ZEALAND BROILER CHICKENS

8.4.1 Description

This option maintains the requirement to test for *Salmonella* in broiler chickens at the end of primary processing in the NMD poultry programme whilst introducing a *Salmonella* target that drives further improvement to the occurrence of *Salmonella* in New Zealand broiler chickens. Any standard should be evaluated after a period of time

8.4.2 Pros

- Any target should maintain the status quo or should drive improvements in the level of *Salmonella* detected.
- A custom made target should be relevant to reduce foodborne illness and the results should provide further information about the pathways of *Salmonella* infection.
- A tighter *Salmonella* Performance Standard could lead to improvements in the overall microbiological loading on carcasses.

8.4.3 Cons

- Further work may be required to determine the sensitivity and applicability of the current methods for sampling and testing for *Salmonella* due to the low prevalence of *Salmonella* on broiler chickens. This is a longer term approach that would require MPI to undertake a detailed scientific evaluation to determine the baseline *Salmonella* prevalence.
- The number of *Salmonella* detections has continued to remain low despite the increased production and processing of organic and/or free range birds which are farmed in a less controlled environment.
- A tighter target may not result in the reduction of cases of foodborne illness.
- The introduction of a tighter target could be perceived as a barrier to entry for new primary processors of chickens.

8.5 REVIEW OF THE ACTIONS IN THE NMD PROGRAMME IN THE EVENT OF THE DETECTION OF *SALMONELLA* ON POULTRY CARCASSES

MPI is currently considering amendments to the requirements of the Animal Products (National Microbiological Database Specifications) Notice 2015 (MPI[2], 2015). One of the areas for consideration is the response that industry takes in the event that the *Salmonella* Performance Standard is breached. The NMD Specification reads:

> "6.7.2 Group 3 – *Salmonella* performance standard
>
> It is recommended that on breaching the US Performance Standard operators immediately review the process and livestock *Salmonella* status to identify and document factors that

resulted in breach of the performance standard. This may lead to modification of process control programmes (pre-requisite and HACCP)."

MPI has evidence that the poultry industry responds proactively and positively to the detection of any *Salmonella* in the NMD programme and takes action. MPI has considered a number of options to amend the response to the detection of *Salmonella*.

8.5.1 Option 1: Maintain the status quo

Leave the response to the detection of *Salmonella* as drafted in the NMD specification.

Pros:

- No change. The poultry industry continues to respond to the detection of *Salmonella* in the NMD programme.

Cons:

- This does not reflect the approach that the poultry industry takes in the event of detecting *Salmonella* at the end of primary processing.
- The actions in the event of the detection of *Salmonella* remain as a recommendation and may be inconsistently applied

8.5.2 Option 2: MPI to formalise the actions after any detection of *Salmonella*

A two-tiered approach is proposed whereby the poultry industry would follow best practice to review the root causes of any *Salmonella* detection including the feed, livestock, personnel and the process. This approach would formalise the requirement for any *Salmonella* detected to be serotyped by the Institute of Environmental Science and Research. Secondly that if the *Salmonella* Performance Standard is exceeded then operators should review the process and provide MPI Verification Services with a *Salmonella* Management Plan describing the actions to be taken to reduce the *Salmonella* prevalence. MPI may also take additional action including sanctions under Section 89 of the Animal Products Act 1999.

Pros:

- This reflects the approach that the poultry industry has taken which responds and undertakes corrective and preventative actions after any detection of *Salmonella* rather than as a result of failing the *Salmonella* Performance Standard
- The typing of *Salmonella* isolates will continue to provide MPI, animal health and public health agencies with valuable information that should inform attribution studies, animal surveillance and foodborne disease investigations.

Cons:

- There may be an additional cost to the poultry industry when responding to the detection of *Salmonella* at the end of primary

8.6 MPI'S PREFERRED APPROACH

8.6.1 *Salmonella* monitoring and target for broiler chickens

MPI's preferred approach is option 3 to introduce the revised USDA FSIS *Salmonella* Performance Standard for Young Chickens whereby *Salmonella* may not be detected in more than 5 out of 51 sample moving window (revised 2015). This approach not only continues to maintain the monitoring of poultry carcasses for *Salmonella* but introduces a more meaningful and more representative target that is closer to the low level of *Salmonella* detected in New Zealand chickens.

8.6.2 Response to the detection of *Salmonella*

In addition, MPI's preferred approach for the response to the detection of *Salmonella* is Option 2 which formalises the approach that the poultry industry currently undertakes in the event that any *Salmonella* is found following sampling for the NMD programme and provides further details of the recommendations in the event that the *Salmonella* Performance Standard is exceeded.

8.6.3 Salmonella and other poultry

MPI also recognises that the USDA FSIS also includes *Salmonella* Performance Standards for other poultry species at primary and secondary processing. When the poultry NMD programme was introduced it was intended that the scope should be extended to other species and types of chicken in addition to broiler chickens. MPI has outlined options for the inclusion of turkeys and ducks, and additional classes of chickens, such as poussin, breeder chickens and end-of-lay chickens within the poultry NMD programme within other discussion papers that form part of this consultation process.

8.6.4 Sampling and analytical methods

This paper has not addressed whether the sampling and analytical methods for the whole carcass rinse and *Salmonella* provide an appropriate level of confidence in the robustness, sensitivity and specificity, etc. MPI proposes that this risk management question will be addressed through the development of a research project.

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10 Appendix 1: Human Salmonellosis

10.1.1 Cases of foodborne salmonellosis

In 2014 there were a total of 954 (21.2 per 100,000 people) laboratory notified cases of human salmonellosis, of these 387 (8.6 per 100,000 head of population (Confidence intervals 4.9-11.9)) were estimated to be foodborne (Horn *et al*, 2015) as determined by expert consultation. A summary of the number of laboratory notified cases from 2014 is provided in Table 5.

Table 5 – Summary of confirmed laboratory notified cases of human salmonellosis from 2014

	Number of cases	Rate per 100,000 people
Total number of salmonellosis cases	954	21.2
Non-travel related cases	623	13.8
Estimate foodborne	387	8.6 (4.9-11.9)
Hospitalisations	113 (11.8%)	-
Deaths	0	-

10.1.2 New Zealand Attribution Studies

A review of scientific evidence for salmonellosis aetiology in New Zealand concluded that poultry was "very likely" (>90% probability) to be at least a moderate cause (between 10-30% or higher of all cases) of salmonellosis (Wilson and Baker, 2009).

A later review of 204 New Zealand salmonellosis outbreaks from 2000 through 2009 was not able to quantify the proportions of salmonellosis cases attributable to specific foods (Adlam et al., 2010; King et al., 2011). There were only eight outbreaks where specific foods were identified by laboratory evidence as being contaminated with *Salmonella*; only one of these foods may have contained chicken but the record did not identify which of a variety of bakery products (chicken sandwich, bacon and egg pie, Panini, fried chicken, chicken roll) was *Salmonella*-positive.

A recent attribution study (French et al., 2013) collected a total of 939 non-typhoidal *Salmonella* enterica isolates from separate samples from May 2011 to April 2012. Attribution models fitted to the serotype and PFGE typing data indicated that, between May 2011 and April 2012, 60% (95% credible interval [CI] 30-86%) of human salmonellosis cases were attributable to *Salmonella* from cattle. Sixteen percent (95% CI 1-44%) and 15% (95% CI 0-42%) of human salmonellosis cases were attributable to *Salmonella* bacteria from poultry and wild birds respectively, and fewer than 10% of cases were attributable to *Salmonella* bacteria from other sources (e.g. sheep and pigs). *Salmonella* was rarely isolated from faecal samples collected from healthy pigs and sheep in abattoir lairages.

S. Typhimurium was the most commonly occurring *Salmonella* serotype in New Zealand humans almost half of the isolates and over two-thirds of isolates from cattle and wild birds. Of the serotypes isolated from human cases approximately 60% showed commonality with those from cattle, wild bird and 16% with poultry strains with the use of MLVA and phage typing. The pathways of infection remain unknown and further investigation is required to determine these.

The results from the French *et al*. (2013) attribution study are reflected by the reported cases of *Salmonella* each year. In New Zealand the majority of human salmonellosis cases are caused by *S*. Typhimurium (52% in 2010; Lim et al., 2011), with a lesser proportion due to *S*. Enteritidis (10% in 2010).

10.1.3 Cost of illness

European estimates of the cost of salmonellosis are similar to New Zealand estimates (given population differences), with Kemmeren *et al*. (2006) estimating the cost of salmonellosis in the Netherlands to be 8.8 million Euros in 2004.

A recent report from the United States ranked *Salmonella* as contributing the most to the total burden of foodborne illness, amongst 14 pathogens, in terms of quality adjusted life years (QALYs; 16,782) and in terms of cost of illness ($US 3.3 billion) (Batz et al., 2012). *Salmonella* in poultry ranked as the fourth (of ten) highest pathogen-food pair in terms of QALYs (3,610 QALYs) and cost of illness ($US 712 million). The higher ranking pathogen-food pairs were *Campylobacter* in poultry, *Toxoplasma* in pork and *Listeria* in deli meats. No equivalent analysis of the burden of illness at the pathogen-food level is available for New Zealand.

10.1.4 Case control studies and risk factors concerning *Salmonella* and poultry in New Zealand

Two case-control studies investigated two human salmonellosis outbreaks where exposure to poultry was identified as one of several possible risk factors, but neither study was able to confirm poultry (or any other food) as the cause of the outbreak (King *et al*. 2011). These were:

S. Enteritidis 9a (2005)

An outbreak of 24 cases of *S*. Enteritidis 9a infection in 2005 was associated with consumption of food purchased from a premises serving Middle Eastern dishes (OR = 10.2, 95% CI 2.4-49.9) (Anonymous, 2005). Whilst no single food item was identified; consumption of chicken, hummus, flat bread, lettuce, tomato, onions and cabbage were all significantly associated with infection. Food samples tested from the implicated premises identified *S*. Orion from tahini but *S*. Enteritidis 9a was not isolated.

S. Mbandaka (2008)

An outbreak of 34 cases of S. Mbandaka infection in 2008 was epidemiologically linked with purchasing chicken breast from a supermarket that was supplied by a specific poultry processor (odds ratio in multivariate model = 9.24 or 5.83, depending on the model used), and eating eggs prepared away from home (odds ratio in multivariate model = 7.41 or 6.11, depending on the model used) (McCallum and Das, 2008). *Salmonella* was not isolated from food samples from case homes and implicated food premises, using swabs from bench tops, chopping boards, fridges and hand wash basins. While a specific poultry processor was the suspected source of the outbreak, no laboratory evidence was available to confirm this.

There have been five other case-control studies and poultry or poultry products were not identified as being significantly associated with salmonellosis in any of these studies (King et al., 2011).

11 Appendix 2 – International perspectives

11.1.1 USA

- The *Salmonella* standard was based on the results of a national baseline survey of slaughter plants before the rule was put in place. The rule places a limit on the acceptable number of samples that test positive in a given sample from an abattoir
- The current *Salmonella* standard (from July 2011) for young chicken[4] is a maximum of 5 positive samples in a 51-sample (5/51 samples (n=51, c=5). FSIS Notice 22-15 moves the *Salmonella* and *Campylobacter* verification testing program for poultry carcasses moves from a sample set to a moving window approach from 1st May 2015 so that sampling will occur on a continuous basis
- The FSIS *Salmonella* standard is based on the assumption that 80% of establishments operating at the acceptable performance level will achieve results that are deemed to satisfy the criteria. Based on this criterion, the performance standard for *Salmonella* in young chickens is 7.5 percent (USDA FSIS[5] website accessed 15th August 2014)
  In the USA ground chicken is included within the scope of the *Salmonella* Verification Sampling Program

In January 2015[6] the USDA FSIS announced *Salmonella* a new pathogen reduction performance standards for *Salmonella* and *Campylobacter* in raw chicken parts and not-ready-to-eat (NRTE) comminuted (ground, mechanically separated or hand or mechanically deboned and chopped, flaked, minced, or otherwise processed to reduce particle size) chicken and turkey products. The FSIS announced plans to sample raw chicken parts to gain additional information on the prevalence and the microbiological characteristics of *Salmonella* and *Campylobacter* in those products. Also announced were plans to routinely sample throughout the year rather than infrequently sampling on consecutive days to assess whether establishments' processes effectively address *Salmonella* on poultry carcasses and other products derived from these carcasses, including chicken parts and comminuted chicken and turkey product (Table 6). This assessment will apply a moving window of 51 sample results.

[4] young chicken carcasses including broilers, fryers, roasters, and Cornish game hens, as described in 9CFR 381.170(a),

[5] http://www.fsis.usda.gov/wps/portal/fsis/home/!ut/p/a0/04_Sj9CPykssy0xPLMnMz0vMAfGjzOINAg3MDC2dDbwsfDxdDDz9AtyMgnyMDf3dDPQLsh0VAcy6FX0!/?1dmy&page=gov.usda.fsis.internet.newsroom&urile=wcm%3Apath%3A/fsis-content/internet/main/topics/data-collection-and-reports/microbiology/salmonella-verification-testing-program/salmonella-verification-testing-program

[6] Federal Register / Vol. 80, No. 16 / Monday, January 26, 2015 / Notices [[Page 3940]] Food Safety and Inspection Service [Docket No. FSIS-2014-0023] Changes to the Salmonella and Campylobacter Verification Testing Program: Proposed Performance Standards for Salmonella and Campylobacter in Not-Ready-to-Eat Comminuted Chicken and Turkey Products and Raw Chicken Parts and Related Agency Verification Procedures and Other Changes to Agency Sampling http://www.fsis.usda.gov/wps/wcm/connect/b711839a-c0b9-420f-9d74-8568310a1352/2014-0023.htm?MOD=AJPERES Accessed on 12th March 2015

Table 6: USDA FSIS performance standards for primary and secondary processed poultry products

Product	Maximum acceptable percent positive		Performance standard	
	Salmonella	*Campylobacter*	*Salmonella*	*Campylobacter*
Broiler Carcasses	9.8	15.7	5 of 51	8 of 51
Turkey Carcasses	7.1	5.4	4 of 56	3 of 56
Comminuted Chicken	25.0	1.9	13 of 52	1 of 52
Comminuted Turkey	13.5	1.9	7 of 52	1 of 52
Chicken Parts	15.4	7.7	8 of 52	4 of 52

* based on eight months of data

11.1.2 Canada

The Canadian Food Inspection Agency (CFIA) requires disease monitoring programs in hatcheries, abattoirs, egg grading stations and breeding flocks. There is no routine monitoring for *Salmonella* at the farm level.

- Routine sampling for federally registered poultry processors for *Salmonella* (compulsory for those plants wishing to qualify for export to the USA). The results are compiled and available from the Canadian Food Inspection Agency (CFIA).
- The sampling requires a whole carcase wash per shift to determine the prevalence of *Salmonella* spp, but serotyping of any *Salmonella* detected is not required.

11.1.3 Australia

- FSANZ established the Primary Production and Processing (PPP) Standard for Poultry Meat (Standard 4.2.2[7]) is part of a series of national food safety standards to strengthen food safety and traceability throughout the food supply chain from paddock to plate.
- There are no current microbiological limits in the Food Standards Code for *Salmonella* in raw chicken meat (FSC 1.6.1) and Standard 4.2.2 requires that poultry processors to identify and control food safety hazards associated with poultry processing and verify the effectiveness of the control measures.
- Whilst there are requirements that apply across the Commonwealth of Australia, requirements to identify, control and monitor hazards such as *Salmonella* during production or to have a biosecurity scheme, these are implemented on a jurisdictional level. As such there may be

[7] FSANZ Poultry Standard http://www.foodstandards.govt.nz/code/primaryproduction/poultry/pages/default.aspx

differences in approaches between the different states and territories; some of the poultry processors are voluntarily monitoring for *Salmonella*.

- FSANZ is reviewing the existing microbiological limits in Standard 1.6.1 to ensure that that appropriate criteria are used throughout the food chain[8] .

11.1.4 European Union

- Broiler chicken carcasses are required to meet the process hygiene microbiological criteria for *Salmonella.* The criterion requires that *Salmonella* should not be detected in any more than 7 out of 50 birds. The sample is a 25g samples of neck skin collected from the carcass after chilling and tested using a method equivalent to EN/ISO 6579. The actions in response to the non-compliance with the criterion are to undertake improvements in slaughter hygiene, to review of process controls, origin of animals and biosecurity measures.
- There are detailed rules on a *Salmonella* food safety criterion for fresh poultry meat in European Union (EU) food regulations. The European Commission (EC) Regulation (EC No 2073/2005 as amended) on the Microbiological Criteria for Foodstuffs specifies for

  'Whole poultry carcasses:

  Slaughterhouses shall sample whole poultry carcases with neck skin for *Salmonella* analyses. Cutting and processing establishments other than those adjacent to a slaughterhouse cutting and processing meat received only from this slaughterhouse, shall also take samples for *Salmonella* analysis. When doing so, they shall give priority to whole poultry carcases with neck skin, if available, but ensuring that also poultry portions with skin and/or poultry portions without skin or with only a small amount of skin are covered, and that choice shall be risk-based.

  For fresh poultry meat other than poultry carcasses

  For the *Salmonella* analyses for fresh poultry meat other than poultry carcases, five samples of at least 25 g of the same batch shall be collected. The sample taken from poultry portions with skin shall contain skin and a thin surface muscle slice in case the amount of skin is not sufficient to form a sample unit. The sample taken from poultry portions without skin or with only a small amount of skin shall contain a thin surface muscle slice or slices added to any skin present to make a sufficient sample unit. The slices of meat shall be taken in a way that includes as much as possible of the surface of the meat.';

  The microbiological criteria for whole poultry carcasses and secondary processed poultry applicable through this EC Regulation is provided in Table 6.

[8] http://www.foodstandards.govt.nz/code/microbiollimits/Pages/default.aspx

Table 6: Microbiological Criteria for Whole poultry carcasses included in Regulation (EC No 2073/2005 as amended)

Food category	Micro-organisms/their toxins, metabolites	Sampling-plan (1)		Limits (2)	Analytical reference method (3)	Stage where the criterion applies	
		n	c	m			
1.5. Minced meat and meat preparations made from poultry meat intended to be eaten cooked	*Salmonella*	5	0	From 1.1.2006 Absence in 10 g From 1.1.2010 Absence in 25 g	EN/ISO 6579	Products placed on the market during their shelf-life	
1.7. Mechanically separated meat (MSM) (9)	*Salmonella*	5	0	Absence in 10 g	EN/ISO 6579	Products placed on the market during their shelf-life	
1.9. Meat products made from poultry meat intended to be eaten cooked	*Salmonella*	5	0	From 1.1.2006 Absence in 10 g From 1.1.2010 Absence in 25 g	EN/ISO 6579	Products placed on the market during their shelf-life	
2.1.5. Poultry carcases of broilers and turkeys	*Salmonella*	50 (5)	7(6)	Absence in 25 g of a pooled sample of neck skin	EN/ISO 6579	Carcases after chilling	Improvements in slaughter hygiene and review of process controls, origin of animals and biosecurity measures in the farms of origin

(5) The 50 samples are derived from 10 consecutive sampling sessions in accordance with the sampling rules and frequencies laid down in this Regulation.

(6) The number of samples where the presence of *Salmonella* is detected. The c value is subject to review in order to take into account the progress made in reducing the *Salmonella* prevalence. Member States or regions having low *Salmonella* prevalence may use lower c values even before the review.

- The EU has created regulations that require all member states to create national *Salmonella* control programs for all levels of chicken production. Reduction goals under the EU regulations are member state specific and focus on *Salmonella spp*. of public health significance.

- In 2003, the EU set up an extended control programme for zoonoses. Enhanced *Salmonella* control programmes in poultry were implemented in all EU Member States. Targets were set for the reduction of *Salmonella* in poultry flocks (e.g. laying hens, broilers, turkeys). Restrictions were also imposed on the trade of products from infected flocks.
- The EU via the European Food Safety Agency (EFSA) and the European Centre for Disease Prevention and Control (ECDC) publish an annual report on zoonoses and foodborne outbreaks[9] that includes data relating to *Salmonella*.

[9] http://www.ecdc.europa.eu/en/publications/Publications/EU-summary-report-zoonoses-food-borne-outbreaks-2012.pdf