



*Campylobacter* in Poultry –  
Risk Management Strategy

2007 - 2010

## Prelims

Amendment 0

September 2007

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# 1 Introduction

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The New Zealand Food Safety Authority's mission is to protect consumers and enhance New Zealand's position as a trusted supplier of food. NZFSA recognises the high rates of human campylobacteriosis in New Zealand and the contribution that food, and poultry especially, make to this unacceptable health burden.

It has now been scientifically established that poultry meat is a primary exposure pathway in New Zealand. NZFSA has developed a comprehensive risk management strategy aimed at achieving sustainable reduction in *Campylobacter* levels in chicken meat through scientifically robust interventions at appropriate points in the food chain, and adopting a multi-pronged approach to *Campylobacter* risk reduction.

The *Campylobacter* risk management strategy includes:

- developing targeted controls throughout the food chain
- focusing on hazard -based controls in the medium term
- focusing on risk-based controls in the longer term
- determining the proportionality of poultry compared with other transmission pathways
- intensifying monitoring programmes to establish current baselines and show changes over time
- promoting good hygienic practice (GHP) by consumers
- collaborating with the international science community on all aspects of risk assessment and risk management

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While the ideal is for risk-based controls, given the scale of the public health problem, overseas experience, and the evolving science, hazard-based interventions will be required as an urgent response to reduce the public's exposure to *Campylobacter*.

This document describes the NZFSA *Campylobacter* in NZ poultry risk management strategy for the next three years and, specifically, spells out the work programme that will be achieved in the next twelve months. We will regularly report on progress on the NZFSA website.

## 2 Objectives of the *Campylobacter* Risk Management Strategy

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The objectives of the *Campylobacter* risk management strategy are as follows:

1. To reduce the incidence of foodborne human campylobacteriosis
2. To better quantify the proportion of foodborne cases attributable to poultry
3. To understand the relative value of different interventions throughout the food chain in reducing risks to human health
4. To make well-informed risk management decisions on appropriate control measures and their implementation
5. To design and implement an ongoing monitoring and review programme to assess the effectiveness of risk management decisions

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## 3 Background

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### 3.1 What is *Campylobacter*?

*Campylobacter* is a bacterial organism that causes the gastrointestinal disease campylobacteriosis when it lodges in the walls of a person's intestine. In particular, there are two species of *Campylobacter* that cause human illness and these are *Campylobacter jejuni* and *Campylobacter coli*.

### 3.2 Human Campylobacteriosis

Illness usually strikes within 2 – 5 days of exposure but can take up to 10 days. Symptoms include general muscle pain, stomach cramps, nausea, headache or fever followed by sudden watery diarrhoea that may contain blood. Most people feel ill for about a week. During the illness, and up to a fortnight afterwards, bacteria are shed from the gut and can survive on hands and moist surfaces for up to an hour.

The relationship between exposure and human illness is by no means clear. The dose-response relationship of *Campylobacter* and human illness is not well established. The role of immunity is not clear either. Nevertheless it can be assumed that the smaller the exposure, the more likely a reduction in the incidence of human illness will be.

The incidence of human campylobacteriosis in New Zealand is unacceptably high. Much research is being undertaken to identify solutions capable of reducing these high rates.

### 3.3 Pathways

There are many pathways for *Campylobacter* to reach the human population (especially in New Zealand) and knowing the relative importance of each of these is obviously very important when prioritizing areas for control. Once a significant pathway has been identified, its relative significance must be established using attribution techniques. Available scientific information shows that poultry meat is the main food pathway.

Knowledge of the cost and the feasibility of application of measures to reduce risks is an important input to risk management. In this regard, a risk model is a very useful tool that

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assists in the decision making process by organizing existing knowledge on potential interventions, identifying data gaps and providing estimates of outputs.

### **3.4 Ongoing Comprehensive Research**

The New Zealand Food Safety Authority's (NZFSA) research programme on *Campylobacter* has been comprehensive and longstanding over more than ten years, including involvement of the Ministry of Health and the Institute of Environmental Science and Research (ESR). It is now scientifically established that poultry is a primary pathway for the disease in New Zealand as it is in other countries. However, it must be noted that as far as current knowledge indicates, poultry accounts for just over half of the identifiable infections. Therefore whatever is done to address the problem in poultry, will impact on only a proportion of the reported cases in New Zealand.

### **3.5 Risk Management Framework**

The NZFSA risk management framework (RMF) provides a systematic process whereby knowledge on risk and evaluation of other factors relevant to control of hazards are used to choose and implement regulatory standards or other measures. The four generic steps involved in applying a RMF are shown in Figure 1. Effective risk management incorporates appropriate risk communication and stakeholder representation at all steps.

**Figure 1: Components making up the Risk Management Framework**



### 3.6 *Campylobacter* Risk Management Strategy Working Group

NZFSA has a dedicated *Campylobacter* risk management strategy working group to coordinate all work relating to *Campylobacter* in poultry, and update the risk management strategy. The working group represents expertise from several of the business groups within NZFSA.

### 3.7 Risk Communication

Communicating the risks inherent in food is an important part of the *Campylobacter* risk management strategy. NZFSA will communicate all aspects of the *Campylobacter* risk management strategy, results of work undertaken and develop communication strategies to assist the successful and effective implementation of *Campylobacter* reduction initiatives that result from this work.

Further information including press releases, reports, research and resources can be found at <http://www.nzfsa.govt.nz/>

Details of various NZFSA funded risk profiles and research can be found at: <http://www.nzfsa.govt.nz/science>

# 4 Work Streams

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This section sets out the work relating to *Campylobacter* that has been completed or is currently underway. This work is described under each of the main work streams:

- 4.1 Development and Implementation of Surveillance Activities;
- 4.2 Development and Implementation of Good Operating Practice and Hazard-based Controls;
- 4.3 Development and Implementation of Risk-based Controls
- 4.4 Development and Implementation of Monitoring Activities;
- 4.5 Risk Communication;
- 4.6 International Collaboration; and
- 4.7 Involvement of External Stakeholders.

For each of work streams 4.1 – 4.4, a short overview is given and the key objectives for the work stream are set out. Completed and current work associated with the particular work stream is then listed with a more detailed breakdown of this work found in Annex 1.

For the last three work streams, Risk Communication, International Collaboration and Involvement of external stakeholders, a brief overview of the key objectives or the main components of the work stream is given.

Annex 2 outlines the timetable for deliverables for the next twelve months.

Annex 3 contains a decision tree and intervention table currently used to inform decisions on hazard-based interventions. The table will be continually updated as scientific information comes to hand.

## 4.1 Development and Implementation of Surveillance Activities

Surveillance of communicable diseases in New Zealand is the responsibility of the Ministry of Health. NZFSA becomes involved when there is suspicion of food related causes of a case's illness. Campylobacteriosis is an important foodborne disease in New Zealand, having the one with the highest level of notifications. Because of this high incidence, campylobacteriosis is the largest contributor to the economic costs of foodborne diseases in New Zealand. The cause of the increasing incidence has not been determined to date. The issue of it being a surveillance artefact has been considered. However scientific evaluation suggests this is not the case and further work is needed to clarify the issues associated with this trend.

### 4.1.1 Surveillance of Foodborne Illness

#### 4.1.1.1 Key Objectives

- Accurately determine the incidence of foodborne human campylobacteriosis from poultry relative to other sources
- In cooperation with ESR and MoH, contribute to an effective surveillance programme that will enable demonstration of mid- and long term trends
- Apply genotyping of strains found at various points of the food chain to assist with food source attribution and other epidemiological studies.

#### 4.1.1.2 Completed Work<sup>1</sup>

- Campylobacteriosis in New Zealand: Results of the Magic Study
- A systematic review of the aetiology of human campylobacteriosis in New Zealand
- Evaluation of the foodborne disease outbreaks/human health surveillance interface

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<sup>1</sup> Further detail on completed scientific work can be found in Annex 1 and full science reports are located at: [www.nzfsa.govt.nz/science](http://www.nzfsa.govt.nz/science)

#### 4.1.1.3 Current Work<sup>2</sup>

- Acute gastro-intestinal studies (NZFSA/ESR 2005-2007)
- Enhancing surveillance of potentially foodborne enteric diseases in New Zealand (NZFSA/Massey University and MidCentral Health, 2006-2008)
- Comparison of human and poultry *Campylobacter* isolates utilising MLST in two additional centres with those available in Manawatu (NZFSA/ESR and Massey University, 2007)
- Development and application of new tools for the analysis of *Campylobacter* surveillance data: identifying the spatial and temporal determinants of raised notifications in New Zealand (NZFSA/Massey University and ESR, 2007-2008)
- Systematic reporting of epidemiology of potentially foodborne disease in New Zealand (NZFSA/ESR 2007-2008)
- The relative contribution of food pathways to the burden of human campylobacteriosis in New Zealand (NZFSA/Massey University, 2005 – 2009)

#### 4.2 Development and Implementation of Good Operating Practice (GOP) and Hazard-based Controls

Development and implementation of GOP and hazard-based controls for *Campylobacter* in poultry will reflect a combination of the best available scientific evidence, consideration of international best practice, and practicality within the NZ situation.

##### 4.2.1 Key Objectives

- To identify the most effective and practical intervention(s) and other (e.g. non regulatory) measures at relevant points in the food chain and ensure their implementation
- To establish a quantitative link between implementation of hazard-based controls and achievement of any performance targets that may be established

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<sup>2</sup> Further detail on current scientific work can be found in Annex 1

## 4.2.2 Completed Work<sup>3</sup>

### 4.2.2.1 Risk Profiles, Discussion Documents and Scientific Projects

- *Campylobacter jejuni* / *coli* in poultry
- *Campylobacter* on red meat and poultry offal
- *Campylobacter* on uncooked bovine, ovine and porcine meat
- Undercooked chicken livers as a vehicle for campylobacteriosis
- *Campylobacter* pathways discussion document
- Pathogen loading on freshly slaughtered chickens
- The effect of refrigeration on *Campylobacter* survival on poultry meat
- Domestic food practices in New Zealand – freezer survey

### 4.2.2.2 Good Operating Practice / Hazard-based Controls

- The joint NZFSA/PIANZ Poultry Industry Broiler Growing Biosecurity Manual
- Observations and documentation of current practices throughout the retail sector.

## 4.2.3 Current Work<sup>4</sup>

### 4.2.3.1 Science Projects

- On-farm factors for *Campylobacter* infection of poultry (NZFSA/ ESR 2006-2007)
- Assessment of domestic food handling practices (NZFSA/ESR 2006-2007)
- Resuscitation of putative viable but non-culturable foodborne bacteria of significance to New Zealand (NZFSA/ESR 2006-2008)
- Quantifying the reduction of *Campylobacter jejuni* on skin-on chicken breasts frozen and stored up to 10 weeks in a domestic freezer (NZFSA/ESR 2007-2008)

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<sup>3</sup> Further detail on completed scientific work can be found in Annex 1 and full science reports are located at: <http://www.nzfsa.govt.nz/science>.

<sup>4</sup> Further detail on current scientific work can be found in Annex 1

- Quantification of *Campylobacter* from internal and external rinsates (NZFSA/ESR 2007-2008)
- Effect of commercial freezing on reduction of *Campylobacter* on poultry (NZFSA/ESR 2007-2008)
- Leakproof packaging (NZFSA/ESR 2007-2008)
- Evaluation of on-farm risk factors (NZFSA/ESR 2007-2008)
- Effectiveness of current GOP on level of faecal contamination and cross contamination (NZFSA 2007-2008)

#### 4.2.3.2 GOP and Hazard-based Controls

- *Campylobacter* intervention decision tree (see Annex 2)
- Table of interventions (see Annex 2)
- Confirmation of hazard-based intervention standard
- Poultry Processors Code of Practice – chapter on primary processing
- Poultry Processors Code of Practice – chapter on secondary processing
- Confirmation of changes to standards for retail/food service
- Audit of application of Poultry Industry Broiler Growing Biosecurity Manual
- Audit of application of Poultry Processors Code of Practice – chapter on primary processing
- Updated guidance material on safe handling of poultry meat and relevant time temperature applications

### 4.3 Development and Implementation of Risk-based Controls

A quantitative risk assessment on *Campylobacter* in poultry is being developed by ESR. Currently it is being evaluated by Med-Vet-Net collaborators, together with a number of similar European models.

The purpose of this model is to establish the most effective ways of reducing campylobacteriosis in the human population. The previous section discussed options that appear promising for reducing human exposure to *Campylobacter* but quantitative linkages between specific interventions and their impact in terms of reducing food borne risks need to be established.

Risk models can establish these linkages and thereby facilitate robust risk management decisions that take into account all available options and their relative value.

#### 4.3.1 Key Objectives

- To quantify the influence of specific controls at different steps in the food chain on risk estimates in NZ, and create a “menu” of such controls and the resulting risk estimates.
- To model “what if” scenarios for new controls that become available e.g. decontamination processes
- To demonstrate the most effective ways to manage the risk to the consumer from *Campylobacter* in poultry while ensuring practicality and feasibility of interventions

#### 4.3.2 Completed Work<sup>5</sup>

- Comparative risk model: *Campylobacter spp.* In red meat and poultry
- Preliminary relative risk assessment for *Campylobacter* exposure in New Zealand (Enteric Zoonotic Disease Modelling Group) web link: <http://www.zoonosesresearch.org.nz/>
- Quantitative risk model: *Campylobacter* in the poultry food chain

#### 4.3.3 Current Work<sup>6</sup>

- Secondary Processing of Poultry (NZFSA/ESR 2006-2007)

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<sup>5</sup> Further detail on completed scientific work can be found in Annex 1 and full science reports are located at: [www.nzfsa.govt.nz/science](http://www.nzfsa.govt.nz/science)

<sup>6</sup> Further detail on current scientific work can be found in Annex 1.

- Comparative exposure model: Incorporation of *Campylobacter* in poultry and red meat (NZFSA/ESR 2006-2007)
- *Campylobacter* in food and the environment, examining the link with public health (NZFSA/ESR, Massey University, MfE, NIWA, 2007 - 2010)

#### **4.4 Development and Implementation of Monitoring Activities**

Baseline surveys, ongoing monitoring for performance and targeted surveys (*Campylobacter* in poultry flocks and on carcasses) are necessary to assess the effectiveness of control measures implemented on-farm and at the processor. NZFSA and industry require an ongoing robust national picture of *Campylobacter* carriage rates throughout the food chain in order to develop and monitor performance targets, and to identify new risk management options.

##### **4.4.1 Key Objectives**

- Accurately determine the prevalence and level of *Campylobacter* in poultry (all species but beginning with broilers) in New Zealand considering each key stage of the food chain:
  - at point of slaughter (reflecting farm practices);
  - during processing;
  - at retail (one-off studies or intermittent)

#### 4.4.2 Completed Work<sup>7</sup>

- Establishment of the National Microbiological Database (NMD) programme for *Campylobacter*

#### 4.4.3 Current Work

- Review of *Campylobacter* monitoring databases
- *Campylobacter* profile and trend analysis
- Establishment of a relevant performance target based on NMD results
- Evaluation of audit reports from NZFSA VA and CIG
- Establishment of performance monitoring targets

### 4.5 Risk Communication

Effective communication is vital to the success of both the working group and the implementation of any initiatives, controls and interventions that might result from its work. Risk communication is especially important in that it allows an issue to be considered in a context that assists individuals to assess relative value, cost and consequence of particular actions or behaviour. The key goal of good risk communication is to promote understanding of the reasons for situations, decisions and actions and in doing so empower people to make sound and valid decisions and judgments.

#### 4.5.1 Key Objectives:

- To proactively inform interested parties (both public and industry) of major developments, milestones and decisions (and the reasons for those decisions)
- To communicate via multiple methods, where appropriate, to ensure that interested parties have every opportunity to get the information they need, in the way they need it, in a timely manner
- To use existing NZFSA publications as much as possible as communication vehicles (Food Focus, 4degreesC, Food Connect, industry newsletters, NZFSA website, media releases, fact sheets etc)
- To use new and targeted communication channels as required and appropriate in order to reach those not otherwise covered

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<sup>7</sup> Further detail on completed scientific work can be found in Annex 1 and full science reports are located at: [www.nzfsa.govt.nz/science](http://www.nzfsa.govt.nz/science)

- To work with associations and groups along the farm-to-fork continuum in order to use, where possible and appropriate, existing channels those associations and groups already have in place (including continuing to educate consumers on safe food handling behaviours in the home)
- To ensure that the NZFSA website is the key repository of all information relating to this strategy, that it is updated as required and that the information can be easily accessed from the home page
- To develop communication strategies as appropriate to assist the achievement of these objectives

#### 4.6 Current Work

- Website presentation of trends in New Zealand's *Campylobacter* profile
- Consumer survey on knowledge, attitudes and beliefs with respect to *Campylobacter* in poultry, including acceptability of possible interventions.

#### 4.7 International Collaboration

NZFSA works closely with international counterparts to coordinate research, and to share and discuss scientific approaches and results in order to maximize the benefits of scientific knowledge on *Campylobacter* in poultry for inclusion into New Zealand's risk management strategy. Collaborative science projects are underway with international food safety agencies.

- **Med-Vet-Net.** The poultry model that has been developed by ESR is currently being evaluated by Med-Vet-Net collaborators together with similar models.
- **Codex International standards.** The Codex Alimentarius Commission is regarded as a key body for international food related standard setting activities. The Codex Committee on Food Hygiene has tasked New Zealand with leading the international risk-based standard for *Campylobacter* control in poultry. This is a five year project and the first working group has been held in May 2007.
- **USDA-FSIS consumer handling.** Potential collaborative work is being investigated.
- **FSANZ.** New Zealand is observing development of the poultry primary production and processing standard including a Code of Practice and associated guidance material that will apply to Australia.

#### 4.8 Involvement of External Stakeholders

NZFSA works closely with a variety of stakeholders in New Zealand in order to ensure understanding of the comprehensive risk management strategy and to share and obtain feedback on results from the work programme on an ongoing basis. The stakeholder base includes FSANZ, all industry sectors and their organisational groups, consumer advocate groups, academia, and scientific institutions.

- Enteric Zoonotic Disease Research Steering Committee (administered by NZFSA)
- Science providers e.g. Crown Research Institutes, Universities
- District Health Boards and Territorial Authorities
- Industry associations, e.g. covering growers, processors, retail and food service
- NZFSA Consumers Forum
- NZFSA Academy

## 5 Annex 1: Completed and Current Scientific work

### 1. Surveillance

#### 1.1 Completed scientific work

##### **Campylobacteriosis in New Zealand: Results of the Magic Study**

A multi-centre case-control analysis of gastroenteritis induced by *Campylobacter* carried out by ESR for Ministry of Health and Public Health Commission.

##### **A systematic review of the aetiology of human campylobacteriosis in New Zealand**

A systematic review of the available evidence around the aetiology of human campylobacteriosis in the New Zealand setting, including a consideration of the scientific quality of that evidence (particularly foodborne transmission).

##### **Evaluation of the foodborne disease outbreaks/human health surveillance interface**

An evaluation of current foodborne disease surveillance with the aim of improving the quality of epidemiological information that is gained from foodborne disease surveillance, investigation and reporting.

#### 1.2 Current scientific work

##### **Acute gastro-intestinal studies (NZFSA/ESR 2005-2007).**

A series of studies to estimate the burden of disease associated with acute gastro-intestinal illness in New Zealand and associated under-ascertainment in the surveillance process.

##### **Enhancing surveillance of potentially foodborne enteric diseases in New Zealand (NZFSA/Massey University and MidCentral Health, 2006-2008)**

Determining source attribution mainly through the comparison of *Campylobacter* profiles using MLST typing and trialling new methods and processes for public health management.

##### **Comparison of human and poultry *Campylobacter* isolates utilising MLST in two additional centres with those available in Manawatu (NZFSA/ESR and Massey University, 2008).**

Determining whether the human and poultry *Campylobacter jejuni* isolate findings from the present Manawatu attributions studies are indicative for other areas in New Zealand.

**Development and application of new tools for the analysis of *campylobacter* surveillance data: identifying the spatial and temporal determinants of raised notifications in New Zealand (NZFSA/Massey University and ESR, 2007-2008).**

Development of a model based approach for the identification of risk factors / determinants of the spatial and temporal determinants of *Campylobacteriosis* notifications in New Zealand.

**Systematic reporting of epidemiology of potentially foodborne disease in New Zealand (NZFSA/ESR 2007-2008)**

Development and implementation of a reporting system for potentially food-borne diseases in New Zealand that meets the needs of the NZFSA risk management framework and associated projects.

**The relative contribution of food pathways to the burden of human campylobacteriosis in New Zealand (NZFSA/Massey University, 2005-2009).**

A NZFSA funded PhD programme

2. Good Operating Practice and hazard based controls

**2.1 Completed scientific work**

***Campylobacter jejuni / coli* in poultry**

A risk profile that discusses issues relating to *campylobacter* in poultry.

- *Campylobacter jejuni/coli* on mammalian and poultry offals
- **A risk profile that discusses issues relating to *Campylobacter* in red meat and poultry offal.**
- *Campylobacter jejuni/coli* on red meat
- **A risk profile that discusses issues relating to *Campylobacter* and uncooked bovine, ovine and porcine meat.**

**Undercooked chicken livers as a vehicle for campylobacteriosis**

A microbiological evaluation of chicken liver pate recipes, resulting in identification of optimal hygiene practice for preparation and provision of educational materials

***Campylobacter* pathways discussion document**

A review document identifying the relative importance of different transmission routes for *Campylobacter*.

**Pathogen loading on freshly slaughtered chickens**

Data on the prevalence and numbers of *Campylobacter* on freshly slaughtered chickens immediately after exsanguination and before scalding

### **The effect of refrigeration on *Campylobacter* survival on poultry meat**

An evaluation of the effectiveness of temperature controls in the reduction of *Campylobacter* numbers achieved under standard industry practice and potential new chilling and freezing regimes is assessed.

### **Domestic food practices in New Zealand – Freezer survey**

A survey to provide baseline information on domestic freezer types commonly in use in New Zealand. Information on typical domestic freezer temperatures was collected. Freezing and thawing temperature profiles for chicken samples were recorded with a view to generating information to support a more quantitative assessment of the effects of freezing.

## **2.2 Current scientific work**

### **On-farm factors for *Campylobacter* infection of poultry (NZFSA/ESR 2006 – 2007)**

The identification of on-farm risk factors that contribute to the *Campylobacter* status of New Zealand poultry flocks. Current control measures for those on-farm risk factors will be analysed including how widely they are implemented and their likely effectiveness.

### **Assessment of domestic food handling practices (NZFSA/ESR 2006-2007)**

The further investigation of *Campylobacter* transfer rates and the risk of consuming foods that have been prepared by barbecuing.

### **Resuscitation of putative viable but non-culturable foodborne bacteria of significance to New Zealand (NZFSA/ESR 2006-2008)**

The assessment of the ability of foodborne pathogens (including *Campylobacter*) to enter into, and emerge from, a putative viable but non culturable state.

### **Quantifying the reduction of *Campylobacter jejuni* on skin-on chicken breasts frozen and stored for up to 10 weeks in a domestic freezer (NZFSA/ESR 2007)**

Establishment of the reduction of the numbers of two *Campylobacter* isolates following simulated domestic freezing and frozen storage for up to 10 weeks.

### **Quantification of *Campylobacter* from internal and external carcass rinsates (NZFSA/ESR 2007 – 2008)**

Quantification of the numbers of *Campylobacter* recovered from the rinsates of poultry after dressing. The intention is to establish the distribution of *Campylobacter* on various parts of the chicken carcass.

### **Effect of Commercial Freezing on Reduction of *Campylobacter* on Poultry (NZFSA/ESR 2007 – 2008)**

The quantification of the effect of commercial freezing followed by simulated distribution and domestic storage on levels of *Campylobacter* on skin-on chicken breast portions.

#### **Leakproof packaging (NZFSA/ESR 2007 – 2008)**

A survey of drip from poultry (whole birds, portions and livers if available) that has been leak proof packaged. The amount of fluid will be measured and presence or absence of *Campylobacter* will be established. *Campylobacter* will be enumerated if present.

The handling of leak proof packaged product by consumers will be evaluated as will be the possible contamination of the kitchen.

#### **Evaluation of on-farm risk factors (NZFSA/ESR 2007 – 2008)**

Clarification of the role of selected pathways with regard to flocks becoming positive for *Campylobacter*. Practical measures related to selected pathways for reducing the probability of *Campylobacter* being introduced into a flock will be evaluated. This project builds on project “On-farm factors for *Campylobacter* infection of poultry”.

- Effectiveness of current GOP on level of faecal contamination and cross contamination (NZFSA 2007-2008)
- **Assessment of the effect of good operating practice as documented in the Processors Code of Practice - primary processing on decreasing the level of visible faecal contamination/cross contamination**

### **3. Risk-based Controls**

#### **3.1 Completed Scientific work**

##### **Comparative risk model: *Campylobacter* spp. In red meat and poultry**

A computer based model constructed to estimate and compare exposures of New Zealanders to *Campylobacter* from three types of red meat (sheep, pig meat, beef) and poultry.

##### **Preliminary relative risk assessment for *Campylobacter* exposure in New Zealand (Enteric Zoonotic Disease Modelling Group)**

Web link: <http://www.zoonosesresearch.org.nz/>

Two models, one of which explores the relative importance of four of the most commonly identified infection exposures and the other which explores the persistence of *Campylobacter* in a rural setting.

##### **Quantitative Risk Model: *Campylobacter* spp. in the poultry food chain**

A quantitative risk model that investigates *Campylobacter* spp. contamination in the processing and consumption stages of the New Zealand poultry food chain.

### **3.2 Current Scientific work**

#### **Secondary Processing of Poultry (NZFSA/ESR 2006-2007)**

Improvement of the model for *Campylobacter* contamination through the poultry food chain; particularly in regard to the modelling of secondary processing, to assist risk management of campylobacteriosis.

#### **Comparative exposure model: Incorporation of *Campylobacter* in poultry and red meat (NZFSA/ESR 2006 – 2007)**

Integration of existing files for *Campylobacter* in poultry and meat into the 'Preliminary relative risk assessment for campylobacter exposure in New Zealand'

#### ***Campylobacter* in food and the environment, examining the link with public health (NZFSA, ESR, Massey University, MfE, NIWA, 2007 - 2010)**

NZFSA together with the Ministry for the Environment (MfE) have been awarded \$735,000 to help further research into *Campylobacter*. The grant, from the Ministry of Research, Science and Technology, will be made available over three years. The work will assist in better understanding the links between human health and the environment.

## **4. Monitoring**

### **4.1 Completed Scientific work**

#### **Establishment of the National Microbiological Database**

NZFSA has established a microbiological monitoring programme to estimate on a national basis, the prevalence of *Campylobacter* in flocks (sheds) of poultry at slaughter and the prevalence and numbers of *Campylobacter* on poultry carcasses after processing and primary refrigeration. This programme will be ongoing.

## 6 Annex 2: Key milestones 2007-2008

Surveillance		
Activity	Notes	Expected completion date
Acute gastro-intestinal studies	Final report	September 2007
Comparison of human and poultry <i>Campylobacter</i> isolates utilising MLST in two additional centres with those available in Manawatu	Final report	September 2007
Development and application of new tools for the analysis of <i>Campylobacter</i> surveillance data: identifying the spatial and temporal determinants of raised notifications in New Zealand	Final report	March 2008
Systematic reporting of epidemiology of potentially foodborne disease in New Zealand	Final report	June 2008
Enhancing surveillance of potentially foodborne enteric diseases in New Zealand	Final report	September 2008
Good Operating Practice and hazard based controls		
Activity	Notes	Expected completion date
On-farm factors for <i>Campylobacter</i> infection of poultry		September 2007
Assessment of domestic food handling practices		September 2007
Confirmation of changes to retail standards		October 2007
Poultry Processors Code of Practice – primary processing: <ul style="list-style-type: none"> <li>• Implementation</li> </ul>		<ul style="list-style-type: none"> <li>• November</li> </ul>

<ul style="list-style-type: none"> <li>Audit</li> </ul>	One audit per annum to gauge success of implementation.	<p>2007</p> <ul style="list-style-type: none"> <li>June 2008</li> </ul>
Consumers Update guidance material	NZFSA is working closely with the New Zealand Foodsafe Partnership to promote proper consumer poultry handling	December 2007
Effect of commercial freezing on reduction of <i>Campylobacter</i> on poultry		December 2007
Mandated standard for hazard based intervention (where necessary) in conjunction with performance target		April 2008 - <i>to be confirmed</i>
Quantification of <i>Campylobacter</i> from internal and external rinsates		May 2008
Resuscitation of putative viable but non culturable foodborne bacteria of significance to NZ		June 2008
Leakproof packaging		June 2008
Evaluation of on-farm risk factors		June 2008
Effectiveness of current GOP on faecal contamination/cross contamination		June 2008
Poultry Processors Code of Practice- secondary processing: <ul style="list-style-type: none"> <li>implementation</li> </ul>		June 2008
Check implementation of Broiler Growing Biosecurity Manual	At least one annual review of Manual	June 2008
<b>Development and implementation of risk-based controls</b>		
<b>Activity</b>	<b>Notes</b>	<b>Expected</b>

		<b>completion date</b>
Secondary processing of poultry		September 2007
Comparative exposure model		November 2007
<b>Monitoring</b>		
<b>Activity</b>	<b>Notes</b>	<b>Expected completion date</b>
Hazard monitoring within the food chain <ul style="list-style-type: none"> <li>- flock prevalence</li> <li>- carcass (NMD)</li> </ul>	Trend analysis	Quarterly
Establishment of performance monitoring target		October 2007
Establishment of an NMD performance target		April 2008
Review of monitoring databases		June 2008
Evaluation of NZFSA audit reports		June 2008
<b>Risk communication</b>		
Progress report on website		Monthly
2007 NZFSA Food Safety Conference	<i>Campylobacter</i> Strategy progress	Sept 2007
Website presentation of trends in <i>Campylobacter</i> profile		Ongoing
Survey of consumers' knowledge, attitudes and beliefs with respect to <i>Campylobacter</i> in poultry, including acceptability of possible interventions.		April 2008

# 7 Annex 3: *Campylobacter* Intervention Table and Decision Tree

## **Introduction**

This Annex is a resource document containing current information on *Campylobacter* interventions potentially capable of achieving a 2 log or greater reduction in the pathogen at a particular broiler chicken processing step.

It also contains a decision tree that enables risk managers to assess the available information in light of international and New Zealand science and industry practice when considering risk management options, and before making risk management decisions.

More background information on hazard-based control of *Campylobacter* is available from NZFSA upon request.

## **Explanation of the Table to Capture *Campylobacter* Intervention Decisions**

The following should be considered and described as appropriate under the relevant table headings. It is anticipated that the Science Group completes all columns (as much as possible) except the 2 on the far right, which will be completed by the Risk Manager.

### **Name/description of control measure**

Insert the normal name of the control measure, e.g. trisodium phosphate rinse.

### **Process step**

Identify the process step or steps where this control measure is applied.

### **Critical limits / Equipment set up**

Identify processing equipment settings (e.g. counterflow) and the critical limits for the process step e.g. minimum concentration, temperature, time, pH etc.

### **Log reduction capability**

Insert the log reduction that most evidence supports (presumes comparison of initial loading with post intervention loading). This should be in the order of a 2 log reduction or greater as indicated within the decision tree.

Explain any known limitations, e.g. whether this has been shown only for a particular strain of *Campylobacter*.

### **Status**

Insert one of the following:

- Parked – no further work being done at this point in time – with justification;
- Stage through decision tree (indicate number of the box from the tree corresponding to the work in progress or whether accepted by NZFSA as an intervention.)

### **International Science**

Consider robustness of science including:

- Peer-reviewed and published
- Peer reviewed by Science Group (unpublished)
- Methodology robust
- Number of studies supporting the findings
- Natural contamination or lab strains inoculated into product
- Insert any details given re costs.

Insert any issues related to stakeholder (including consumer) acceptance.

### **NZ Science**

As for international science but in NZ context.

### **Field Trials**

Consider:

- Trials done in commercial conditions
- Number of premises
- Whether trial is representative of most premises

### **RM Practicality**

Consider whether the control measure(s) are practical under NZ conditions:

- Cost
- Availability of equipment and consumables
- Issues re feasibility, e.g. changes to facilities

### **RM Options**

Insert Risk Management Options for Consideration

- Education / Guidance
- COP

Specification / Regulation

Table to Capture *Campylobacter* Intervention Decisions (as at 11 September 2007)

Name/description of intervention	Process step	Critical limits & Equipment set up	Log reduction capability	Status	International Science	NZ Science	Field Trials	RM Practicality	RM Options
Acidified sodium chlorite (ASC)				<p>There is evidence that ASC can be applied effectively However, the reduction is not always &gt; 2log<sub>10</sub></p> <p>In NZ it is not proven on a commercial scale but figures will be available after October 2007</p>					
Acidified sodium chlorite (ASC)	<p>ASC spray cabinet</p> <p>after inside-outside-bird-</p>	<p>1,100 ppm sodium chlorite</p> <p>9,000</p>	1.75 log <sub>10</sub>		<p>Kemp <i>et al.</i>, 2001</p> <p>Peer reviewed and</p>		<p>Experiments were carried out in 5 US commercial plants</p>		

	washer before chiller  (Sanova)	citric acid  pH 2.5 ± 0.05  14 – 18°C  15s			published  Method appears robust  Natural contaminatio n		Probably representativ e for US premises		
Acidified sodium chlorite (ASC)	Postchill dip  (Sanova)	15 seconds exposure  600 to 800 ppm ASC  pH 2.5-2.7	2 experiment s:  0.92 and 1.2 log <sub>10</sub>		Oyarzabal <i>et al.</i> , 2004  Peer reviewed and published  Method appears robust  Natural contaminatio n		Experiments were carried ou in 1 commercial US poultry- processing facility  Cannot assess whether trial is representativ e		
Acidified sodium chlorite (ASC)	Post screw- chill dip  (Sanova)	900 – 1000 ppm  pH 2.5 – 2.6	3.8 log <sub>10</sub>		Sexton <i>et al.</i> 2007  Peer reviewed and published		Experiment was 1 commercial Australian premises  Industry report		

		20 s			Methodology appears robust		Trial would not be representative for commercial conditions because dip would contain small number of birds only (600 l solution)		
Acidified sodium chlorite (ASC)	Spray	0.1 % solution of ASC (vol/vol)  Prepared with citric acid  Misted onto skins at 2 mL/s for 3s  Used within 5 min of mixing	Reduction if applied:  before treatment spray  1.52 log <sub>10</sub>  after treatment spray  0.93 log <sub>10</sub>		Artritt <i>et al.</i> 2002  Peer reviewed and published  Laboratory experiment  Known strains		This experiment was not done under commercial conditions and not representative of these.		
Acidified sodium chlorite (ASC)	ASC spray  (Sanova)	1,100 ppm  Prepared with citric acid	1.15 - 1.54 log <sub>10</sub>  2.12 log <sub>10</sub> if preceded by chlorinated		Kemp and Schneider 2002  Peer reviewed and		Experiments were performed in two commercial US processing plant		

		pH 2.5  240 mL  12 s	wash  Description not clear whether post-chill achieved similar results anyway		published  Method appears ok  Natural contamination		Probably representative for US premises		
Acidified sodium chlorite (ASC)	Post chill dip (Sanova)	15 seconds  400 ppm	App. 2.8 log <sub>10</sub>			Roy Biggs (personal communication 2006)  Results made available to NZFSA  Methodology appears ok	Commercial plant  1 premises  Dipping not representative for large numbers of birds		
Acidified sodium chlorite (ASC)	Prechill dip (Sanova)	15 seconds  700-800 ppm	> 3 log <sub>10</sub>			Roy Biggs (personal communication 2007)  Results made available to NZFSA  Methodology appears ok	Commercial plant  1 premises  Dipping not representative for large numbers of birds		

Acidified sodium chlorite (ASC)	Post chill dip  (Johnson Diversey )	15 seconds  700 ppm	0.5 - 2.5 log <sub>10</sub>			Roy Biggs (personal communication 2007)  Results made available to NZFSA  Methodology appears ok	Commercial plant  1 premises  Dipping not representative for large numbers of birds		
<b>Acetic Acid</b>	Scalding tank	52°C  0.1% & 5 minutes  0.2% & 2 minutes	App. 5 log <sub>10</sub>  > 2 log <sub>10</sub>	<b>Collect more data</b>	Okrend <i>et al.</i> 1986  Peer reviewed and published  Strain clinical isolate				
<b>Trisodium Phosphate (TSP)</b>	Post-chill dip	10% TSP  50°C  15 s	1 day storage: 1.5 log <sub>10</sub>  6 days storage: 1.2 log <sub>10</sub>	<b>Dip and spray experiments showed insufficient reduction</b>  <b>Number of disadvantages</b>	Slavik <i>et al.</i> 1994  Peer reviewed and published  Known		Laboratory conditions  MPN estimates		

				<b>listed</b>	strains				
Trisodium Phosphate (TSP)	Cell suspensions	37°C  10% TSP  Only or in combination with nisin or lysozyme	Maximum reductions > 2 log <sub>10</sub>		Caneiro de Melo 1998  Peer reviewed and published  Known strains		Laboratory conditions (cell suspensions) not representative for commercial conditions		
Trisodium Phosphate (TSP)	Spray on skin	10% TSP	Reduction if applied:  before treatment spray  1.63 log <sub>10</sub>  after treatment spray  1.28 log <sub>10</sub>		Arritt <i>et al.</i> 2002  Peer reviewed and published  Known strains  Methodology appears ok		Laboratory conditions, not representative for commercial conditions		
Trisodium Phosphate (TSP)									
<b>Cetylpyridium chloride (CPC)</b>	Spray on skin	0.1 % CPC	Reduction if applied:	<b>Monitor the literature</b>	Arritt <i>et al.</i> 2002		Laboratory conditions, not		

		0.5% CPC  Misted onto skins at 2 mL/s for 3s	before treatment spray  0.1% - 1.42 log <sub>10</sub>  0.5 % - 2.89 log <sub>10</sub>  after treatment spray  0.1% - 0.77 log <sub>10</sub>  0.5 % - 4.67 log <sub>10</sub>	<b>and pursue actively if not sufficient other options available</b>	Peer reviewed and published  Known strains  Methodology appears ok		representative for commercial conditions		
<b>Electrolysed water</b>	Washing	10 and 30 minute treatments  4°C and 23°C	App. 3 log <sub>10</sub>	<b>Unclear how difficult to implement under commercial conditions . Monitor international literature</b>	Park et al. 2002  Peer reviewed and published  Six-strain mixture  Methodology appears ok	N/A	Experimental conditions, not representative for commercial conditions		

SonoSteam®	Before washing operation	1 second	1.9 – 3.1 log <sub>10</sub>	Equipment not known to be in NZ. Monitor international trends	Rosenquist et al.  Draft paper and website  Natural contamination	N/A	Not reported		
Freezing	-18°C to -30°C		App 2 log <sub>10</sub>	There is information from various sources that freezing is effective in reducing <i>Campylobacter</i> counts. Degree of reduction varies		A further ESR project has been commissioned by NZFSA to compare effectiveness of various temperatures			
NZ Domestic freezing and thawing	Post primary processing	app -18°C storage then thawing  28 days  56 days	1.8 – 2.1 log <sub>10</sub>  1.9 – 2.2 log <sub>10</sub>			ESR project commissioned by NZFSA	Simulated domestic freezing conditions		

Freezing at – 18°C	Post primary processi ng	32 days  Chicken skin  Chicken juice	2.2 log <sub>10</sub>  1.5 log <sub>10</sub>		Birk <i>et al.</i> 2006  Peer reviewed and published  Methodology robust  1 laboratory strain		Laboratory experiment, not representativ e for commercial conditions		
Freezing at – 20°C	Post primary processi ng	2 week period  Ground chicken  Chicken skin	0.56 – 1.57 log <sub>10</sub>  1.38 – 3.39 log <sub>10</sub>		Bhaduri and Cottrell 2004  Peer reviewed and published  Methodology robust  3 laboratory strains		Laboratory experiment, not representativ e for commercial conditions		
Freezing at – 20°C	Post primary processi ng	31 days  Thawed at 7°C	0.65 log <sub>10</sub>	Note low reduction of immersion chilled flock	Georgsson et al. 2006  Peer reviewed and published		Birds were commercially frozen as practised in Iceland		

		Immersion chilled (1 flock)	1.83 – 2.87 $\log_{10}$		Methodology robust				
		Spray chilled (4 flocks)			Natural contamination				
Freezing at – 20°C	Post primary processing	3 weeks  Thawed at 4°C	2 $\log_{10}$		Sandberg <i>et al.</i> 2005  Peer reviewed and published  Methodology robust  Natural contamination		Frozen at a laboratory		
Freezing at – 20°C	Post primary processing	48 hours	2 - 3 $\log_{10}$		Solow <i>et al.</i> 2003  Peer reviewed and published  Methodology robust		Not a field experiment		

					3 <i>Campylobacter</i> strains inoculated on skin				
Freezing at -30°C	Post primary processi ng	72 hrs	1.8 log <sub>10</sub>		Zhao <i>et al.</i> 2003  Peer reviewed and published  Methodology robust  3 strains of <i>Campylobacter</i>		Laboratory conditions		

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## Decision tree

