Guidelines for the safe retailing of meat and meat products

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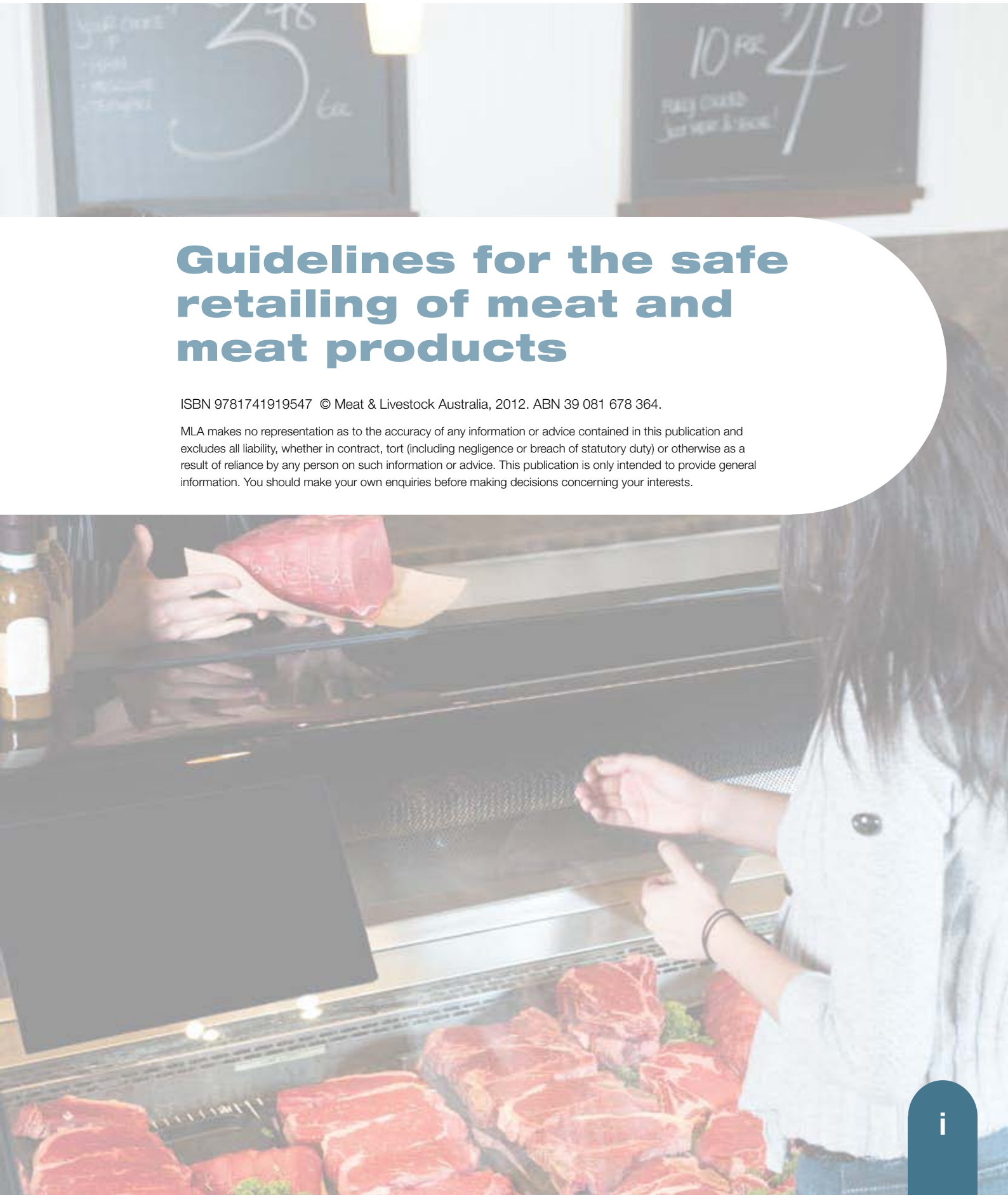

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Food Safety Plans for butcher shops

Food Safety Plans for independent butchers

In 1998 the National Meat Association (NMA – now the Australian Meat Industry Council, AMIC) asked Meat and Livestock Australia (MLA) to help in preparing Food Safety Plans (FSPs) for independent butchers.

At the time HACCP was just being introduced into the meat industry following a number of incidents in which consumers died or were seriously injured:

In the USA, consumption of hamburgers from the Jack-in-the-Box chain killed seven children and injured more than 50 others

In Australia, one child died and more than 150 were injured following consumption of mettwurst manufactured by Garibaldi Smallgoods

These incidents led to food safety plans being mandated for all sectors of the meat industry and, over the period since 1998, there have been other problems in which consumers have died, with ready-to-eat meats being the cause.

In response, meat regulators have gradually introduced new requirements for the industry, requirements which apply to butcher shops and manufacturers, alike, the most recent being the *Regulatory guidelines for the control of Listeria.*

For this reason, AMIC and MLA have produced resources such as videos, guidelines and booklets to help the industry meet increased requirements:

1. ***Guidelines for the safe manufacture of smallgoods***
2. ***Safe manufacture of value-added products (DVD)***
3. ***Listeria monocytogenes in smallgoods: risks and controls***
4. ***How to comply with regulatory guidelines for the control of Listeria by meat retailers: advice on how to set up a testing program***
5. ***Reducing the risk of Listeria monocytogenes in smallgoods***

For more information on these resources go to:
http://www.mla.com.au/Publications-tools-and-events

Introduction

What you need to do after reading these Guidelines

1. Write work instructions or monitoring forms – only you can do this, for your individual operation, and for approval by your controlling authority.

2. Set out how you meet all the provisions of the Food Standards Code. You need to do this before your regulator will sign-off on your food safety plan:

   - Standard 3.1.1 (Interpretation and Application)
   - Standard 3.2.1 (Food Safety Programs)
   - Standard 3.2.2 (Food Safety Practices and General Requirements)
   - Standard 3.2.3 (Food Premises and Equipment)
   - Standard 4.2.3 (Production and Processing Standard for Meat)
   - AS 4696:2007 (Australian Standard for Hygienic Production and Transportation of Meat and Meat Products for Human Consumption)

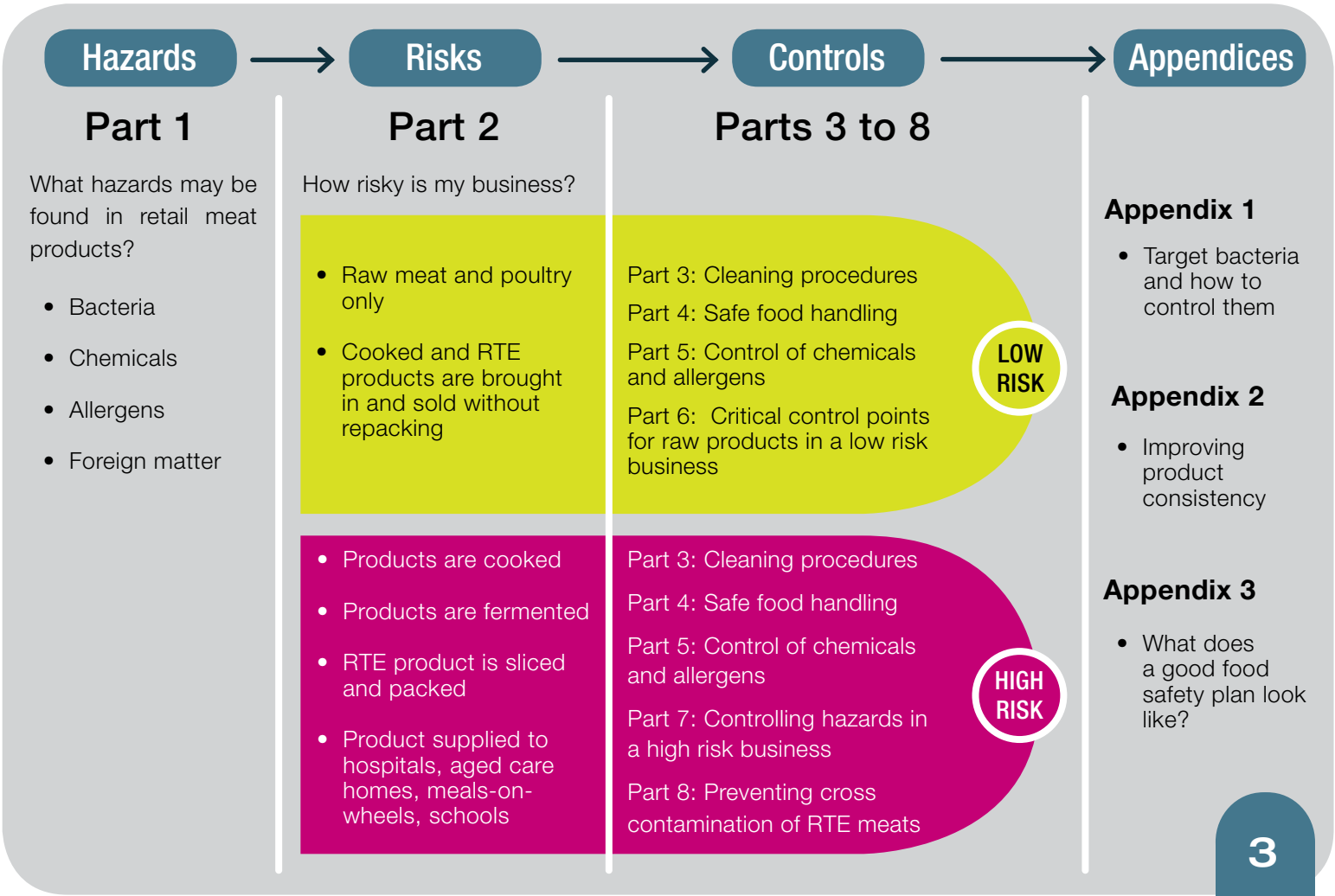
Introduction

What these Guidelines help you do

In these Guidelines we:

1. **Provide a risk rating for your operation**
2. **Suggest ways you can reduce the risk to your customers**
3. **Supply scientific backing for your Food Safety Plan**
4. **Provide background information to support training programs for owners of butcher shops, staff and apprentice butchers - don't forget, you have a regulatory requirement to make sure you and every staff member have the skills and knowledge to manufacture all your products safely.**

Roadmap to these Guidelines



Introduction

Glossary of terms

< ..... Less than, as in less than 10

> ..... More than, as in more than 10

Ambient temperature ..... Temperature of the air around you or the product

AMIC ..... Australian Meat Industry Council

Anaerobic ..... The absence of oxygen, a state which can exist in canned and vacuum-packed products

a_w ..... Water activity

Calibration ..... Measurement of the accuracy of a piece of equipment e.g. a thermometer

Cold chain ..... The process of maintaining foods under refrigeration, in either a chilled or frozen state, during storage, distribution and marketing

Comminuted ..... A meat product which is chopped or minced

Contaminant ..... Is something which may make food unsafe or unwholesome. Examples of contaminants are micro-organisms, chemical residues or metal specks

Controlling authority ..... The Commonwealth, State or Territory authority which is responsible for the enforcement of standards

Critical control point ..... A point, procedure, operation or stage in a process at which a hazard is prevented, eliminated or reduced to an acceptable level

Critical limit ..... The limit to which a hazard must be controlled at a critical control point to prevent or reduce it to an acceptable level

Food Safety Plan ..... A food safety plan is designed to protect the food safety of the product. A food safety plan is the total of good manufacturing practices, sanitation standard operating procedures and HACCP plan operated by a company

GMPs ..... Good Manufacturing Practices

HACCP ..... Hazard Analysis Critical Control Point is the system which identifies and controls those hazards which pose a significant risk to food safety

Hazard ..... A biological, chemical or physical agent which may compromise or affect food safety

Immuno-compromised ..... Consumers whose immunity is reduced to a level which makes them more vulnerable to infection

Log ..... Logarithm – used to express microbial counts e.g. log 2 is 100, log 3 is 1,000

Microbial count ..... The number of micro-organisms living in or on a food product

Microbiological limits ..... The maximum number of micro-organisms specified for a food product

Micro-organisms ..... Viruses, yeasts, moulds and bacteria

Pathogen ..... A micro-organism which causes illness

pH ..... A measure of acidity or alkalinity

Polyentrapment ..... Plastic film which becomes caught within meat during the packaging process

Potable ..... Water quality which is consistent with the Australian Drinking Water Guidelines 1996. Potable water is drinking quality water

ppm ..... Parts per million, also referred to as mg/kg (milligrams per kilogram)

Product recall program ..... The system a company follows to recover product suspected of being faulty from the market place

RTE meats ..... Ready to eat meats are products that are intended to be consumed without further heating or cooking and include cooked or uncooked fermented meats, pate, dried meat, slow cured meat, luncheon meat, cooked cured or uncured muscle meat

SSOPs ..... Sanitation Standard Operating Procedures

Spoilage bacteria ..... Bacteria which limit the shelf-life of foods by producing objectionable odours and slime

Spores ..... Reproductive bodies, more resistant to environmental factors than the vegetative cells which form them. Spores produced by *Bacillus* and *Clostridium* are of most importance in meat processing

Toxin ..... A chemical which can cause illness. Toxins may be produced in food by bacteria

UCFM ..... Uncooked comminuted fermented meat

Validate, validation ..... The process of obtaining evidence to demonstrate that hazards in a food process are controlled

Vegetative cells ..... Cells of bacteria and fungi which replicate and do not produce spores

Verify, verification ..... Monitoring used in food processing to demonstrate that critical limits and other important parameters have been complied with

Part 1

HIGH RISK

LOW RISK

So what's the problem – what are the hazards you need to control?

Food poisonings from meat and meat products

Butchers manufacture a wide range of raw, cooked, cured, fermented and dried meat products from the meat and offals of cattle, sheep, pigs and chickens.

There are many hazards you need to control in your business and we identify which are the most important by:

- **Looking at food poisoning outbreaks from meat**
- **Listing recalls of meat and meat products.**

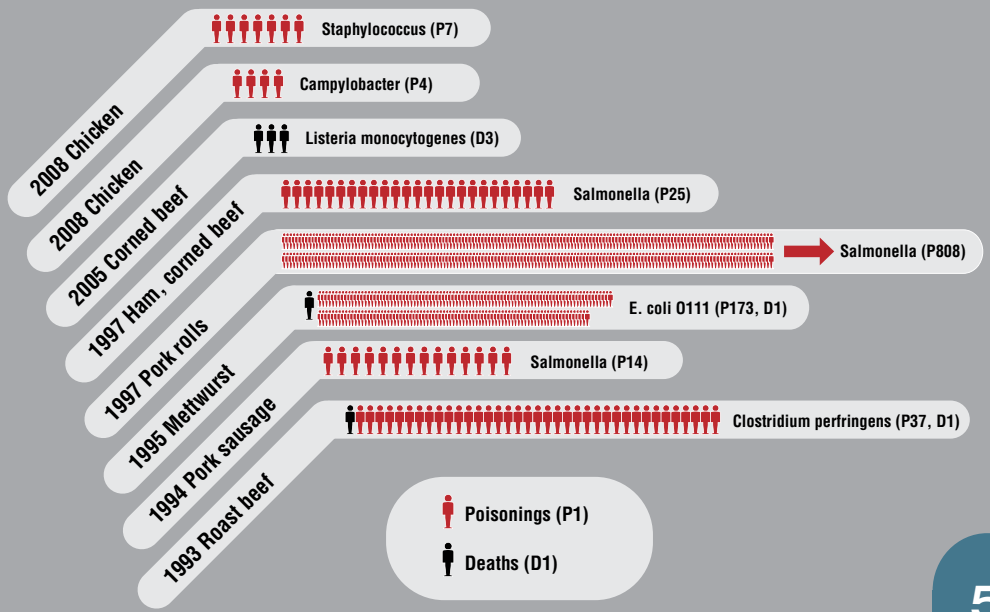
Using data collected by state authorities and OzFoodNet, we have illustrated below the meat products which caused food poisonings in Australia over recent years.

The examples below identify target bacteria – hazards you must control through your food safety plan. We have a section (Appendix 1) on these target bacteria.

Several of the food poisonings occurred in institutions such as aged care facilities and hospitals, which underlines how vulnerable some consumers are.

There is more information on which of your customers are the most vulnerable in Part 2: So how risky is my business? and Part 7: Control of hazards in high-risk business.

Meat products which caused food poisonings in Australia over recent years



Part 1

HIGH RISK

LOW RISK

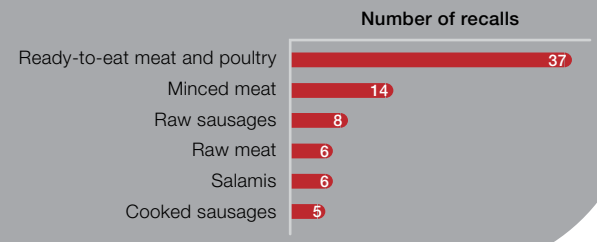
Product recalls

There is a list of all meat recalls on the Australian Competition & Consumer Commission (ACCC) website (http://www.recalls.gov.au).

From 2000-2012 there have been more than 70 recalls of meat and poultry products and the product categories are illustrated below. As you can see, the main product categories recalled were ready-to-eat meat/poultry (37 recalls) and minced meats (14 recalls).

Source: www.abc.net.au,www,tvnz.co.nz (oneNews/Fairfax), www.wellington.scoop.co.nz

Recalled product categories



Cause of the recall

The main reason for recall involves bacteria, almost always *Listeria monocytogenes* in ready-to-eat (RTE) meat and poultry, and occasionally *Salmonella*.

Foreign matter problems were metal (10), plastic (8), rubber (2), glass (1) and oil (1).

Labelling is an increasing cause of recalls because allergens such as dairy product or egg have not been included on the label. We have a section on allergens and how you can control them in Part 5: Control of chemicals and allergens.

Although manufacturers and supermarket chains accounted for most of the recalls, butcher shops were involved in 35% of them.

The FSANZ recall data point us towards the main hazards and the product types most commonly affected by them. So when we develop a HACCP Food Safety plan (see Appendix 3) we can link hazards and products and put in control points and critical control points to take care of them.

Foreign matter was the main cause for recall of minced meat – almost always the presence of metal fragments.

Part 2

HIGH RISK

LOW RISK

So how risky is my business?

Risk assesment

We assess risk by putting together two factors:

1. **The chance that the hazard will occur**
2. **The severity of the effect when a hazard does occur**

In meat retailing the risk varies according to the scale and scope of your business.

Many of the products, such as roasts, chops, steaks are low-risk because cooking will remove the hazards. On these products the hazards are all on the surface and are killed almost instantly by the heat of the oven, frying pan or barbecue.

In others, such as sausages and hamburgers, the hazards are spread through the product, so undercooking will lead to increased risk.

In America, many consumers like their hamburgers undercooked and this results in what they call the “hamburger season” when cases of illness increase.

Your risk rating soars if you manufacture cured and cooked products, particularly if you slice and pack in your premises.

Why is the risk increased? The answer is simple – the chances of cross contamination by transferring dangerous bacteria from raw meat to RTE meat are high.

Cross contamination in your premises

Cross contamination can happen in many ways and you can only prevent it by taking a number of precautions.

Here’s what large manufacturers of RTE meats do to try and prevent cross contamination:

- **Complete separation of raw and cooked areas**
- **Complete separation of staff who work in different areas – they have different amenities and different colour uniforms**
- **When RTE staff go to smoko, the room is locked and they leave their outer uniforms and boots behind**
- **They re-enter through an airlock, put on their uniforms, boots, hats and wash hands**
- **Slicing and packing rooms have filtered air, positive pressure and link to the despatch through a tiny hatch**

These are just some common precautions which the big companies take – how many do you have in your preparation area?

“I’ve been in the business 30 years and never hurt anyone”

Part 2

HIGH RISK

LOW RISK

Butchers just like you – shocking tales!

Maybe you think nothing will go wrong – you think "I've been in the business 30 years and never hurt anyone".

Well think again – here are two tales of woe concerning butchers who made the same products you do. They don't any more – find out why.

"You go from being Scottish butcher of the year to mass murderer of the year."

In 1996 John Barr a butcher in Scotland produced RTE meats which became contaminated with *E. coli* O157, and caused 279 illnesses and 20 deaths. Mr Barr had recently been named Scottish Butcher of the Year. He avoided serious charges when legal teams brokered a deal and was fined £2250 (about $4000). Speaking to the press, Mr Barr confessed that, until the disastrous outbreak, he had barely even heard of the *E. coli* bug and would be 'haunted' by the deaths for the rest of his days. He'd been close to a nervous breakdown and was still on medication for depression. He added: *"You go from being Scottish butcher of the year to mass murderer of the year."*

Professor Hugh Pennington led an inquiry into the incident and made many recommendations aimed at ensuring such an incident wouldn't happen again.

But in 2005, it did. In South Wales a total of 157 cases, almost all of them children at 44 schools, became ill, 30 were hospitalised and one boy aged 5 years, died. RTE meats supplied for school lunches by butcher John Tudor & Son contained *E. coli* O157. The company's principal, William Tudor pleaded guilty to seven food hygiene offences and was jailed for 12 months.

Professor Pennington again led an inquiry – the second in less than a decade. His recommendations took in industry and regulators, but those aimed at butcher shops included:

1. All food businesses must ensure that their systems and procedures are capable of preventing the contamination or cross-contamination of food with *E. coli* O157
2. Food businesses must get to grips with food safety management based very clearly on the seven key HACCP principles, ensuring it is a core part of the way they run their business
3. Additional resources should be made available to ensure that all food businesses understand and use the HACCP approach and have in place an effective, documented, food safety management system which is embedded in working culture and practice
4. Discussion with employees must be a standard part of food hygiene inspection visits

You're thinking "It couldn't happen to me"

Part 2

It's easy to dismiss what happened in the UK, but both operations were licensed by their local authorities and audited regularly – just like you.

They also:

- **Processed and packed RTE meats in the same room as raw meats**
- **Stored carcases and RTE meats in the same chiller**
- **Weighed raw and RTE meats on the same scales before packing**
- **Used the same vacuum packing machine for raw and RTE meats**
- **Had staff without adequate skills and knowledge**
- **Had grown their business and were manufacturing much large volumes from the same premises**

HIGH RISK

LOW RISK

All these points are trigger points for increased risk.

Ask yourself *"How many of these triggers apply to my operation?"*

If any of them rate a 'Yes' you should be thinking about how you can keep your customers in a less risky place.

In later sections we cover exactly this point – how you can protect your customers from illness, and your business and yourself from prosecution.

You probably remember the Garibaldi mettwurst illnesses in 1995. The consequences were severe for Garibaldi Smallgoods and its principals; the company closed within days and the principles were charged with manslaughter - later reduced to *'creating a risk of harm'* to which they pleaded guilty.

"The identification of the company's product, and its linkage with the death and severe illness of the children, had a catastrophic effect upon the company's business, such that it ceased operations on Monday 6 February 1995. This involved the downfall of one of the largest producers of smallgoods in South Australia, and the loss of more than 100 jobs, and has had a deleterious effect upon several other producers of smallgoods in this State."

Garibaldi Smallgoods: Coroner's report

Part 2

HIGH RISK

LOW RISK

Check out your business – rate your risk

Thinking about scale, the more you make, the more chance for something to go wrong – both UK butchers mentioned above were very successful - they grew their businesses very rapidly but didn't keep pace with the increased chance of a hazard occurring.

The risk in your business model comes from three main factors:

1. **Product range** – the more products you make, the greater the chance for hazards to enter the final product.
2. **How you sell** – slicing to order into a plastic bag means the food will probably be eaten within a day or two – not enough time for the hazard to grow to a level which will infect the consumer. But if you vacuum pack RTE meats the customer may keep them for some weeks, giving the target hazard, *Listeria*, plenty of time to grow.
3. **Your consumer base** – some customers are less able to withstand infection by the bacteria you are targeting. They are the very young, the aged, pregnant women and people whose immune response is low. And if you supply your local hospital, aged care facility or school the risk to your business increases greatly.

Based on the above there are two risk levels:

- **Low risk butchers**
- **High risk butchers**

Look at the table below and work out whether yours is a low- or a high-risk business.

Risk level	Business activity	Target hazards	Problem products
Low risk	I sell raw meats and poultry only I sell mainly raw meats but I also buy in cooked sausages and RTE meats which I sell as is – I don't repack them	*Salmonella,* Pathogenic *E. coli and Campylobacter* None – hazards already inactivated by supplier	Minced and comminuted products Chicken pieces
High risk	I also sell raw meats and poultry but I also cook some of my products and make UCFM, which I slice and vacuum pack I have contracts to supply hospitals, aged care homes, meals-on-wheels and schools	*Salmonella* Pathogenic *E. coli* *Campylobacter* *Listeria monocytogenes* *Clostridium perfringens* *Clostridium botulinum*	Sliced RTE meats susceptible to cross contamination, especially if there's only one slicer in the shop

Part 2

HIGH RISK

LOW RISK

So I'm a low risk business – no worries?

Don't get carried away – you still have a whole raft of hazards to control.

- **Foreign matter. If you have a mincer there's always the chance of metal fragments breaking off. In Part 1 we showed most of the product recalls for minced meat were for metal fragments**
- **Allergens. If you value-add with marinades you're probably adding allergens. We have a section on allergens so check it out**

Danger signals

There are some early-warning signs when a business is building up risk - check out this list. If you answer *"Yes"* to any of these, you're moving into danger territory.

	Danger signals	Yes	No
1.	Things are going great – we're making heaps more products	☐	☐
2.	I've had to take on new staff – must get around to sending them on a training course	☐	☐
3.	I'm making some great new products – customers really love the different things we put into our mini-roasts	☐	☐
4.	Pub across the road wants a heap of fancy stuff for weekend lunches	☐	☐
5.	We're flat out - I'll have to think about another slicer and vacuum machine	☐	☐
6.	Must call that cleaning guy – this place looks like a bomb's hit it when we finish up each day	☐	☐
7.	The aged care home's asking for another week's use-by on the vac-pack sliced meats – no problem	☐	☐
8.	Due for an audit soon – must get the paperwork up to date	☐	☐
9.	We're that busy, our chiller's never empty – we mop it once a week though	☐	☐

HIGH RISK

Part 2

HIGH RISK

LOW RISK

OK – I can see I have a high-risk business – what should I do?

If you run a high-risk business you should seriously consider options to reduce the risk. We cover these in the MLA booklets:

- ***"Listeria monocytogenes; risks and control"*** **– Section 3:** ***"Anti-Listeria technologies and processes"***
- ***"How to comply with regulatory guidelines for the control of Listeria by meat retailers: advice on how to set up a testing program***

For more information on these resources go to:
http://www.mla.com.au/Publications-tools-and-events

There are ingredients you can use in curing, and others you can spray on the surface of finished products, which inactivate all your target bacteria, your ingrediant supplier can advise you about these antimicrobials. They're not magic bullets and you'll need to use them in conjunction with good processing and cleaning. In other words, you just need to keep it simple and do everything right! That's if you want to eliminate the risks like those which built up for the butchers in Scotland and Wales – butchers just like you who played Russian roulette, and the gun went off!

Part 3

HIGH RISK

LOW RISK

Cleaning procedures for retail butcher shops

Construction of the processing area

If you make RTE meats in your butcher's shop, you must work in clean premises and use equipment and techniques which give safe products.

As a food premises you come under the Australia New Zealand Food Standards Code, particularly Standard 3.2.3 Food Premises and Equipment. It's easy to read and can be downloaded from the Food Standards Australia New Zealand (FSANZ) web site, www.foodstandards.gov.au.

There is also an Australian Standard on how your premises should be designed and built, the Australian Standard for the Hygienic Production and Transportation of Meat and Meat Products for Human Consumption (AS 4696:2007).

In addition, some states also have individual standards that apply to manufacturers of meat retailers e.g. Victorian Standard for Hygienic Production of Meat at Retail Premises (March, 2006).

In general, standards are either prescriptive or outcome-based.

- **Prescriptive standards specify every last detail you must meet e.g. the arc needed for coving between wall and floor.**
- **Outcomes-based standards specify only that you need to achieve a safe product and the detail of how you achieve safety must be included in your food safety plan.**

Your local controlling authority will have copies of these standards.

In a well designed and constructed premises:

- **There is a safe water supply**
- **Food contact surfaces are kept in good, clean condition**
- **Cross-contamination from insanitary objects is prevented**
- **Hand washing, hand sanitising and toilet facilities are available and kept clean**

- **Food packaging materials and food contact surfaces are protected from adulteration with lubricants, fuel, pesticides, cleaning compounds, sanitising agents, condensate and other chemical, physical and biological contaminants**
- **Toxic compounds are stored and used safely**
- **Employee health is monitored and controlled**
- **Pests are excluded**
- **Wastes are confined and disposed of safely**

These elements are to prevent the contamination of materials and final products with micro-organisms (germs) from people, equipment and the workplace environment.

Part 3

HIGH RISK

LOW RISK

How to clean your premises

Keeping your premises clean and sanitised is essential to producing safe products. You'll need a documented cleaning and sanitising program explaining how all parts of your premises are cleaned.

There are two parts to your program — cleaning and sanitising.

Cleaning

Cleaning is the removal of soils like waste, dirt, grease, food scraps and blood from equipment and premises. You need a detergent designed to remove these soils so they can be rinsed away with water. You know cleaning has been done properly if equipment and surfaces are visibly free from soils and deposits.

Sanitising

Sanitising destroys any micro-organisms which remain in or on the equipment after cleaning. Successful sanitising reduces levels to less than five bacteria per cm^2 of surface. Sanitising involves using chemical sanitisers and these work only on clean surfaces – if there's any soil remaining they get degraded and don't do the job.

Your cleaning and sanitising program should include:

- **Details of areas to be cleaned and how often they're done**
- **Step-by-step procedures for cleaning**
- **Instructions on how to dismantle and reassemble equipment**
- **Concentrations of chemicals to be used**
- **Contact time for chemicals to do the job**
- **Water temperature (cold, warm or hot)**
- **Drainage and drying procedures**

You'll do the job properly only if:

- **Staff are trained and are given enough time**
- **Proper detergents and equipment are used**
- **Sanitisers are effective against pathogens like *Listeria*.**

During the working day you will need to dry clean around the slicing and packing area.

Equipment and utensils should be cleaned and sanitised periodically during the day.

Work areas and equipment should be cleaned and sanitised at the end of each day.

Think about additional 'blitzes' at weekends to clean and sanitise drains, your cool room and refrigerated units.

HIGH RISK

LOW RISK

Stages in cleaning

Do it step-by-step:

- **Dry clean the area by removing scraps**
- **Rinse the area with warm water**
- **Apply the detergent solution or foam and leave it on all surfaces for the time specified by the manufacturer**
- **Scrub surfaces to loosen and remove dirt**
- **Rinse detergent solution off with potable water and drain**
- **Apply a chemical sanitiser and leave it on all surfaces for the time specified by the manufacturer**
- **Rinse off chemical sanitiser with potable water and drain (not needed if a non-rinse sanitiser is used)**
- **Allow surfaces and equipment to dry**

Your chemical supplier will advise you on the most suitable detergent and sanitiser, plus the way to apply them.

In a small room the bucket-and-brush technique will be fine.

In a medium sized premises you'll need a low pressure set-up where detergent can be foamed on, and rinsed off.

A high-pressure blast is not suitable – it just spreads contamination.

It's important that equipment and floors are constructed so they dry. If they stay moist, bacteria, especially *Listeria*, will start to grow.

Some do's and don'ts

- **Don't use porous and absorbent items like rags, wooden-handled tools – they harbour bacteria**
- **Use separate brushes for cleaning product and non-product surfaces – colour-coded is good**
- **Sanitise brushes and store them correctly between use**
- **Use low pressure cleaning systems to minimise splashing and aerosols**
- **Store hoses on reels or racks**
- **Clean shelving inside chillers every week and door handles daily**
- **Have a look up at the blowers in the cool room – if they're covered in dust that's bad news for everything underneath. Chillers need regular cleaning and it's easier to schedule that if you manage the room properly (FIFO – first in first out) and having everything on shelves)**
- **Ensure door seals are in good condition – they can harbour *Listeria***
- **Always do a 'pre-op' clean. When you start work, have a good look to see surfaces and equipment are clean and, if they aren't, do a cleandown and sanitise. This will slow you up, so find out why it wasn't done properly the first time around**

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Part 4

HIGH RISK

LOW RISK

Safe Food Handling

Use hygienic handling practices

Now that you are aware of the cleaning procedures required to produce safe food products, it is also important that all staff are following hygienic handling practices, to minimise cross contamination.

In part 2 we highlighted how butchers in Scotland and Wales lost control of their businesses and how one of them, William Tudor was jailed for 12 months, due to the death and illness he caused as a result of dangerous food handling procedures. As a food handler you have certain legal obligations to help protect both you and your customers from potential foodborne illness. It is the Manager's responsibility to ensure that food handlers have the appropriate skills and knowledge for food preparation and serving customers.

No matter how clean your working environment is, if your staff do not follow hygienic practices, there is a high chance that your business could end up in the same situation as William Tudor's.

Cross contamination

is the process of transferring harmful bacteria to food from contaminated food products, hands, surfaces or equipment.

What do we mean by safe food handling?

When we think about safe food handling, there are several areas which are important:

1. Clean equipment and premises (covered in Part 3)
2. Personal hygiene
3. Temperature control (covered in Parts 6 & 7)
4. Preventing cross contamination (covered in Part 8)

These areas are all covered in these Guidelines but in this section we will focus on personal hygiene. Food handlers need to maintain high levels of personal hygiene and ensure they do not directly or indirectly contaminate food during handling/packaging.

The main areas of personal hygiene include:

- **Clothing**
- **Hands**
- **Health**

Part 4

HIGH RISK

LOW RISK

Clothing

- Uniforms (aprons, caps) should be clean and washed daily to avoid the transfer of bacteria from dirty clothing onto an employee's hands and product.
- Aprons should be removed before food handlers leave for a cigerette break, meal or toilet break.
- Hair nets and disposable gloves should be changed as often as necessary (e.g. after leaving the work station, removing rubbish, handling unclean surfaces or machinery, after touching hair, body or sneezing etc.).

Hands

- Cross contamination due to the transfer of bacteria from the food handler to product can occur in many ways, but dirty hands is the main cause.
- Food handlers must wash their hands frequently throughout the day, especially:
  - Before commencing work
  - After a cigerette break, meal or toilet break
  - After coughing or sneezing
- Hands should be washed with a hand sanitiser and warm running water and must be dried thoroughly with a single use towel or in a way that is unlikely to transfer bacteria onto the hands.

Remember:

Safe food handling practices result in safe food products!

Health

If a food handler has…	The food handler will…
One or any of the following symptoms of food borne disease: Diarrhoea Vomiting Sore throat with fever Fever Jaundice	Immediately inform the manager/food safety supervisor; Seek medical attention; and Not return to work until they have been symptom free for 48 hours
Been diagnosed with food borne diseases such as: Hepatitis A Norovirus	Cease all contact with food and food contact surfaces; and Not return to food handling duties until medical clearance is provided.
An exposed wound, cut or infected skin sore.	Cover with a bandage and highly visible water proof covering.
Any discharge from their ears, nose or eyes.	Take medication to stop any nasal or other discharge that may contaminate the food.

So what's on a butcher's hands?

Just because your hands 'look' clean, it doesn't mean that they are clean enough to handle food. It may actually surprise you what a butcher's hands carry. A recent butcher shop survey measured the bacteria on butcher's hands to determine the presence of two key bacteria (*E.coli*, an indicator of faecal contamination and *Staphylococcus aureus*, a common cause of food poisoning).

Bacteria indicating faecal contamination (*E. coli*) were on 18% of the hands tested even before the butchers started work and this doubled, so that by the end of the day 36% of butchers hands were transferring faecal bacteria to everything they touched. Similar results were also found for *Staphylococcus aureus*. This goes to show the importance of regular hand washing, clean clothing and healthy staff.

Food handlers have an overall responsibility for doing whatever is reasonable to make sure that they do not make food unsafe or unsuitable for people to eat.

Part 5

HIGH RISK

LOW RISK

Control of chemicals and allergens

Control of preservatives – sulphite level in fresh sausages

Sulphite has been used as a preservative in sausage manufacture for about two thousand years and is essential to give the product sufficient shelf life.

Sulphite can be used in raw sausages and sausage meat at a concentration up to 500 ppm (sometimes written as 500 mg/kg), but it cannot be used in minced meat.

There are two good reasons for ensuring that you don't put sulphite in minced meat:

1. **Some people are allergic to sulphite – it can cause asthmatic and other respiratory conditions in these customers**
2. **It's illegal and your regulators may take you to court even if only a small amount is detected**

Make sure you have procedures so you prevent inadvertent transfer of even a small amount of sulphite. Many butchers make batches of mince first thing, when the grinder is clean and free of sulphite.

For sausage meat you can validate that 500ppm sulphite is present by:

- **Making a batch size designed to use the whole pack of premix and which has been formulated to give a final product with not more than 500ppm sulphite**

Or

- **Working out how much metabisulphite is needed for a specific batch and weighing the correct amount of premix**

Your calculation is the validation and your controlling authority will check it.

You need to verify that each batch of fresh sausage contains no more than 500 ppm sulphite by noting on the batch sheet that the correct addition has been made.

Remember:

Don't fiddle with ingredients – use them strictly according to the manufacturer's instructions

Part 5

HIGH RISK

LOW RISK

Allergen control

The Allergen Bureau (www.allergenbureau.net) estimates 4-8% of children and 1-2% of adults have a food allergy.

When people eat food containing an allergen to which they are sensitive, symptoms range from mild to severe and affect the:

- **Respiratory tract (wheezing, asthma)**
- **Gut (nausea, vomiting diarrhea)**
- **Skin (hives, eczema, itching)**

By far the most serious condition is anaphylaxis – blood pressure drops, breathing is restricted and the victim goes into shock; some people die of anaphylactic shock.

What can I do to look after my customers?

There is a group of allergens called the Big 8, which cause 90% of all allergic reactions.

Keep a register of all the allergens you have on the premises. Your supplier of premixes can help with this.

Your register can be a simple list like the one below, backed up by information from your ingredient supplier. Then you can answer any questions from concerned customers.

Allergen	Present
Milk and dairy products	Yes/No
Eggs and egg products	Yes/No
Peanuts and peanut products	Yes/No
Tree nuts and their products	Yes/No
Sesame and sesame products	Yes/No
Soy and soy products	Yes/No
Crustaceans	Yes/No
Fish	Yes/No

How can I stop allergens getting in?

Control allergen products by:

1. **Making allergen-free products first thing so equipment is clean**
2. **Washing all equipment, food contact surfaces and utensils between batches**
3. **Labelling each product if it contains an allergen e.g. some marinades contain peanuts (satay sauce)**
4. **Labelling product if it is allergen-free e.g. if you make gluten-free sausages**

You can see that labelling is a key part of controlling allergens and your customers rely on you to tell them whether your products are safe for their special needs.

You also need to:

list products which contain cereals with gluten and their products, sulphite and bee products (Royal jelly).

Labelling

When customers purchase your product, they need to know:

- **If the food is fresh or out of date**
- **If there are allergens**
- **How to store and cook it**
- **Ingredients in the product**
- **How much the product weighs, and its cost**
- **Where it was produced and by which company**

If yours is a small shop and you cut or slice to order it's likely the only label you need will be on the product in retail display.

If you sell pre-packaged meats you must conform with strict regulations.

Check out these websites:

www.measurement.gov.au/TradeMeasurement/Business/Pages/MeatandSeafood

The NSW Food Authority website is very informative:

www.foodauthority.nsw.gov.au/industry/food-business-issues/labelling

www.foodauthority.nsw.gov.au/consumers/food-labels/label-facts

Other state regulators may have useful information on their website so log on and check out what they have to say.

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Part 6

Critical Control Points for raw products in a low risk business

LOW RISK

Low risk hazards

Low risk butchers make the following raw products:

Risk level	Product type	Packaging format	Storage
Low risk	Raw meat in pieces (steaks, chops, roasts)	Plastic bag	Chilled
	Fresh sausages	Plastic bag	Chilled
	Minced meat	Plastic bag	Chilled
	Marinated meat	Plastic bag	Chilled

The process flow diagram (on page 25) shows how these products are manufactured from carcases, carcase trim and cartoned meats.

Process stages are set out in a Hazard Worksheet (refer page 26) for each product type.

Some stages are common to all product types e.g. retail display, over-the-counter sale and overnight storage.

Target bacteria which need controlling in raw products are listed below and more detail is presented in Appendix 1.

Target bacterium	Control in my operation
Salmonella	Chilling to colder than 7°C
E. coli O157	Chilling to colder than 7°C
Staphylococcus aureus	Avoid touching meat with bare hands

Part 6

Critical Control Points (CCPs) in a low risk business

LOW RISK

CCP1 – Temperature control

Validation of key temperatures was done when the Australian Standard (AS 4696) was first developed in the mid-1990s.

It is based on the well-established fact that pathogens reasonably likely to occur on raw meat (*Salmonella, E. coli* and *Staphylococcus aureus*) cannot grow at temperatures colder than 7°C (see Appendix 1 for more information on these target bacteria).

The temperatures listed in the Standard are regulatory requirements. Many HACCP plans include chilled storage of raw meat as a CCP and have 7°C (carcases) and 5°C (pieces of meat) as Critical Limits.

There are times when you may not conform with the regulations:

1. **Carcases are delivered warmer than 7°C on their surfaces**
2. **There's a long power outage**
3. **While you're boning bodies and pieces of meat in the shop**
4. **If you let meat build up in the trim bucket**

Your food safety plan will contain contingencies for when meat is delivered warmer than 7°C – get them straight into the coolroom, in front of the blowers.

If there's an extended loss of power you may have a generator, or a refrigerated vehicle you can load up, or another coolroom which you use.

CCP2 – Allergen control

There's a great deal of information in Part 5 on allergens and labelling. You need to be across this – your customers are relying on you to:

- **Have good procedures to control allergens**
- **Label products correctly**
- **Provide advice if they have any doubts**

You can reduce risk by doing allergen-free products first thing, when all your equipment is clean.

- **Grind minced meat first up so there's no carry-over of sulphite from sausage meat**
- **Label your marinades properly - satay will contain peanuts and maybe soy**
- **Tell customers if you put dairy or cereal products in your value-added meats**

CCP3 – Grinding / chopping

If you hear a 'ping' from the mincer it tells you a piece of metal is floating around.

Or, when you dismantle the grinder for cleaning you may find a piece has broken off, it means metal is in the product.

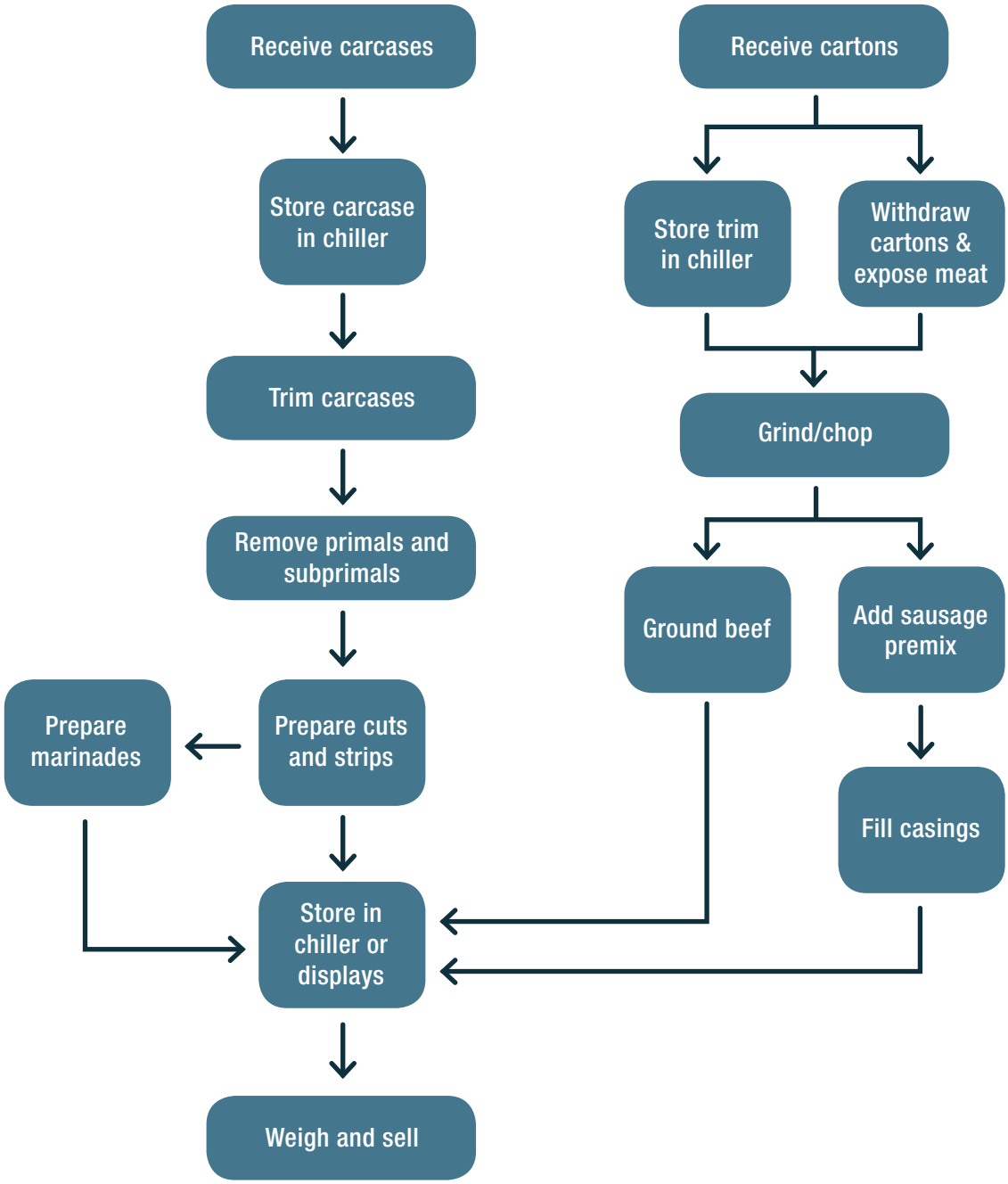
You will need to discard that batch.

When you're boning bodies you need to use common sense:

- **Bone carcases early in the day when it's cooler and this minimises the temperature rise**
- **Bone body-by-body so the time meat is out of the chiller is minimised**
- **Have a small trim bucket and empty it into a large tub in the chiller every 30 minutes**

Part 6

Process flow diagram: raw meats and meat products



LOW RISK

Part 6

Hazard Worksheet: raw meat receival, processing and storage

LOW RISK

Process step	Hazard	What can go wrong	Hazard control
Step 1: ***Receival of carcases and boxed meats***	BIOLOGICAL	Carcase surface warmer than 7°C, boxed meat warmer than 5°C Growth of target bacteria possible	Place meat under refrigeration as soon as possible
	CHEMICAL	No increase in hazard	
	PHYSICAL	No increase in hazard	
Step 2: ***Chill storage*** ***CCP 1***	BIOLOGICAL	Target bacteria grow Target bacteria cross contaminated to cured and cooked products	Prevent growth of target bacteria by maintaining product temperature carcases no warmer than 7°C and pieces of meat no warmer than 5°C Segregate raw and RTE meats Staff wash hands after loading in carcases and before handling cooked, cured meats
	CHEMICAL	No increase in hazard	
	PHYSICAL	No increase in hazard	
Step 3: ***Trim carcase and bone into meat pieces***	BIOLOGICAL	Target bacteria grow	Minimise growth of target bacteria by having carcases out of the chiller for as short a time as possible. Limit time trim bucket out of chiller to 30 minutes
	CHEMICAL	No increase in hazard	
	PHYSICAL	No increase in hazard	
Step 4: ***Store trim in chiller***	BIOLOGICAL	Target bacteria grow	Chiller temperature minimises bacterial growth of trim
	CHEMICAL	No increase in hazard	
	PHYSICAL	No increase in hazard	
Step 5: ***Prepare meat cuts***	BIOLOGICAL	Target bacteria grow	Minimise growth of target bacteria by having primals and subprimals out of refrigeration only while they are being processed
	CHEMICAL	No increase in hazard	
	PHYSICAL	No increase in hazard	
Step 6: ***Retail display*** ***CCP 1***	BIOLOGICAL	Target bacteria grow	Prevent growth of target bacteria by maintaining product temperature no warmer than 5°C
	CHEMICAL	No increase in hazard	
	PHYSICAL	No increase in hazard	
Step 7: ***Weighing***	BIOLOGICAL	Transfer of bacteria from hands of sales staff	Use gloved hand or bag turned inside out to prevent hand-product contact
	CHEMICAL	No increase in hazard	
	PHYSICAL	No increase in hazard	
Step 8: ***Overnight chill storage*** ***CCP 1***	BIOLOGICAL	Target bacteria grow	Prevent growth of target bacteria by maintaining product temperature no warmer than 5°C
	CHEMICAL	No increase in hazard	
	PHYSICAL	No increase in hazard	

HACCP chart: raw meat receival, processing and storage

Critical Operation	Hazard	Critical Limits of the Control Measures	Monitoring				Corrective Action	Records	Verification
			What	How		Who			
Chill storage and retail display **CCP 1**	Growth of target bacteria	Carcase surfaces no warmer than 7°C. Pieces of meat no warmer than 5°C	Product	Measure surface temperature Probe core	Every day	Operator	If carcases >7°C, or if meat pieces >5°C, place before blowers to obtain rapid chill If chiller or retail display cannot maintain product temperatures below 5°C arrange for alternate storage	Form 1	Weekly check of records. Monthly calibration of temperature gauges (Form X)

LOW RISK

Hazard Worksheet: minced meat production

Process step	Hazard	What can go wrong	Hazard control
Step 1: ***Remove trim from chiller***	BIOLOGICAL	Target bacteria are *Salmonella* and *E. coli*	Minimise temperature rise by limiting time trim is out of chiller
	CHEMICAL	No increase in hazard	
	PHYSICAL	No increase in hazard	
Step 2: ***Grinding*** **CCP 2**	BIOLOGICAL	No increase in hazard	
	CHEMICAL	Sulphite cross contaminated from trim in auger of grinder	Grind minced meat first thing, before grinding for sausage meat.
	PHYSICAL	Grinder loses metal fragments	If 'ping' heard during grinding, or blades have lost metal, discard batch
Step 3: ***Accumulate in plastic tub and store in chiller***	BIOLOGICAL	No increase in hazard	
	CHEMICAL	No increase in hazard	
	PHYSICAL	No increase in hazard	
Step 4: ***Retail display*** **CCP 1**	BIOLOGICAL	Growth of target bacteria	Prevent growth of target bacteria by maintaining product temperature no warmer than 5°C
	CHEMICAL	No increase in hazard	
	PHYSICAL	No increase in hazard	

Part 6

LOW RISK

HACCP chart: minced meat production

Critical Operation	Hazard	Critical Limits of the Control Measures	Monitoring				Corrective Action	Records	Verification
			What	How	When	Who			
Chill storage and retail display **CCP 1**	Growth of target bacteria	Product temperature no warmer than 5°C	Product	Probe core	Every day	Operator	If chiller or retail display cannot maintain product temperatures below 5°C, arrange alternative storage	Form 1	Check all records weekly Calibrate gauges monthly (Form X)
Allergen control **CCP 2**	Sulphite in meat still in grinder	No sulphite allowed in minced meat	Product	Work instruction to prepare all minced meat first up, through clean grinder	Every batch of minced meat	Operator	Do not sell meat as minced meat Rework as product which can have sulphite	Form 1	Check all records weekly
Grinding **CCP 3**	Metal lost from mincer	No metal allowed in minced meat	Product	Observe moving parts of grinder at clean-down	Every batch of minced meat	Operator	Discard meat suspected of containing metal fragments	Form 1	Check all records weekly

Hazard Worksheet: value-added meat production

Process step	Hazard	What can go wrong	Hazard control
Step 1: Preparation of marinades and addition of ingredients **CCP 2**	BIOLOGICAL	*None*	
	CHEMICAL Allergens	Vulnerable customer eats product containing an allergen	Ensure displayed product is labelled so that customer is made aware Make allergen-free products first-up to prevent cross contamination
	PHYSICAL	No increase in hazard	
Step 2: Retail display **CCP 1**	BIOLOGICAL	Target bacteria grow	Prevent growth of target bacteria by maintaining product temperature no warmer than 5°C
	CHEMICAL	No increase in hazard	
	PHYSICAL	No increase in hazard	

HACCP chart: value-added meat production

Critical Operation	Hazard	Critical Limits of the Control Measures	Monitoring				Corrective Action	Records	Verification
			What	How	When	Who			
Chill storage and retail display ***CCP 1***	Growth of target bacteria	Product temperature no warmer than 5°C	Product	Probe core	Every day	Operator	If chiller or retail display cannot maintain product temperatures below 5°C, arrange alternate storage	Form 1	Check all records weekly. Calibrate gauges monthly (Form X)
Marinades and ingredients ***CCP 2***	Allergic customer purchases product	Every marinated product labelled as to contents	Display container	Ticket	Preparation of every container	Operator	Unlabelled product withdrawn from sale until identity confirmed and label fixed	Label	We maintain a list of allergens present in each of our marinades

LOW RISK

Part 6

Hazard worksheet: fresh sausage manufacture

LOW RISK

Process step	Hazard	What can go wrong	Hazard control
Step 1: Unpacking cartoned meats	BIOLOGICAL	Growth of target bacteria such as *Salmonella* and pathogenic *E. coli*	Control temperature/time of meat during processing to minimise multiplication of pathogens
	CHEMICAL	No increase in hazard	
	PHYSICAL	Polyentrapment	Care when removing film from liner
Step 2: Trimming	BIOLOGICAL	No increase in hazard	
	CHEMICAL	No increase in hazard	
	PHYSICAL	No increase in hazard	
Step 3: Ingredient addition	BIOLOGICAL	No increase in hazard	
CCP 2	CHEMICAL	Sulphite a hazard to asthmatics	Sulphite concentration 500 mg/kg
Step 3: Chipping, mincing, bowl chopping ***CCP 3***	PHYSICAL	Machinery loses fragments of metal	Controlled at metal detector where available or by taking precautions as detailed in GMPs section
Step 4: Filling	BIOLOGICAL	No increase in hazard	
	CHEMICAL	No increase in hazard	
	PHYSICAL	No increase in hazard	
Step 5: Metal detection	BIOLOGICAL	No increase in hazard	
	CHEMICAL	No increase in hazard	
	PHYSICAL	No increase in hazard	Control point for metal
Step 6: Retail display	BIOLOGICAL	Target bacteria grow	Prevent growth of target bacteria by maintaining product temperature no warmer than 5°C
CCP 1	CHEMICAL	No increase in hazard	
	PHYSICAL	No increase in hazard	

Typical HACCP chart: fresh sausage manufacture

Critical Operation	Hazard	Critical Limits of the Control Measures	Monitoring				Corrective Action	Records	Verification
			What	How	When	Who			
Storage **CCP 1**	Pathogens	Product temperature no warmer than 5°C	Product	Chiller gauge	Every batch	Operator	If retail display cannot maintain temperatures below 5°C arrange for alternate storage	Chiller log	Weekly check of records. Weekly calibration of temperature gauges (Form X)
Ingredient addition **CCP 2**	Sulphite level	Premix added so that sulpite content is no more than 500mg/kg	Every batch	All premix pack added	Every batch	Operator	Rework batch so sulphite level no more than 500mg/kg	Batch sheet	Weekly check of records
Bowl chopping, grinding **CCP 3**	Metal lost during chopping/ grinding	No metal allowed in comminuted product	Product	Observe moving parts of grinder at clean-down	Every batch of minced meat	Operator	Discard meat suspected of containing metal fragments	Form 1	Check all records weekly.

LOW RISK

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Part 7

HIGH RISK

Controlling hazards in a high risk business

Ready-to-eat meats

Ready-to-eat (RTE) meats are high-risk and a typical product line for cured and cooked meats is:

Risk level	Product type	Packaging format	Storage
High risk	Cooked cured muscle meats	Plastic bag, vacuum pack to order	Chilled
	Cooked sausages	Plastic bag	Chilled

If you ferment meat (UCFM), dry it (jerky) or make pâté you'll find detailed information in the *Guidelines for Safe Manufacture of Smallgoods* (available from MLA).

The process flow diagram on page 36 shows how these cured, cooked meats are manufactured from carcases and from trim in cartons.

Process stages are set out in the Hazard Worksheets for each product type on page 37.

Target bacteria which need to be controlled in raw and RTE products are listed below, and more detail is presented in Appendix 1.

Target bacterium	Control in my operation
Salmonella, pathogenic *E. coli, L. monocytogenes*	Cook according to AS 4696:2007.
All target bacteria	Maintain chilled at no warmer than 5°C through storage and retail display. Avoid touching meat with bare hands.
Clostridium botulinum	Add nitrite to give 125 ppm in finished product.
Clostridium perfringens	Cool according to AS 4696:2007.

Part 7

HIGH RISK

Critical Control Points (CCPs) in a high risk business

CCP1 – Temperature control

All the controls for raw meat receival, boning and storage are covered in *Part 6: Critical Control Points in a low risk business for raw products* so, in this section, we'll cover brine manufacture and use.

Fresh brine should be used for every batch, chilled water used to make it, and it should be kept chilled (in Appendix 2 we cover brine manufacture and its use in great detail).

CCP2 – Nitrite control

Curing solutions used for injection should not be recycled after the first day of use or between batches.

Solutions used for injection (pumping) curing or immersion (soaking) curing should be monitored for saline and nitrite concentration.

Brine injector machines and immersion curing equipment should be cleaned and sanitised regularly.

Check uptake of brine by weighing pieces of meat before and after injection.

Nitrite level is important because it:

- **Prevents spores of *C. botulinum* from germinating during cooling**
- **Is toxic to consumers**

Because of its toxicity the permissible level is 125 ppm in the final product.

Monitoring of nitrite levels in your products is achieved exactly as set out for ensuring sulphite levels are not exceeded, and you record its addition on each batch sheet of cured products.

Proprietary brands of curing chemicals in sachets give the correct quantity of nitrite for the batch size, so under or over added of nitrite can be avoided.

CCP3 – Cooking

The Australian Standard gives you two options for cooking:

- **Maintain the site of microbiological concern at 65°C for at least 10 minutes**

OR

- **Maintain the site of microbiological concern at an alternative time and temperature which achieves the same result as 65°C/10 minutes.**

The site of microbiological concern is that part of the meat where target bacteria will be most difficult to kill.

If you inject meat, that site is the slowest heating point within the product. If you don't inject, it's the surface.

The aim of cooking is to reduce the level of target bacteria and spoilage bacteria so the product is safe for all its shelf life.

The target bacterium in cooking is *L. monocytogenes* and your process must be designed so that, if 1,000,000 were present at the site of microbiological concern, cooking would reduce the population to less than one. This is called a 6-D process and times and temperatures to deliver this for *L. monocytogenes* are listed below (Appendix 1 has more information on this dangerous bacterium).

Holding times at product core temperatures required to deliver 6 log reductions in *Listeria monoctyogenes* counts:

Temperature (°C)	Time (min)
55	200
56	146
57	108
58	79
59	58
60	44
61	33
62	24
63	18
64	13
65	10
66	7
67	6
68	4
69	3
70-72	2
73-75	1
76 or warmer	<1

You can validate your process by inserting a probe at the slowest heating point of the largest piece of meat and putting that piece at the slowest heating part of your smoker oven or water bath.

How do you know which is the slowest heating point?

Put the probe in cuts of meat in different parts of the oven and record the time it takes for your target cooking time e.g. 65°C to be reached. The longest time is the slowest heating point.

Keep all your results to show your controlling authority.

You need to monitor every batch by putting the probe in the largest cut, in the slowest heating point of the oven.

CCP4 – Cooling

The Australian Standard (AS 4696:2007) provides details of a 2-stage cooling process for cured and for uncured cooked meats.

		Maximum time (hours)	
	Temperature	Uncured products	Cured products
Stage 1	52°C to 12°C	6	7.5
Stage 2	12°C to 5°C	Within 24 hours of completion of cooking	

The aim of cooling is to prevent growth of the target bacterium *Clostridium perfringens*.

Full details of what makes this bacterium tick are in Appendix 1, but most important is that it grows in the absence of oxygen and grows rapidly as meat cools from 48° to about 35°C.

So the slowest cooling points of large cuts are vulnerable, which is why the regulation is aimed at getting products through this danger zone quickly.

Some businesses find the cooling standard is difficult to achieve for large products e.g. Mortadella or Christmas leg hams.

For large cuts you'll need to do some or all of the following:

- **Shower them with cold water**
- **Hold them in ice water (and replenish the ice as needed – make sure potable water is used for ice slurry)**
- **Hang them in front of the blowers in the chiller**

Part 7

HIGH RISK

You can validate your cooling process by:

1. **Inserting a probe into the site of microbiological concern (slowest cooling point) and checking the temperature after 6 hours cooling for cured meats or 7.5 hours for uncured. Record the temperature so you can show your controlling authority.**

2. **Probing meats 24 hours after you stopped cooking and recording the temperature**

This will tell you if your process is a valid one – that is, does it conform with AS 4696:2007.

Don't forget that you need to revalidate annually or if you change your cooling process.

For most products, monitoring is straightforward and just means putting product into the chiller and making sure the chiller temperature at the gauge is normal.

Raw and RTE meats are separated in the chiller and on display.

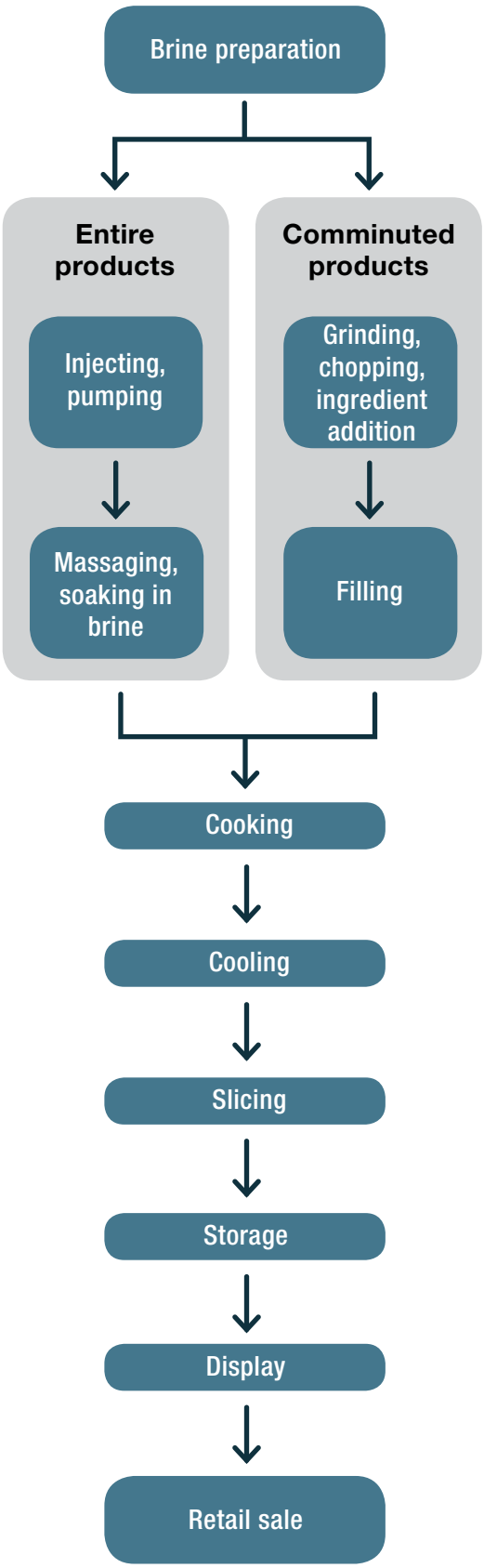
CCP5 – Allergen control

Allergens are covered in Part 5: Control of chemicals and allergens.

CCP6 – Grinding/chopping

Grinding/bowl chopping may introduce metal into the product. Read more about this CCP on page 24.

Process flow diagram: cured and cooked meats



HIGH RISK

Hazard Worksheet: Curing and cooking meat products

Process step	Hazard	What can go wrong	Hazard control
Step 1: ***Brine preparation, curing and injection*** **CCP 2** **CCP 5**	BIOLOGICAL	Insufficient nitrite may allow growth of target bacteria	Use correct weight of premix – ideally this involves using whole pack for a single batch
	CHEMICAL	Too much nitrite can cause illness in consumers	Use correct weight of premix – ideally this involves using whole pack for a single batch
	CHEMICAL	Allergens added inadvertently	Ensure correct premix used for allergen-free product Ensure allergen-free product manufactured only with clean utensils, equipment and benches
	PHYSICAL	Injector needle breaks	Find and remove all metal or dump affected product
Step 2: ***Bowl chopping, grinding*** **CCP 6**	BIOLOGICAL	No increase in hazard	
	CHEMICAL	No increase in hazard	
	PHYSICAL	Grinder, chopper loses metal	Stop production and dump affected product unless all the metal can be removed
Step 3: ***Filling into casing***	BIOLOGICAL	No increase in hazard	
	CHEMICAL	No increase in hazard	
	PHYSICAL	No increase in hazard	
Step 4: ***Cooking*** **CCP 3**	BIOLOGICAL	Undercooking can allow survival of target bacteria	Check that centre temperature reaches 65°C for 10 min or an equivalent process
	CHEMICAL	No increase in hazard	
	PHYSICAL	No increase in hazard	
Step 5: ***Cooling*** **CCP 4**	BIOLOGICAL	Growth of surviving spores of *Clostridium perfringens*	Cool product according to Australian Standard 4696:2007
	CHEMICAL	No increase in hazard	
	PHYSICAL	No increase in hazard	
Step 6: ***Slicing***	BIOLOGICAL	Contamination with pathogens, especially *Listeria*	Implement series of GMPs (see Appendix 3)
	CHEMICAL	No increase in hazard	
	PHYSICAL	No increase in hazard	
Step 7: ***Storage and distribution*** **CCP 1**	BIOLOGICAL	Loss of refrigeration – target bacteria grow	Finished products stored no warmer than 5°C
	CHEMICAL	No increase in hazard	
	PHYSICAL	No increase in hazard	

Part 7

HIGH RISK

HACCP chart: curing and cooking of meat products

Critical Operation	Hazard	Critical Limits of the Control Measures	Monitoring				Corrective Action	Records	Verification
			What	How	When	Who			
Storage, distribution **CCP 1**	Target bacteria may grow	Product no warmer than 5°C	Product	Probe cuts of meat	Every batch	Operator	If refrigeration malfunctions move to alternate storage.	Chiller or vehicle gauge	Calibrate room gauge monthly (Form X)
Bowl chopping, grinding **CCP 6**	Metal lost during chopping/ grinding	No metal allowed in comminuted product	Product	Observe moving parts of grinder at clean down	Every batch of minced meat	Operator	Discard meat suspected of containing metal fragments	Form 1	Weekly check of records
Allergens **CCP 5**	Allergic reactions in susceptible consumers	No allergen	Brine	Correct premix	Every batch	Operator	If allergen added inadvertently relabel so that consumer aware product is not allergen-free	Batch sheet	Weekly check of records
Curing **CCP 2**	Spores of target bacteria	Nitrite not more than 125mg/kg in finished product	Brine	Correct amount of premix	Every batch	Operator	Replace brine with correct concentration	Batch sheet	Weekly check of records
	Toxic levels of nitrite		Brine	Correct amount of premix	Every batch	Operator	Discard product if received too much nitrite	Batch sheet	Weekly check of records
Cooking **CCP 3**	Pathogens may survive	Slowest heating point >65°C for 10 min or approved arrangement	Product	Thermometer	Every batch	Operator	If loss of power reprocess	Batch sheet	Weekly check of records Calibrate the thermometer monthly
Cooling **CCP 4**	Spores can germinate and grow if cooling is slow	Cool 52° to 12°C within 7.5 hours and then to 5°C within 24 hours from end of cooking	Product	Thermometer	Every batch	Operator	If refrigeration likely to be lost for more than a few hours contingencies include hiring a generator or moving product to a back-up premises	Batch sheet	Weekly check of records Calibrate the thermometer monthly

Part 8

HIGH RISK

Preventing cross contamination of RTE meats

Now for the hard part

So you've done everything right – brine made up, meat pumped and cooked to give a '*Listeria* cook'(65°C/10 min or equivalent).

Now for the hard part – stopping *Listeria* getting back onto your product.

Let's recap on what smallgoods manufacturers do to prevent *Listeria* getting into final products:

- **Raw and cooked areas are completely separate**
- **Staff from each area have different amenities, different colour uniforms and keep to their own section**
- **They re-enter through an airlock, put on their uniforms, boots, hats and wash hands**
- **Slicing and packing rooms have filtered air and positive air pressure**
- **Slicing and packing rooms link with the despatch through a tiny hatch**

Even with all these precautions *Listeria* sometimes gets into the product, which then has to be recalled.

You'll see from Appendix 1 that *Listeria* is the bug from hell for RTE meats because it:

- **Grows in the fridge – every week's storage leads to a 10-fold increase in numbers**
- **Tolerates salt – so it grows on cured meats**
- **Grows in vacuum packs**
- **Targets vulnerable people and kills 20-30% of those who become infected**

Vulnerable consumers

There are four groups of your customers who are especially vulnerable to *Listeria* and other target bacteria which may get into your RTE meats: very old people, children, pregnant women, people whose immune systems are down.

Taken together these people represent more than 20% of your customers.

Even very low numbers of target bacteria in your RTE meats can make them seriously ill.

You may service large numbers of vulnerable consumers if you have contracts with:

- **Meals-on-wheels**
- **Local aged care facility**
- **Local hospital**
- **Local school**

So you need to do your best to prevent it getting into your final products as you slice and vacuum pack.

Part 8

HIGH RISK

Reducing the risk

Here are some ways butchers reduce the risk of cross contaminating final products:

Slice and vacuum pack once a week when no raw meat is in the room

Some butchers cook on Saturday afternoon, cool over the weekend and pack early on Monday.

Clean the room and equipment

Clean the room on Saturday afternoon, take out the nylon panels from the vacuum packer and clean/sanitise them, plus the chamber of the vacuum packer.

Clean clothing

When you're ready to slice put on a clean white coat, glove up and slice onto a clean sheet of paper. Get your mate to weigh, bag and vacuum pack product.

Spray all working surfaces with antimicrobial

Before start-up when you slice and pack, spray the surface of the scales, bench, vacuum packer and slicer blade with food-grade, no-rinse detergent. Remove any excess with a paper towel.

Spray the outside of each product with antimicrobial

Your ingredient supplier can advise on these antimicrobials and their suitability.

It's a constant battle to control *Listeria* and your shop is wide open to contamination from raw meat and the environment as customers enter and when you load product in the rear entrance.

Listeria must be a main focus, otherwise you'll keep being pinged under the Regulatory guidelines for the control of *Listeria*.

You'll also build up risk for your customers.

There's lots of information in the MLA booklets:

1. *Guidelines for the safe menufacture of smallgoods*
2. *Listeria monocytogenes in smallgoods: risks and controls*
3. *How to comply with regulatory guidelines for the control of Listeria by meat retailers: advice on how to set up a testing program*

For more information on these resources go to:
http://www.mla.com.au/Publications-tools-and-events

Appendix 1

Target bacteria and how to control them

What are target bacteria?

Target bacteria are those that cause illness among consumers of meat products and they are called pathogenic bacteria. Pathogens make us ill in two ways by:

- Producing a toxin (poison) which they release into the meat, causing illness usually between 2-6 hours after consumption.

OR

- Breeding within our gut. It usually takes between 24 and 48 hours for these bacteria to grow enough numbers to cause illness.

The pathogens you need to control are:

- *Salmonella*
- Pathogenic *E. coli*
- *Staphylococcus aureus*
- *Listeria monocytogenes*
- *Clostridium botulinum*
- *Clostridium perfringens*
- *Campylobacter*

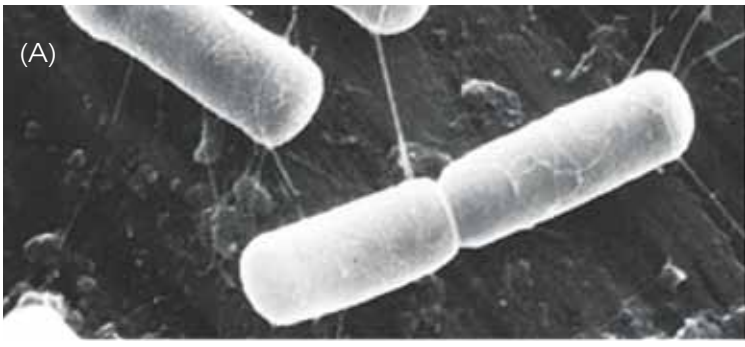
Bacteria can exist in two forms – vegetative cells and spores. Vegetative cells tend to be easily killed by heat but spores are resistant to heat and chemicals. *Clostridium botulinum* and *Clostridium perfringens* form spores and they present special problems, which we'll cover in this section.

All the target bacteria are found on raw meat, though at very low levels.

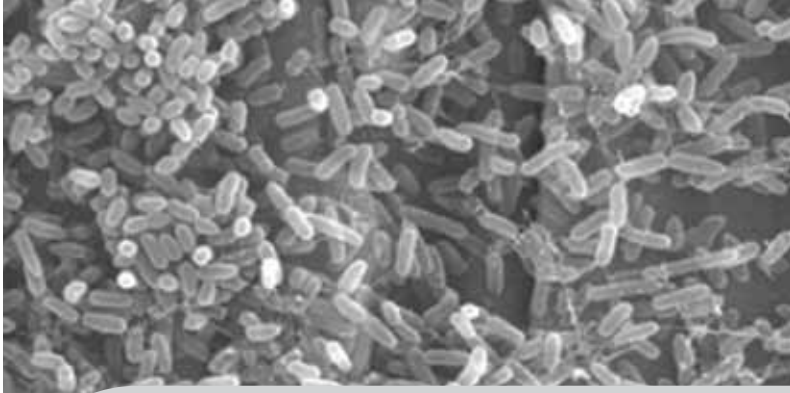
Pathogens are present in some of the raw materials you receive. In this section we'll build up a fact file on each of these important pathogens and their likes and dislikes. We'll also identify how you can control each bacterium in different meats, including cured and cooked products.

The problem

Bacteria are microscopic – if you lined them up in a queue you'd get about 1 million of them in a metre. This allows them to get into small crevices on working surfaces (A) and on meat (B).



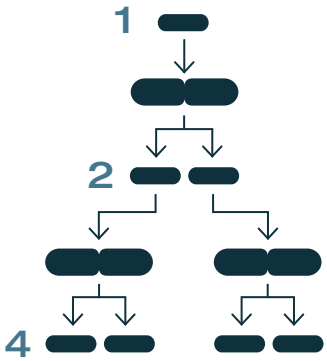
Appendix 1



The result of bacterial growth – the meat surface is overgrown and the population will be more than 10 million/cm^2 of the meat's surface

Bacteria growth

They may be small but they punch well above their weight because of the way they grow. They simply divide into two, and you can see some of them doing this in the previous images, on page 41.

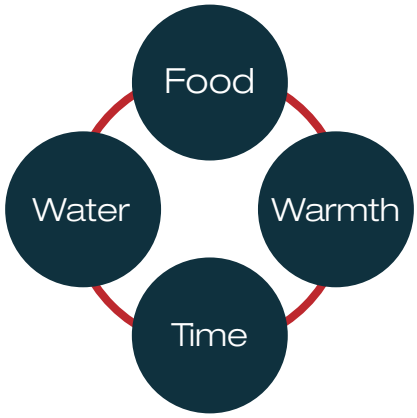


As you can see, this doubles the population and, given good conditions, one bacterium will multiply to 1,000,000 in less than 7 hours. As you can see, they completely overgrow the surface of the meat, generate off odours and make the meat slimy.

Simple division is a streamlined way of doubling the population. If conditions are good one bacterium will grow to more than 1 million in about 7 hours.

What do bacteria need?

If bacteria have four factors (food, water, warmth and time) they'll grow quickly to big populations.



Meat is a nutritious food for bacteria – it contains protein, vitamins and other growth factors – and it's more than 70% moisture, so it's an excellent food for bacteria.

Temperature is a major control for bacteria and, in the meat industry two groups are important depending on where they can grow.

	Growth range	Fastest growth	Target bacteria
Psychrotrophs	-5 to 20°C	12 to 15°C	*Listeria*
Mesophiles	7 to 45°C	25 to 37°C	*Salmonella* *E. coli* *Staphylococcus* *Clostridium*

Appendix 1

Depending on the temperature of the meat, the time required to double the population varies. For example, if the temperature is around 30°C, *Salmonella* will double in about 20 minutes; at 10°C it will take 8 hours to double and at 7°C it won't grow.

Controlling bacteria in your operation

The basis of most controls is simple - just take away whatever bacteria need in order to grow. You're in the meat business, so you can't deny them their food. The other three factors are within your control and you use them widely in your everyday operations.

Temperature

In your business you probably use four temperature zones to control target bacteria:

- Freezing stops all growth because most of the water is converted to ice crystals.
- Chilling cooler than 7°C stops those target bacteria which are mesophiles, but not *Listeria* which can grow steadily at chill temperatures.
- Cooking at 65°C for 10 minutes kills all target bacteria, but not spores of *Clostridium*.
- Cooling cooked meats rapidly through the Danger Zone (35-45°C) prevents spores germinating and increasing the population.

Water

Curing has been used for thousands of years and involves adding salt or sugar to make a brine. In brine, the water is 'tied-up' by the salt and is not available to the bacteria. There is a technical term called 'water activity (a_w)' which describes how much water is tied up. Pure water has an a_w = 1.0 while cured meats like ham and bacon have an a_w =<0.95.

This is important because a_w =<0.95 is the cut-off point for growth of target bacteria such as *Salmonella* and *E. coli.*

Ingredients

Other controls which you use involve addition of chemicals which prevent bacterial growth. Adding sulphite to sausage meat slows down the growth of spoilage bacteria and gives you and your customers sufficient shelf life

Nitrite in ham and bacon prevents *Clostridium* spores from germinating.

If you use liquid smoke or smoke generated from wood you're also using chemicals which help to stop target bacteria from growing.

Vacuum packing

When you remove air from a pack by drawing a vacuum you're taking away the oxygen which spoilage bacteria need in order to grow. So vacuum packing improves shelf-life, but it has no effect on *L. monocytogenes*, which can grow in vacuum packs at chill temperatures.

Time

Ageing carcases and vacuum packed primals in the chiller can improve their eating quality but *L. monocytogenes* grows steadily in the chiller. In fact, your chiller may be a permanent source of *Listeria* – growing in the door handle, door seals, refrigeration drip tray.

Appendix 1

Salmonella

Salmonella is named after Dr Salmon who first isolated it around 1880. There are several thousand types of *Salmonella*, most of which cause illness in humans. Some types cause mild gastroenteritis while others cause fevers which can be fatal, such as typhoid fever (this is caused by *S. typhi*).

Salmonella is normally found in the gut of animals and birds and is therefore found on raw meat and poultry.

It is only found rarely on Australian meat, as can be seen from recent baseline surveys of chilled carcases, frozen boneless beef and retail meats.

	Positive samples/total number of samples (percentage positive)
Beef primals	0/1144
Boneless beef	1/1082 (0.1%)
Lamb carcases	0/1117
Boneless sheep meat	17/551 (3.1%)
Ground beef	4/360 (1.1%)
Diced lamb	2/360 (0.6%)

By contrast, a survey of retail chicken purchased from butcher shops and supermarkets found 36% were contaminated in Adelaide and 48% in Sydney.

Although *Salmonella* is only rarely found on Australian meat, if its growth isn't controlled it can cause large problems as shown below.

1981	Victoria	Salami	>300 ill
1993	South Australia	Salami	>100 ill
1997	Victoria	Cooked meats	>900 ill, 3 dead

Problems in salami should be overcome if starter cultures are used and the fermentation and maturation occur properly.

The Victorian problem from cooked meat was thought to be due to poor separation of raw and cooked meats, so that *Salmonella* was able to cross contaminate final product.

We have a special section on how butchers prevent cross contamination (Part 2).

Risk rating for HACCP plans

	Severity	Likelihood	Risk rating
Raw meat	Moderate	Low	Low
Raw poultry	Moderate	High	Moderate

Infectious dose

How much *Salmonella* is needed to cause illness? Early studies indicated at least 100,000 were needed to cause gastroenteritis in healthy adults. More recently, as few as 100 organisms caused illness when eaten in high-fat foods because the fat protects bacteria as they pass through the acidity of the stomach. Smallgoods like salamis have a high fat content and the bacteria may survive passage through the stomach.

Growth of *Salmonella*

Salmonella grows over a wide range of environmental conditions commonly found in the meat and smallgoods industries. These conditions include temperature, pH and water activity.

You can see how chilling, curing and fermenting all prevent it growing.

Conditions	Minimum	Fastest growth
Temperature (°C)	7	35-43
pH	3.8	7-7.5
a_w	0.94	0.99

Killing of *Salmonella*

Salmonella is susceptible to heat and at 65°C they die very quickly. For example, suppose a Strasbourg has a count of 1 million/g before cooking. After bringing the temperature of the sausage to 65°C and holding for one minute, less than one *Salmonella* would survive. This shows the effectiveness of the cooking process as a CCP.

Appendix 1

Pathogenic *Escherichia coli*

Escherichia coli is named after Dr Escherich who first isolated it in 1885. Generic *E. coli* grows in the gut of all warm-blooded animals and large numbers are excreted in the faeces. One gram of our faeces may contain 10 million *E. coli* – fortunately they have no effect on our wellbeing.

However, there are also pathogenic types of *E. coli* and they cause severe food poisoning. The most important types are called Enterohaemorrhagic *E. coli* (EHEC).

Fortunately, it is found only rarely on Australia meat, as can be seen from recent baseline surveys of chilled carcases, frozen boneless beef and retail meats.

	Positive samples/total number of samples (percentage positive)
Beef carcases	1/1155 (0.1%)
Boneless beef	0/1082
Lamb carcases	6/1117 (0.6%)
Boneless sheep meat	1/557 (0.2%)
Ground beef	1/357 (0.3%)

Pathogenic *E. coli* in mettwurst caused a major incident in South Australia in 1995 when around 150 people became ill. For 22 people the illness was very severe and one child died. Many of those who survived have life-long complications from the infection.

Risk rating for HACCP plans

	Severity	Likelihood	Risk rating
Raw meat	High	Low	Moderate
Raw poultry	High	Low	Moderate

Infectious dose for pathogenic *E. coli*

The infectious dose for healthy adults is probably in the thousands of cells. The symptoms are usually gastroenteritis which clears up in a few days. However, for those who are at risk, like the very young and very old, the infectious dose can be low, maybe less than 100 cells.

Illnesses caused by pathogenic *E. coli*

There are three types of illnesses where the bacterium:

- Invades the gut and causes bloody diarrhoea (this is Haemolytic Colitis or HC)
- Makes toxins which cause kidney failure (this is called Haemolytic Uraemic Syndrome or HUS)
- Causes blood clots which may lead to brain damage (this is called Thromobocytic Thromobocytopaenic Purpura or TTP)

Growth and death of EHEC

EHEC grow in similar conditions as *Salmonella* and are vulnerable to heat, and cooking at 65°C is very effective in eliminating them.

Relevance for smallgoods manufacture

Because it's a contaminant on raw meat, it is a target organism for all smallgoods processes.

The fermentation process has the most problems in making sure the pathogen is inactivated.

There are several stages in the process which are critical, like adding salt to prevent *E. coli* growth, plus fermentation and maturation for making the bacteria inactive.

However, pathogenic *E. coli* have resistance to acidity and the maturation period for salami is vital for making sure that the bacterium is destroyed. As well, the high fat content of salamis may protect the bacterium in the acid conditions of the stomach.

If you make fermented meats you can read more about *E. coli* in *Guidelines for the Safe Manufacture of Smallgoods.*

Appendix 1

Listeria monocytogenes

Listeria has been known for over 70 years as a pathogen of small animals. It was named after Lord Lister who pioneered antiseptic surgery – methods for preventing wounds becoming infected during surgical operations. During the 1980s it became known as a food-borne pathogen. The pathogenic species is *Listeria monocytogenes*.

Listeria monocytogenes has caused a number of serious outbreaks of food poisoning from smallgoods in several countries around the world and in Australia.

1990	Western Australia	Pâté	11 ill, 6 deaths
1992	France	Pork tongues	279 ill, 63 deaths
1998-99	USA	Hot dogs, deli meats	101 ill, 15 deaths
2000-01	USA	Frankfurters	>29 ill, >4 deaths
2005	South Australia	Corned beef	3 deaths

The infective dose and illness

For most people, more than 100,000 *Listeria* must be eaten before they become ill and the illness is usually a 2-4 day bout of gastroenteritis.

For other consumers, fewer than 1,000 organisms can make them ill. These consumers are elderly people, pregnant women and their foetus or new-born baby, plus people whose immune system is low or compromised e.g. because they are on a course of antibiotics or cancer treatment, or because their liver is damaged.

Illness starts as flu-like symptoms and progresses to meningitis or septicaemia (blood poisoning), when death occurs in 20-30% of cases.

Risk management

Regulators have set a 'zero-tolerance' for *L. monocytogenes* in ready-to-eat foods because of the low infectious dose for susceptible consumers. Unfortunately zero tolerance is very difficult to achieve in practice. *Listeria* is a robust organism which lives in food premises and also grows steadily in refrigerated foods.

Risk rating for HACCP plans

	Severity	Likelihood	Risk rating 'normal' customers	Risk rating 'vulnerable' customers
Cooked meat	High	Low	Low	High
Cooked poultry	High	Low	Low	High

Growth of *L. monocytogenes*

L. monocytogenes grows over a wide range of environmental conditions commonly found in the meat industry. It can grow in refrigeration and will increase its population 10-fold in a week, it is salt tolerant and can grow in vacuum packs.

Conditions	Minimum	Fastest growth
Temperature (°C)	0	37
pH	4.4	7
a_w	0.92	0.99

Killing *L. monocytogenes*

The organism is not very heat resistant. Temperatures at 65°C for 10 minutes or 75°C for 30 seconds will kill populations as high as one million in every gram of product.

Relevance for smallgoods manufacture

You should read the booklet *Listeria monocytogenes in smallgoods: risks and controls*, plus, if you vacuum pack RTE meats, the booklet *How to comply with regulatory guidelines for the control of Listeria by meat retailers: advice on how to set up a testing program.*

Appendix 1

Staphylococcus aureus (Golden Staph)

Under the microscope *Staphylococcus* looks like bunches of grapes and the name comes from its appearance. It also makes a golden pigment which is seen in boils and pimples – hence its common name of "Golden Staph".

Historically, it has been responsible for many outbreaks of food poisoning from RTE meats. Over recent years however, the organism has been better controlled, probably because of better handling techniques and refrigeration.

The organism makes a toxin which it releases into the food. Its effects are rapid, usually 2-6 hours after eating the toxic food victims are affected by symptoms of gastro, especially vomiting.

Risk rating for HACCP plans

	Severity	Likelihood	Risk rating
Raw meat	Low	Medium	Low
Raw poultry	Low	Medium	Low

Growth of *S. aureus*

The bacterium grows at similar temperatures to *Salmonella* and so is controlled by refrigeration. It tolerates salt and can grow in concentrations as high a 20%. It does not compete well against spoilage bacteria and usually becomes overgrown. However, in RTE foods and high-salt foods it has a competitive advantage and will grow to high numbers if the temperature and other factors are right.

Killing of *S. aureus*

It is relatively easy to kill by heating, and cooking programs for *Listeria* will eliminate high populations of *S. aureus*.

Unfortunately the toxin is extremely stable and is not inactivated by cooking.

Relevance for smallgoods manufacture

Staphylococci are carried by up to 40% of healthy adults in noses, ears and mouths.

This means that food handlers can transfer the bacterium when they handle food which is why regulations do not allow bare hands to contact RTE foods.

The organism is also present on the hides of cattle and the tonsils of pigs, from where it can get onto the raw meat.

Active refrigeration at the abattoir followed by effective cold-chain handling will prevent the organism multiplying to levels where toxin might become a problem for the smallgoods manufacturer.

Staphylococcus has a competitive advantage in many smallgoods categories. In cooked, cured smallgoods the organism has a double advantage of reduced competition because of cooking and salt content. Effective chilling of cooked products is a CCP and post process handling to prevent recontamination from food handlers is a GMP.

In fermented meats *S. aureus* has a competitive advantage before fermentation starts, because the salt concentration prevents the natural bacteria from overgrowing it.

There may be some growth of *S. aureus* until the starters begin producing lactic acid. However, if the original level of *S. aureus* in the batter is low, it will not grow to levels where the toxin has an effect on consumers.

Appendix 1

Clostridium perfringens

This organism has been known for many years as the cause of gas gangrene in wounds, particularly in war wounds.

Later it became recognised as a cause of food poisoning and was called 'Canteen disease' because of large outbreaks among workers who ate in their work's canteen.

The illness

The organism causes mild food poisoning symptoms - diarrhoea which usually clears up within 24 hours. The cause is a toxin made by the organism and passed into our gut. Outbreaks are almost always associated with cooked meat dishes which have been cooled slowly, allowing the organism to grow to high numbers.

High numbers (more than 1 million/g) are usually needed to produce enough toxin to cause symptoms of food poisoning.

Risk rating for HACCP plans

	Severity	Likelihood	Risk rating
Raw meat	Low	Medium	Low
Raw poultry	Low	Medium	Low

Growth of *C. perfringens*

It does not grow well under acid conditions, or at very low water activity.

It does grow very rapidly, however, at temperatures between 35-45°C.

It is anaerobic – that is, it will only grow in foods where there is little or no oxygen.

Conditions	Minimum	Fastest growth
Temperature (°C)	12	43-47
pH	5.5	7.2
a_w	0.93	0.95-0.96

Killing *C. perfringens*

The organism is a spore-former. The spores survive boiling, and when the temperature of the food falls to 50°C, the spores germinate and new bacteria begin to grow.

Nitrite is effective in delaying spores from germinating and is important in those smallgoods which have an anaerobic atmosphere where *C. perfringens* could otherwise grow.

Relevance for smallgoods manufacture

Clostridium perfringens is of most concern in products which have been cooked and then cooled slowly, which makes it the target organism in the Australian Standard (AS 4696:2007).

When foods are boiled the oxygen inside them is removed. As the food cools, oxygen gradually diffuses back into it from the surfaces exposed to air. However, in a mass of cooked food the centre will remain anaerobic, allowing growth of *C. perfringens*.

Favourable conditions for germination and growth occur in large cuts such as roasts and leg hams and special processes may be needed to cool these through the zone where *C. perfringens* grows very quickly (35-45°C).

Appendix 1

Clostridium botulinum

This organism produces a neurotoxin which is one of the most powerful natural toxins known. It paralyses the respiratory muscles, the lungs and heart. It has traditionally been the most feared food-borne organism and many controls, particularly in thermal processing, are aimed specifically at *C. botulinum.*

It is also among the biological weapons stockpiled by some nations for germ warfare.

The illness

Symptoms begin with those typical of food poisoning but soon intensify so that the respiratory muscles fail and breathing stops.

The fatality rate is at about 40% but patients in urban areas generally survive if they can be given an antiserum and are placed in an iron lung.

The toxin is very potent and a very small amount, less than 1 millionth of a gram, is fatal. Fortunately it is susceptible to temperatures used in cooking.

It is thought that relatively high numbers of *C. botulinum* are required to produce enough toxin to cause botulism.

Risk rating for HACCP plans

	Severity	Likelihood	Risk rating
Raw meat	High	Low	Low
Raw poultry	High	Low	Low

Growth of *C. botulinum*

Some types can grow under refrigeration if the food contains no oxygen (anaerobic). Other types are mildly salt tolerant.

Killing *C. botulinum*

Spores of the organism are not killed by any heating regime used in smallgoods manufacture – only heat treatment such as canning will kill the spores.

Control of spore germination is the same as that for *C. perfringens*, with nitrite important for those products with an anaerobic atmosphere e.g. large sized meat cuts.

Relevance for smallgoods manufacture

The relevance is similar to that for *C. perfringens* with the proviso that, while growth of *C. perfringens* will cause mild diarrhoea, growth of *C. botulinum* will cause serious illness and maybe death.

The toxin is destroyed by heating and is a problem only in those products which are eaten without further cooking.

Appendix 1

Campylobacter

Campylobacter is found in the guts of animals.

During the 1980s it became known as a food-borne pathogen associated particularly with raw poultry and raw milk.

In Australia, *Campylobacter* is the most common cause of food poisoning, with around 16,000 cases notified annually; by comparison *Salmonella* has about 6,000 and *L. monocytogenes* about 120 notifications each year.

Campylobacter is rarely found on raw meat – 0.4% of carcase samples were positive in the most recent national baseline survey.

By contrast, a recent survey of raw poultry purchased from butcher shops and supermarkets in Adelaide and Sydney found that *Campylobacter* was present on around 90% of product purchased – a mix of whole birds and chicken pieces.

Infective dose and illness

The infective dose for *Campylobacter* is thought to be low - around 1,000 cells may cause a range of symptoms associated with gastroenteritis lasting for around 5 days.

Occasionally, infection may be followed by much more serious conditions, arthritis or Guillain-Barré Syndrome (GBS), a condition from which 15% never recover completely and 3-8% die.

Risk rating for HACCP plans

	Severity	Likelihood	Risk rating
Raw meat	Moderate	Low	Low
Raw poultry	Moderate	High	Moderate

Growth of *Campylobacter*

Campylobacter grows over a narrow temperature range rarely found in the meat industry.

Conditions	Minimum	Fastest growth
Temperature (°C)	30	42
pH	4.9	6.5-7.5
a_w	0.98	0.99

Relevance for smallgoods manufacture

Campylobacter only grows at warm temperatures (30-45°C) and is easily killed in cooking. But it is Australia's most commonly reported pathogen, so how does it infect so many people?

Two factors are involved:

- The infective dose is very low
- *Campylobacter* is cross-contaminated from working surfaces and hands to cooked product.

Appendix 2

Improving product consistency

Variation of products and processes

The way you make up your brines is important – here is some advice on how to reduce variability in brine.

Stage	Check	Because
Meat	Variability in size of legs or pieces	If you base your cook cycles on the core temperature of the largest piece, smaller pieces will have lower moisture content
	Fat content	Variable fat content means difference in moisture content of product, and this affects concentration of salt and nitrite
Dry goods	Premix – or do you weigh individual ingredients	Scoop or 'up to here' on a bucket can give variability based on the person doing the measuring
	Scales or scoop?	Some larger scales are accurate only to ± 200g
	Are your scales accurate enough?	Floor scales are even less accurate
	How many people do this on a regular basis?	
	Do you all do it the same way?	
	Is there a documented procedure?	
	How is nitrite incorporated?	If nitrite is in the blend with the spices, it can degrade rapidly - shelf life about 3 months Old blends means the final product will be low in nitrite Nitrite blended with salt/sugars alone is much more stable
	Use in strict rotation within use by	
Brine Make Up	Brine temperature	Brine must be cold before injection to maintain product temperature and to minimise loss of nitrite
	How is water measured - weight or volumetric?	Volumetric can be inaccurate unless well controlled
	How many people do this on a regular basis?	
	Do you all do it the same way?	Variability in the brine concentration leads to variation in antimicrobial concentration
	Is there a documented procedure?	
	Are dry goods used in accordance with suppliers' instructions?	Are the nitrite and salt levels as specified?
	Are the dry goods fully dissolved in the brine before use?	Undissolved dry goods equals variability in salt and nitrite

Appendix 2

Stage	Check	Because
Injection	Does the injection rate you use match the dry goods specification?	If not, concentration of ingredients will not be as intended by dry goods supplier
	Do you check your injection rate?	Check to see if the injected weights match the injection rate you intend to use
	Do you weigh pieces of meat before and after injection?	
Curing	Do you use cover pickle?	If they're not in cover pickle, some brine/liquid will be lost from the middles while they're curing.
	How long are products cured?	Should be about 48 hours to get even brine distribution, longer than that in a strong brine can increase salt levels
Filling / hanging	What type of casing do you use?	If it's moisture proof, there should be no loss
Cooking (no moisture proof casing)	Is the cooker humidity controlled?	Controlled humidity will help reduce variability in weight loss during cook
	Do you make smoked products?	Smoking is often the driest part of the cook cycle
	Manual or part of a program? How is time controlled?	Product surface has to be dry before smoking – or smoke won't adhere. If this is done manually, could introduce more variability
	Is there much variability in length of cook for this product?	Longer in the cooker means more weight lost during cook. Variability in weight loss means variability in salt, nitrite
	Do you know the cook loss or yield?	Moisture loss during cooking results in concentration of ingredients
Chilling (no moisture proof casing)	How much time does the product spend in the chiller before packing?	Extended time in chiller (if not vacuum packed) leads to loss of moisture

Appendix 3

What does a good food safety plan look like?

Food Safety Plan (FSP)

A food safety plan has three parts:

- Hazard Analysis Critical Control Point (HACCP) plan
- Good Manufacturing Practices (GMPs)
- Standard Sanitation Operating Procedures (SSOPs)

Some people think HACCP is all that is needed to ensure safe manufacturing but all three elements are equally important. In fact, a HACCP plan can only succeed if the twin pillars of GMPs and SSOPs are strong.

Another basis for a safe operation is how your premises are designed and constructed so that they can be cleaned properly, and all operations can be carried out safely.

Setting up your HACCP plan

The Codex Alimentarius process for building your HACCP plan has a series of steps:

Step 1: HACCP team roles and responsibilities

I am responsible for the FSP.

Step 2: Description of each product type and packaging format

The following products are covered by the FSP:

Product type	Packaging format	Storage
Raw meat in pieces (steaks, chops, roasts)	Plastic bag	Chilled
Fresh sausages	Plastic bag	Chilled
Minced meat	Plastic bag	Chilled
Marinades	Plastic bag	Chilled
Bacon	Plastic bag	Chilled
Cooked, cured muscle meats	Plastic bag	Chilled
Cooked sausages	Plastic bag	Chilled

Step 3: Intended use of each product

Products are consumed by all sectors of the public irrespective of their age or health status.

Appendix 3

Step 4: Process flow diagram:

This step should list all stages from the time raw materials are received until the final product is placed in retail display. These stages are receiving, preparation, processing, packaging, storage and distribution. Full process flow diagrams for each product are presented in Parts 6 and 7.

Step 5: Verify the flow diagram

You need to verify each part of the process flow diagrams by checking the equipment, ingredients and product flows in your shop.

Step 6: Identify all hazards

Hazards include:

Biological hazards

- Microbial pathogens – a full list of target bacteria is presented in Appendix 1

Chemical hazards

- Sulphite and nitrite in comminuted products, plus allergens (covered in Part 5).

Physical hazards

- Metal or plastic in comminuted products

Step 7: Determine Critical Control Points (CCPs)

The Codex Alimentarius defines a CCP as: "*A step, process or element which prevents, eliminates or reduces a hazard to an acceptable level*".

You should follow each step in the process in a Hazard Control Worksheet. An example is presented on page 57, which is very straightforward because it doesn't contain information on risk (severity of a hazard and likelihood it will occur). This information is presented for each microbiological hazard in Appendix 1, allowing simplification of the hazard sheets.

Each hazard is identified as either a CCP or as a hazard controlled by a GMP or an SSOP.

Procedures for monitoring each CCP and for making corrective action etc are contained in a HACCP chart.

Step 8: Establish Critical Limits for each CCP

For each CCP there are well-established critical limits, outside of which the CCP is deemed to be not in control.

Limits for temperature control, cooking, cooling, nitrite and sulphite are based on the Australia Standard (AS 4696:2007).

Appendix 3

Step 9: Set up a monitoring and checking system at each CCP

The checking and monitoring system is based on the following format.

You'll have your own monitoring forms on which data are entered from each process.

Operation	What	Who	How	When

Step 10: Establish Corrective Actions

The Corrective Action for CCPs, which are not in control, is a two-stage process.

1. Stabilise the immediate problem by quarantining product affected, then make a decision on its disposition.
2. Review the HACCP system and make changes to ensure no recurrence of the problem.

Corrective Actions are detailed in the HACCP chart.

Step 11: Establish a verification system

You can verify your HACCP system by:

- Filing all completed forms each day
- Monitoring them on a weekly basis
- Correcting any significant issues immediately or as soon as practicable
- Reviewing the HACCP plan if there is any significant alteration to a process
- Responding to external audit findings

Step 12: Maintain records

You can maintain your records either as electronic and hard copy files.

Good Manufacturing Practices (GMPs) for retail butcher shops

Good Manufacturing Practices (GMPs) are the way you set up your business and do your processing so that you get safe products.

You will already have GMPs covered in your existing food safety plan, and many GMPs are covered in detail, especially in Parts 6 and 7, so only a brief list will be presented here – you can find out more as you read these guidelines.

Calibration of equipment

Thermometers, gauges on cool rooms, gauges on cookers, salt meters, pH meter, scales.

Receiving and storing of raw materials

Receival and storage temperatures are regulated under the Australian Standard and there is no tolerance for temperatures warmer than those stipulated, except for where an approved program exists for meat receival.

Receiving and storing packaging materials

Packaging materials and packaging practice used for smallgoods should comply with the Australian Standard: AS 2070: 1999, Plastic Materials for Food Contact Use.

Store packaging in a dust and vermin proof room, on racks above the floor so that it is easy to clean underneath them.

Brine manufacture and use

This covered in great detail in Part 7, and especially in Appendix 2.

Allergen control

This is covered in Part 5.

Appendix 3

Cutting and mincing

At the end of each working day, all material in the screw and plates of the mincer should be discarded as it can 'seed' tomorrow's batch with dangerous bacteria.

If you make allergen-free minced products make sure you do this first, in a clean mincer.

Stuffing/filling

Sausages should be filled into food grade casings.

If casings are pre-soaked before filling, they should be soaked in potable water and the water changed regularly.

Metal detection

If you hear a 'ping' from the mincer it tells you a piece of metal is floating around. Or, when you dismantle the grinder for cleaning you may find a piece has broken off. It means metal is in the product.

Fermenting

Check out the *Guidelines for Safe Manufacture of Smallgoods*.

Smoking

Product in the smoker-oven should be evenly spaced to help air circulation and even smoking. Smoking is important for flavour. Smoke also generates chemicals which inhibit growth of bacteria and moulds, and prevents mould growth.

Cooking and cooling

These processes are covered in detail in Part 7.

Slicing and packaging

This is all about preventing pathogens, especially *Listeria* getting into RTE meats – part 8 is dedicated to GMPs for this aspect.

Labelling

If you cut or slice to order it's likely the only label you have will be on the product in retail display. If you vacuum pack you'll probably label with product name and date of packing. Check out Part 5 for more information.

Chilled storage of RTE meats

Correct storage conditions including temperature and prevention of contamination should be maintained and recorded to ensure safety of smallgoods.

Transport of smallgoods

The minimum standard for transporting smallgoods requiring refrigeration is covered under the *Australian Standard for the Hygienic Production and Transportation of Meat and Meat Products for Human Consumption.*

Cleaning procedures for retail butcher shops

Part 3 of these Guidelines deal in detail with how to construct your shop so it can be cleaned properly, and also how to clean it effectively.

1. Construction of the processing area
2. How to clean your premises
3. Stages in cleaning
4. Some do's and don'ts

Appendix 3

Typical hazard control worksheet

Process step	Hazard	What can go wrong	Hazard control
	BIOLOGICAL		
	CHEMICAL		
	PHYSICAL		

Typical HACCP chart

Critical Operation	Hazard	Critical Limits of the Control Measures	Monitoring				Corrective Action	Records	Verification
			What	How	When	Who			

Notes

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