

# FOOD SAFETY SCHEMES MANUAL



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## Introduction

The NSW Food Authority (the Food Authority) has prepared the NSW Food Safety Schemes Manual (the Manual) to specify certain requirements for the following Food Safety Schemes under the Food Regulation 2015:

- Dairy food safety scheme
- Meat food safety scheme
- Plant products food safety scheme
- Seafood safety scheme
- Vulnerable persons food safety scheme
- Egg food safety scheme

The Manual applies to all food businesses licensed under these schemes. The requirements referred to in the Food Regulation 2015, detailed within this document, must be complied with.

### Frequency of testing

The frequency specified in this Manual is detailed in the number of batches produced by the food business. The definition of a batch is listed on page 3 of this document.

### Where testing can be done

Every food and water analysis specified in this Manual must be carried out in a laboratory approved by the National Association of Testing Authorities (NATA) or approved by the Food Authority, for the particular type of analysis to be undertaken. A list of NATA accredited laboratories can be found on the NATA website at [www.nata.asn.au](http://www.nata.asn.au) and a list of laboratories approved by the Food Authority can be found on the Food Authority's website [www.foodauthority.nsw.gov.au](http://www.foodauthority.nsw.gov.au).

Testing requirements for other analysis (e.g. environmental and antibiotic testing) are provided in the relevant section.

### Reporting of failures

The Food Authority must be notified if any sample analysed fails to meet the standard set out in this Manual:

- verbally within 24 hours after the licence holder becomes aware of the results of the analysis (e.g. by phone), and
- in writing within 7 days after becoming aware of the result of analysis (e.g. by fax, email, letter).

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## Definitions

**Batch:** Product produced in a 24-hour production period

**Listericidal process:** A process that reduces *Listeria monocytogenes* microorganisms to a safe level

**Non-reticulated water:** any water supply not piped into a business by either a water utility or local council. It includes rainwater, ground water (e.g. bore water) and surface water.

**Ready-to-eat (RTE) food:** a food product that is in a form that does not require additional preparation prior to consumption.

**Water activity:** the unbound water present in a food that can be used by microorganisms for growth

## Acronyms

**cfu** Colony forming units

**MAP** Modified atmosphere packaging

**RTE** Ready-to-eat

**UCFM** Uncooked comminuted fermented meat



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## Chapter 1 – Dairy food safety scheme

### Sampling and analyses

Licensed dairy businesses must comply with the sampling and analyses provisions of the *Dairy food safety scheme* of the Food Regulation 2015. These requirements are outlined in Table 1.

**Table 1: Analyses of dairy products and water**

Product to be tested	Test to be conducted	Limit	Frequency
Unpasteurised milk for further processing, i.e. pasteurisation	Antimicrobial drug residues <sup>1</sup>	As per Food Standards Code (FSC) 1.4.2	Every tanker load of milk from farm on arrival at the processing facility
Unpasteurised goat milk for human consumption	<i>Campylobacter</i>	Not detected in 25 mL	Every 20 batches
	<i>E. coli</i>	Not exceeding 3/mL	Every 20 batches
	<i>L. monocytogenes</i> <sup>2</sup>	Not detected in 25 mL	Every 20 batches
	<i>Salmonella</i>	Not detected in 25 mL	Every 20 batches
Pasteurised liquid milk products	<i>E. coli</i> <sup>3</sup>	Not exceeding 1 /mL	Every 10 batches
	<i>L. monocytogenes</i> <sup>2</sup>	Not detected in 25 mL	Every 10 batches
Pasteurised cream products	<i>E. coli</i>	Not exceeding 1 /mL	Every 20 batches
	<i>L. monocytogenes</i> <sup>2</sup>	Not detected in 25 mL	Every 20 batches
Cheese	<i>E. coli</i>	Not exceeding 10 /g	Every 20 batches

1 Testing can be undertaken in-house using approved methods, but not necessarily in a NATA-accredited laboratory.

2 The Food Authority has assumed these products will support the growth of *L. monocytogenes*. For further information see Appendix 1.

3 The Food Authority may accept an alternative testing arrangement as complying with the requirements of this Manual, as follows:

Every batch of pasteurised liquid milk products is tested for coliforms with a limit of not exceeding 10/mL. If this limit is exceeded then the batch must be tested for *E. coli* with the limit as not exceeding 1/mL



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Product to be tested	Test to be conducted	Limit	Frequency
Cheese with post pasteurisation ingredients	<i>E. coli</i>	Not exceeding 10 /g	Every 20 batches
	<i>L. monocytogenes</i> – products that will support the growth of the organism (see Appendix 1)	Not detected in 25g	Every 10 batches
	<i>L. monocytogenes</i> – products that will not support the growth of the organism (see Appendix 1)	Not exceeding 100 cfu/g	Every 10 batches
	<i>Salmonella</i>	Not detected in 25g	Every 10 batches
Soft and semi-soft cheese (moisture content greater than 39% and pH greater than 5.0)	<i>E. coli</i>	Not exceeding 10 /g	Every 10 batches
	<i>L. monocytogenes</i> – products that will support the growth of the organism (see Appendix 1)	Not detected in 25g	Every 10 batches
	<i>L. monocytogenes</i> – products that will not support the growth of the organism (see Appendix 1)	Not exceeding 100 cfu/g	Every 10 batches
	<i>Salmonella</i>	Not detected in 25g	Every 10 batches
Dried milk powder	<i>Salmonella</i>	Not detected in 25g	Every 10 batches
Butter (salted or unsalted butter)	<i>E. coli</i>	Not exceeding 10 /g	Every 20 batches
Butter with post pasteurisation ingredients	<i>E. coli</i>	Not exceeding 10 /g	Every 20 batches
	<i>Salmonella</i>	Not detected in 25g	Every 20 batches



Product to be tested	Test to be conducted	Limit	Frequency
Dairy-based desserts and dips with a pH exceeding 4.5 (e.g. custard, chocolate mousse, kashta)	<i>Coagulase positive staphylococci</i> (CPS)	Not exceeding 100 /g	Every 10 batches
	<i>E. coli</i>	Not exceeding 10 /g	Every 10 batches
	<i>L. monocytogenes</i> – products that will support the growth of the organism (see Appendix 1)	Not detected in 25g	Every 10 batches
	<i>L. monocytogenes</i> – product that will not support the growth of the organism (see Appendix 1)	Not exceeding 100 cfu/g	Every 10 batches
Dairy-based desserts and dips with a pH exceeding 4.5 with post pasteurisation ingredients (e.g. custard, chocolate mousse, kashta)	<i>Coagulase positive staphylococci</i> (CPS)	Not exceeding 100 /g	Every 10 batches
	<i>E. coli</i>	Not exceeding 10 /g	Every 10 batches
	<i>L. monocytogenes</i> – product that will support the growth of the organism (see Appendix 1)	Not detected in 25g	Every 10 batches
	<i>L. monocytogenes</i> – product that will not support the growth of the organism (see Appendix 1)	Not exceeding 100 cfu/g	Every 10 batches
	<i>Salmonella</i>	Not detected in 25g	Every 10 batches
Frozen ice cream and edible ices (e.g. gelato)	<i>E. coli</i>	Not exceeding 10 /g	Every 20 batches
	<i>L. monocytogenes</i>	Not exceeding 100 cfu/g	Every 20 batches
Frozen ice cream and edible ices (e.g. gelato) with post pasteurisation ingredients	<i>E. coli</i>	Not exceeding 10 /g	Every 20 batches
	<i>L. monocytogenes</i>	Not exceeding 100 cfu/g	Every 20 batches
	<i>Salmonella</i>	Not detected in 25g	Every 10 batches



Product to be tested	Test to be conducted	Limit	Frequency
Refrigerated ice cream mixes (e.g. soft serve mix)	<i>E. coli</i>	Not exceeding 10 /g	Every 10 batches
	<i>L. monocytogenes</i> <sup>1</sup>	Not detected in 25g	Every 10 batches
Non-reticulated water used in connection with the production and processing of dairy products	<i>E. coli</i>	Not detected in 100mL	Not treated – Every month
			Treated – Every 6 months

<sup>1</sup> The Food Authority has assumed these products will support the growth of *L. monocytogenes*. For further information see Appendix 1.

## Chapter 2 – Meat food safety scheme

### Sampling and analyses

Licensed meat businesses must comply with the sampling and analyses provisions of the *Meat food safety scheme* of the Food Regulation 2015. These requirements are outlined in Table 2.

**Table 2: Analyses of certain meats, meat products, animal by-products and water**

Meat business	Product to be tested	Test to be conducted	Limit	Frequency
Abattoirs	Non-reticulated water used in connection with the slaughtering of abattoir animals	<i>E. coli</i>	Not detected in 100mL	Not treated – Every month
				Treated – Every 6 months
Meat processing plants producing ready to eat (RTE) meat and poultry products	Ready to eat (RTE) meat and poultry, excluding UCFM	<i>E. coli</i>	Not exceeding 3/g	Every 10 batches
		<i>L. monocytogenes</i> – product that will support the growth of the organism (see Appendix 1)	Not detected in 25g	Every 10 batches
		<i>L. monocytogenes</i> – product that will not support the growth of the organism (see Appendix 1)	Not exceeding 100 cfu/g	Every 10 batches
		<i>Salmonella</i>	Not detected in 25g	Every 10 batches
	Sliced or whole packaged RTE meat products, excluding UCFM (vacuum packed or MAP [modified atmosphere packaged] product)	<i>E. coli</i>	Not exceeding 3 /g	Every 10 batches
		<i>L. monocytogenes</i> – product that will support the growth of the organism (see Appendix 1)	Not detected in 25g	Every 10 batches
		<i>L. monocytogenes</i> – product that will not support the growth of the organism (see Appendix 1)	Not exceeding 100 cfu/g	Every 10 batches



Meat business	Product to be tested	Test to be conducted	Limit	Frequency
Meat processing plants producing ready to eat (RTE) meat and poultry products	Sliced or whole packaged RTE meat products, excluding UCFM (vacuum packed or MAP [modified atmosphere packaged] product)	<i>Salmonella</i>	Not detected in 25g	Every 10 batches
		Environmental and work surface testing for <i>Listeria spp</i> <sup>1</sup> .	No positive detection	Every month (5 samples collected pre and post operations)
	Whole packaged RTE meat product that receives a post pack pasteurisation step	<i>E. coli</i>	Not exceeding 3/g	Every 10 batches
		<i>L. monocytogenes</i> – product that will support the growth of the organism (see Appendix 1)	Not detected in 25g	Every 10 batches
		<i>L. monocytogenes</i> – product that will not support the growth of the organism (see Appendix 1)	Not exceeding 100 cfu/g	Every 10 batches
		<i>Salmonella</i>	Not detected in 25g	Every 10 batches
Meat processing plant producing uncooked comminuted fermented meat (UCFM)	Uncooked comminuted fermented meat (UCFM) – Finished product (product which is the subject of a pro-forma)	<i>E. coli</i>	Not exceeding 3.6 /g	Every batch

<sup>1</sup> Testing can be undertaken in-house using approved methods, but not necessarily in a NATA-accredited laboratory. For further information refer to the Food Authority's Listeria Management Program document

Meat business	Product to be tested	Test to be conducted	Limit	Frequency
Meat retail premises	Sliced or whole packaged RTE meat products, excluding UCFM (vacuum packed or MAP [modified atmosphere packaged] product)	<i>L. monocytogenes</i> – product that will support the growth of the organism (see Appendix 1)	Not detected in 25g	Every 10 batches
		<i>L. monocytogenes</i> – product that will not support the growth of the organism (see Appendix 1)	Not exceeding 100 cfu/g	Every 10 batches
		Environmental and work surface testing for <i>Listeria</i> spp. <sup>1</sup>	No positive detection	Every month (5 samples collected pre and post operations. See the Listeria management program for more information)
	Whole packaged RTE meat product that receives a post pack pasteurisation step, excluding UCFM	<i>L. monocytogenes</i> – product that will support the growth of the organism (see Appendix 1)	Not detected in 25g	Every 10 batches
		<i>L. monocytogenes</i> – product that will not support the growth of the organism (see Appendix 1)	Not exceeding 100 cfu/g	Every 10 batches
	Uncooked comminuted fermented meat (UCFM) – Finished product (product which is the subject of a pro-forma)	<i>E. coli</i>	Not exceeding 3.6 /g	Every batch

<sup>1</sup> Testing can be undertaken in-house using approved methods, but not necessarily in a NATA-accredited laboratory. For further information refer to the Food Authority's Listeria Management Program document.

Meat business	Product to be tested	Test to be conducted	Limit	Frequency
Rendering plants	Rendered animal by-product	<i>Salmonella</i>	Not detected in 25g	Every week (from composite sub samples totalling 250g)
		<i>Clostridium perfringens</i>	Not exceeding 10 /g	Every 12 months (Samples taken over 10 consecutive days after rendering as specified in AS 5008-2007 <sup>1</sup> )

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1 AS 5008-2007: Hygienic rendering of animal products

## Chapter 3 – Plant products food safety scheme

### Sampling and analyses

Licensed plant product businesses must comply with the sampling and analyses provisions of the *Plant products food safety scheme* of the Food Regulation 2015. These requirements are outlined in

Table 3.

**Table 3: Analyses of seed sprouts, vegetables packed in oil, fresh cut fruit, fresh cut vegetables, unpasteurised juice and water**

Product to be tested	Test to be conducted	Limit	Frequency
Seed used for sprouting (pre-screening test)	<i>Salmonella</i> Method: 1L sample of spent irrigation water from a test bath of seeds made up of 3kg taken evenly across the batch	Not detected in 100 mL	Every delivery batch of seeds
Spent irrigation water used for seed sprouting	<i>Salmonella</i> Method: 1L composite sample taken evenly across each sprouting container from each production batch. Irrigation water should be sampled just before harvest or at least 48 hrs after lay.	Not detected in 100 mL	Every 10 batches
Seed sprouts (finished product)	<i>E. coli</i> Method: 1 x 100g sample of any finished single sprout-type from each process line	Not exceeding 100 /g	Every 10 batches
Fresh cut fruit	<i>L. monocytogenes</i> 1	Not detected in 25g	Every 10 batches
	<i>Salmonella</i>	Not detected in 25g	Every 10 batches
Fresh cut vegetables	<i>L. monocytogenes</i> 1	Not detected in 25g	Every 10 batches

1 The Food Authority has assumed these products will support the growth of *L. monocytogenes*. For further information see Appendix 1.

Product to be tested	Test to be conducted	Limit	Frequency
	<i>Salmonella</i>	Not detected in 25g	Every 10 batches
Unpasteurised juice	<i>Salmonella</i>	Not detected in 25g	Every 10 batches
Non-reticulated water used in connection with the production and processing of plant products	<i>E. coli</i>	Not detected in 100mL	Not treated – Every month
			Treated – Every 6 months



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## Chapter 4 – Seafood safety scheme

### Sampling and analyses

Licensed seafood businesses must comply with the sampling and analyses provisions of the *Seafood safety scheme* of the Food Regulation 2015. These requirements are outlined in

Table 4.

**Table 4: Analyses of ready to eat seafood products and water**

Seafood business	Product to be tested	Test to be conducted	Limit	Frequency
Seafood processor producing RTE seafood	Opened oysters	<i>E. coli</i>	Not exceeding 2.3 /g	Every 20 batches
	Packaged oysters	<i>E. coli</i>	Not exceeding 2.3 /g	Every 20 batches
	Cooked/smoked seafood	<i>L. monocytogenes</i> – product that will support the growth of the organism (see Appendix 1)	Not detected in 25g	Every 10 batches
		<i>L. monocytogenes</i> – product that will not support the growth of the organism (see Appendix 1)	Not exceeding 100 cfu/g	Every 10 batches
All seafood processors	Non-reticulated water used in connection with the production and processing of seafood	<i>E. coli</i>	Not detected in 100mL	Not treated – Every month
				Treated – Every 6 months



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## Chapter 5 – Vulnerable persons food safety scheme

### Sampling and analyses

Licensed vulnerable persons businesses must comply with the sampling and analyses provisions of the *Vulnerable persons food safety scheme* of the Food Regulation 2015.

No routine analysis of food or water is currently required by the Food Authority for licensed vulnerable persons businesses.



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## Chapter 6 – Egg food safety scheme

### Sampling and analyses

Licensed egg businesses must comply with the sampling and analyses provisions of the *Egg food safety scheme* of the Food Regulation 2015. These requirements are outlined in Table 5.

**Table 5: Analyses of eggs, egg products, blended egg product mixtures, and water**

What to test	Test to be conducted	Limit	Frequency
Pasteurised egg products	<i>Salmonella</i>	Not detected in 25g	Every 10 batches
Dried egg products	<i>Salmonella</i>	Not detected in 25g	Every 20 batches
Pasteurised blended egg product mixture	<i>Salmonella</i>	Not detected in 25g	Every 10 batches
Non-reticulated water used in the production of eggs, processing of eggs, eggs products, or blended egg product mixtures	<i>E. coli</i>	Not detected in 100mL	Not treated – Every month
			Treated – Every 6 months

### Methods of pasteurisation of egg products

Licensed egg businesses that pasteurise egg product and blended egg product mixture must comply with the pasteurisation provisions of the *Egg food safety scheme* of the Food Regulation 2015. These requirements are outlined in Table 6.



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Table 6: Pasteurisation equipment requirements – continuous flow pasteurisers

Method of pasteurisation	Pasteurisation equipment requirements	Verification and validation
Continuous flow	The equipment must include an indicating thermometer for product temperature at the end of the holding tube and for the cold product temperature.	Holding tube time must be (externally) validated every 5 years.
		The indicating thermometer must be compared with the continuous monitoring system each time the pasteuriser is operated (corrective action is required if the difference is more than 0.5°C).
		The indicating thermometers must be calibrated every 6 months (corrective action is required if the difference is more than 0.5°C).
	The equipment must include a continuous recording device for the pasteurisation temperature, sterilisation temperature, cold product temperature, mode of diversion and cleaning time and temperatures.	The following data must be continuously recorded each time the pasteuriser is operated: <ul style="list-style-type: none"> <li>• pasteurising temperature,</li> <li>• sterilising temperature,</li> <li>• cold product temperature,</li> <li>• mode of diversion device, and</li> <li>• cleaning time and temperatures.</li> </ul>
		The recording thermometers must be calibrated every 6 months (corrective action is required if the difference is more than 0.5°C).
	Raw, partially treated product and cleaning systems must not contaminate the pasteurised product.	Pasteurisers must be pressure tested annually.
		The diversion temperature must be challenged during start-up and recorded each time the pasteuriser is operated.
		The pasteuriser must be sterilised for a minimum of 80°C for 10 minutes during start-up (on the cold side) and recorded each time the pasteuriser is operated.
		Pressure differentials must be checked and recorded each time the pasteuriser is operated (either by manually recording the psi on the pressure gauges or the computer system maintaining the pressure differentials).
Batch	The equipment must include a hinged lid or removable cover and an agitator.	Vessel must be enclosed during pasteurisation.

Method of pasteurisation	Pasteurisation equipment requirements	Verification and validation
Batch	The equipment must include a head space thermometer, an indicating thermometer for product temperature, and a continuous monitoring system for time and temperature (e.g. data logger).	<p>The following data must be recorded each time the pasteuriser is operated:</p> <ul style="list-style-type: none"> <li>• continuous pasteurising temperature,</li> <li>• headspace temperature at the beginning and the end of the critical temperature cycle,</li> <li>• indicating thermometer compared with the continuous monitoring system (corrective action is required if the difference is more than 0.5°C), and</li> <li>• pasteurised product cooling time and temperatures (in accordance with clause 7 of Standard 3.2.2 of the Food Standards Code).</li> </ul>
		The indicating and recording thermometers must be calibrated every 6 months (corrective action is required if the difference is more than 0.5°C).
	Raw, partially treated product and cleaning systems must not contaminate the pasteurised product.	Effective seals on valves and outlets.

## Appendix 1: *Listeria monocytogenes* limits in RTE food

In July 2014, revised microbiological limits for *Listeria monocytogenes* were introduced into the Australian New Zealand Food Standards Code (the Food Standards Code) Standard 1.6.1 - '*Microbiological Limits in Foods*'. The limits were revised to acknowledge that RTE food which supports the growth of *L. monocytogenes* increases the risk that the food will contribute to listeriosis, and as such a stricter limit now applies. The revised limits are:

- For RTE foods that support the growth of *L. monocytogenes*, the previous limit 'not detected in 25 gram' will still apply.
- Where RTE foods do not support the growth of *L. monocytogenes*, a new limit 'not exceeding 100cfu/g' can be used.

### Applying the new limits

The Food Authority will apply the revised limits as follows:

- Where a business can demonstrate that the RTE product will not support the growth of *L. monocytogenes*, the 'not exceeding 100 cfu/g' applies
- Where a business cannot demonstrate that the RTE product will not support the growth of *L. monocytogenes*, the 'not detected in 25g' applies
- Where a RTE food will support the growth of *L. monocytogenes*, the 'not detected in 25g' applies

### What are RTE foods?

The Food Standards Code, Standard 1.6.1 defines RTE food as a food that:

- is ordinarily consumed in the same state as that in which it is sold; and
- will not be subject to a listericidal process before consumption; and
- is not one of the following:
  - shelf stable foods
  - whole raw fruits
  - whole raw vegetables
  - nuts in the shell
  - live bivalve molluscs

In terms of the Food Safety Schemes, any food that requires no further processing before consumption would be regarded as RTE.

### Demonstrating *L. monocytogenes* growth will not occur

Information on the food characteristics, shelf life and growth rate can be used to determine whether a RTE food does not support the growth of *L. monocytogenes*. These criteria are included in the Food Standards Code, Standard 1.6.1 and are based on international guidelines and standards.



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## Food characteristics and shelf-life

The Food Standards Code, Standard 1.6.1 includes defined physical and chemical criteria for RTE foods that will not support the growth of *L. monocytogenes*:

- the food has a pH less than 4.4 regardless of water activity; or
- the food has a water activity less than 0.92 regardless of pH; or
- the food has a pH less than 5.0 in combination with a water activity of less than 0.94; or
- the food has a refrigerated shelf life no greater than 5 days; or
- the food is frozen (including foods consumed frozen and those intended to be thawed immediately before consumption).

While the Food Standards Code, 1.6.1 has defined criteria for pH and water activity, there are other recognised criteria for assessing the shelf stability of processed meats<sup>1</sup>. *L. monocytogenes* is considered not to grow in cured and/or dried meat products with the following characteristics:

- pH  $\leq 5.2$  and water activity  $\leq 0.95$  or
- pH  $< 5.0$  or
- Water activity  $< 0.90$

Businesses will be required to provide evidence of any of the above to demonstrate that the RTE food does not support *L. monocytogenes*. This can include:

- laboratory analysis for pH and water activity – the laboratory analysis would need to be reconfirmed should the product formulation or processing steps change. Further, it would be expected that the analysis be repeated at least yearly.
- product specification – verification that the product has a refrigerated shelf-life of no greater than 5 days or is a frozen food.

## Growth rate

If none of the above applies, the Food Standards Code, Standard 1.6.1 also allows RTE products where the growth of *L. monocytogenes* is limited as being regarded as not supporting the growth of the microorganism: This includes:

- Where the level of *L. monocytogenes* will not increase by greater than 0.5 log cfu/g over the foods stated shelf life
- Where the product does not receive a listericidal process, the level of *L. monocytogenes* does not exceed 100 cfu/g within the expected shelf life.

Where businesses intend to use limited growth rate, business will be required to provide evidence that it meets the above criteria. Further information on how this can be achieved can be found in the FSANZ publication, Guidance on the application of microbiological criteria for *Listeria monocytogenes* in RTE food, which can be found on their website.

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<sup>1</sup> Leistner and Rodel; ICMSF, MLA Guidelines for the safe manufacture of smallgoods

## Appendix 2: Controlling *Listeria monocytogenes* in the food processing environment. Guide for the development of an environmental monitoring program

### Glossary

*High risk areas* – areas within a facility where ready-to-eat foods are handled or packaged.

*Listericidal step* – a process step capable of reducing the amount of *L. monocytogenes* that may be present in food to a safe level.

*Listeriosis* – illness caused by ingestion of *L. monocytogenes*.

*Low risk areas* – areas within a facility before the final critical control point specific for *L. monocytogenes* is applied; generally it is where the raw ingredients, materials and intermediary products are handled.

*Niches* – sites within the food processing environment where *L. monocytogenes* becomes established and grows (e.g. hollow rollers on conveyers, space between close fitting parts, cracked seals and valves).

### Purpose

This document provides guidance to food businesses on how to develop an environmental monitoring program for the detection of *L. monocytogenes* in the manufacturing environment.

### Scope

The guidance has been developed for businesses producing ready-to-eat (RTE) foods where:

- The food does not receive a listericidal step; or
- After a listericidal step, the food is further processed, handled or packaged.

Businesses producing ready-to-eat meat products should refer to the document '*National Guidelines – Pathogen Management Regulatory Guidelines for the Control of Listeria*' (2008) published by the Meat Standards Committee.

Businesses producing ready-to-eat dairy products should refer to the document '*National Guidelines – Pathogen Management*' (ISFR, n.d).

While those documents provide information on controlling *L. monocytogenes* in the environment, the principals involved in implementing an environmental monitoring program are generic and consequently can be applied to the detection of other food-borne pathogens such as *Salmonella*.

### What is *Listeria monocytogenes*?

*L. monocytogenes* is a bacterium that is commonly present in the environment and in food processing facilities operating at chill temperatures. This means that it can be found in many raw foods including fruits, vegetables and meats. It is a recognised foodborne pathogen and is of particular concern for some people within the community including pregnant women, infants, the elderly and adults with a lowered immunity (e.g. organ transplant patients, HIV/AIDS patients, cancer patients and those on corticosteroid medication). In these people, listeriosis can result in severe illnesses, with mortality rates as high as 35%. For pregnant women, infection may also result in



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spontaneous abortion or stillbirths. In otherwise healthy people, and where present in food at high levels (e.g.  $>10^7$  colony forming units per gram), the bacteria can cause a mild self-limiting illness (e.g. vomiting and diarrhoea).

*L. monocytogenes* presents a problem for chilled RTE foods as it has been shown to grow at temperatures as low as  $-1^{\circ}\text{C}$ . It has also been shown to grow at temperatures up to  $50^{\circ}\text{C}$ . It generally doesn't tolerate acidic environments with the minimum pH for growth being 4.4. *L. monocytogenes* is generally not that very heat resistant and pasteurisation treatment ( $71^{\circ}\text{C}$  for 15 seconds) is sufficient to destroy vegetative cells.

Further information on the growth of *L. monocytogenes* in chilled foods can be found in Appendix 1.

## ***L. monocytogenes* in the processing environment**

*L. monocytogenes* is a problem in the processing environment because it forms biofilms which are difficult to dislodge during cleaning and provide protection against sanitisers for internal cells in the biofilm.

While a listericidal step is important for eliminating *L. monocytogenes* during the processing of foods, controlling *L. monocytogenes* in the processing environment is important for preventing post-processing contamination in these foods. Evidence has shown that when *L. monocytogenes* is detected in processed RTE foods, this is often due to recontamination after processing. For RTE foods that do not receive a listericidal step, controlling the processing environment is important to minimise the potential for these foods to become contaminated.

While end product testing remains an important part of producing RTE food, it becomes of little value for assessing and verifying control due to the low prevalence and sporadic nature of *L. monocytogenes* in the products. Also, if a product is found to be positive, there is no information on the mode of contamination or how to prevent further occurrences.

Therefore, an environmental testing program targeting *L. monocytogenes* and taking appropriate action when *L. monocytogenes* is detected, is a better, more cost-effective measure to minimise and prevent the risk of product being contaminated.

The general strategies of an environmental program are

1. Prevent the establishment and growth of *L. monocytogenes* and other *Listeria* spp. in the food processing environment, especially on food contact surfaces and surfaces near exposed foods.
2. Implement a sampling program to assess whether the processing environment is under control.
3. Respond to positive environmental test results to eliminate *L. monocytogenes* from the processing environment.
4. Further sampling to verify that the environment after cleaning & sanitation is now under control.
5. Review of overall results monthly to detect problems and trends.
6. Review of overall results quarterly to assess wider trends and measure overall progress towards continuous improvement.



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## General control

Before designing an environmental monitoring program, it is important to ensure the fundamentals of good hygiene practices and good manufacturing practices have been adequately addressed. These form part of the supporting program for a HACCP-based food safety program and assist with control of *L. monocytogenes* and other *Listeria* spp.

### Incoming materials

All raw materials entering the processing areas are a potential source of *L. monocytogenes* contamination. These include ingredients, packaging materials, additives, processing aids and other chemicals. Some important points to consider:

- Unpacking of incoming products (e.g. to minimise contamination of packaging into production areas).
- Purchasing product from reputable businesses that have a food safety program (FSP) or quality system in place for *L. monocytogenes*.
- It may be necessary to periodically test incoming product for *L. monocytogenes*.

### Facility location, design and structure

The facility location, design and structure play a big part in controlling *L. monocytogenes* in the processing environment, especially for RTE foods that require post-processing handling and packaging. Facilities that are not specifically designed for these processes need to have exceptional controls on the systems. Some important aspects include:

- The areas around the facility should be sealed, adequately drained and maintained in a clean and tidy manner.
- The internal area of the facility should be designed to facilitate cleaning & sanitation, have sufficient drainage and not allow the pooling of water. This is especially important in high risk areas.
- Where possible, there should be a physical separation between low risk and high risk areas. Where this is not possible, procedures should be established to prevent cross-contamination from people, materials and equipment from low risk to high risk areas. Positive air pressure system in high risk areas may need to be considered. Adequate decontamination facilities between high and low risk areas also need to be installed.
- There should be sufficient space between equipment to allow both the facility and equipment be effectively cleaned and sanitised.
- Overhead fixtures and equipment where dust and foreign matter can accumulate should be avoided, especially in high risk areas.
- Doors and windows, especially in high risk areas, should be appropriately sealed.
- If renovations occur, normal production should be discouraged. If production continues, consideration should be given to create a physical barrier between the two zones. There would also be the need to increase the frequency of cleaning and sanitation and environmental monitoring. Increased food testing should also be considered.



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## Equipment design

It goes without saying that all equipment, especially in high risk areas, should be appropriate for use and of good hygienic design and construction. The equipment should be maintained in a good condition and parts replaced when worn or damaged. Some points to consider:

- Dead spaces should be avoided as they may permit the build-up of ingredients or product and are difficult to clean and sanitise.
- Product contact surfaces should be smooth and non-porous.
- Leaking taps, hoses and water/steam/condensate lines should be repaired as they can be a source of contamination into the environment and food contact surfaces.
- Cooling units, refrigerators and insect control devices should not be placed above any product processing or production area. Processed product should not be exposed to contamination from above (e.g. condensate on overhead pipes).
- Hands-free taps on equipment such as hand basins and footbaths are encouraged.
- Lubricants should be of food grade and consider the need for additives (e.g. sodium benzoate).

## Cleaning and sanitation program

Effective cleaning and sanitation are vital to control and eliminate *L. monocytogenes* and other microorganisms in the processing environment.

Cleaning and sanitation should be seen as two separate operations:

- Cleaning – the removal of waste, dirt and grease from equipment, premises and vehicle. It can include dry cleaning or wet cleaning with the use of detergents.
- Sanitation – the process of reducing the number of microorganisms present on equipment and within the premises. It can include the use of chemicals, hot water or steam.

The manner in which equipment and the processing environment is cleaned and sanitised depend on many factors and the program should be tailored to the individual businesses. Important points to consider include:

- Standard Operating Procedures for the cleaning and sanitising program, especially for high risk areas, is essential to ensure the program is effective.
- All staff needs to be trained and understand the importance of the program. A training register should be kept.
- The program needs to include all equipment and items that are used by the business in the processing environment.
- Food transport vehicles also need to be included.
- Cleaning and sanitation equipment should be appropriate for use.
- Detergents and sanitisers should be appropriate for use in the food processing environment and used as per the manufacturer's instructions, including concentration. Consideration should be given to rotating sanitisers to ensure optimum efficacy in reducing microbial numbers, and the chemical supplier's advice should be sought.



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- Equipment should be thoroughly cleaned and sanitised after any maintenance or repair work has been undertaken and before being used in production.
- Advice should be sought from equipment manuals or suppliers regarding the extent to which equipment should be dismantled to enable its adequate cleaning and sanitation.
- Particular types of wet cleaning, such as pressure spray hoses, should be avoided during production times as there is a potential for droplets to contaminate the product, or for spray to splash from the floor or drains on to the equipment. However, if wet conditions are normal for production areas, periodic foaming or flooding of floors with sanitisers is recommended.
- Dry cleaning should be considered during production times where there is a build-up of waste or debris.

### Personal hygiene

Good personal hygiene practice is vital in all food processing facilities as it prevents the cross-contamination of food from people and equipment. For businesses producing RTE products that receive post-processing handling or packaging, it is especially important. Businesses should ensure they follow the requirements of the *Australian New Zealand Food Standards Code* (the Code). Other points to consider include:

- All staff, including non-food handlers, should be trained in and follow good personal hygiene practices.
- Additional training should occur for all staff working in high risk areas.
- Visitors should also follow good personal hygiene practices.
- Hands-free taps on hand basins and footbaths should be considered especially in high-risk areas with access to soap solution and drying equipment.
- Personal protective equipment/apparel such as disposable aprons, gloves, hairnets and beard nets should be used by all people entering the processing environment. Alternative colour coverings should be considered for high risk areas. Waterproof boots should be worn by processing staff working in wet areas, and foot baths containing a sanitising solution should be located at the entrance to the manufacturing areas.
- Direct access to high risk areas from low risk areas should be avoided.
- When entering high risk areas from low risk areas, hand and boot washing and sanitation facilities should be available and used. Complete change of protective personal equipment (PPE) is required.



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## Environmental monitoring program for *Listeria*

As mentioned previously, an effective environmental monitoring program can prevent the establishment and growth of *L. monocytogenes* in the processing environment thereby preventing it from becoming a source of contamination in food. The purpose of the environmental monitoring program is to detect *L. monocytogenes* before it enters the product. The program should be designed to find any *L. monocytogenes* that may be present, followed by action to remove it from the environment.

The program should be seen as an investigative program in that the detection of *L. monocytogenes* means the program has been successful in identifying the source of contamination thus allowing its elimination. An environmental monitoring program where *L. monocytogenes* is not detected does not mean that the processing environment is free from *L. monocytogenes*. It may mean that the design of the program is not sufficient to detect the microorganism and thereby not preventing the establishment or growth of the microorganism.

### Design of environmental monitoring program

The design of the environmental monitoring program is specific to an individual business and should be risk-based, taking into account the prior history of a facility with respect to *L. monocytogenes*, target consumers and the complexity of the processing environment. The program involves sampling sites across the processing environment to determine the presence of *L. monocytogenes*.

### Sample sites

Generally sample sites are categorised based on their ability to come in contact with food as shown in **Table 7**. The selection of sites should be based on risk assessment, and biased toward areas where *L. monocytogenes* may be present or those where niches are known to occur. Further, the sites tested at each sampling period should be chosen to ensure all sample sites are included over time.

**Table 7: Classification of environmental sampling sites as part of an environmental monitoring program**

Priority	Examples of sample sites within the priority zone
Zone 1 – food product contact surfaces	Slicers, dicers, hoppers, seals, gaskets, filling heads, mixers, storage vats, feeders, spiral freezer, conveyors including rollers, tables, benches
Zone 2 – non-food product contract surfaces	Floors, walls, ceilings, drain outlets, cold rooms, switches, floor joints, crevices, pools of water, condensate from refrigeration evaporators

### Number of sites and frequency of sampling

Sampling should be determined based on type of product, size of facility/production, number of staff and resources. The minimum requirement, even for the smallest processors, is five samples across both zones at one time, preferable three sites in Zone 1 and two sites in Zone 2. In an ideal environmental monitoring program, *L. monocytogenes* should be detected and subsequently eliminated in Zone 2 preventing the contamination of Zone 1.



**Table 8. A guide for frequency of sampling**

Type of products	Frequency
Foods that can support the growth of <i>L. monocytogenes</i> and the shelf life is greater than 5 days	weekly
Foods than cannot support the growth of <i>L. monocytogenes</i> or the shelf life is less than 5 day	fortnightly

Appendix 1 provides an overview of growth in *L. monocytogenes* in foods.

### Method of sampling

Sampling should occur by swabbing sites using sterile moistened swabs or sponges. An overview of environmental swabbing can be found in the NSW Food Authority's publication '*Environmental swabbing: A guide to method selection and consistent technique*' (2013b). Written procedures should be developed detailing how to conduct the swabbing and all staff should be trained in the procedures, ensuring swabs are not contaminated by the person conducting the swabbing or from other surfaces not swabbed.

### Testing of samples

All samples need to be tested for *L. monocytogenes*. Testing for *Listeria* spp. could be considered as results will be available sooner, although this should be weighed up with the fact that *Listeria* spp. will be more frequently detected in the processing environment compared to *L. monocytogenes* resulting in corrective action being required more often.

Samples can be tested at a laboratory that has accreditation by the National Association of Testing Authorities (NATA) for testing of *L. monocytogenes* in environmental samples. An alternative is the use of certified rapid test kits. These kits require minimal equipment outlay, are easy to use and are relatively cheap (approximately \$10 per test). Only kits that have been certified using International Standard Organisation (ISO) methodology or have approval by the Association of Analytical Communities (AOAC) should be used. Kit suppliers should be able to provide advice on the type of certification or approval their kits have. If rapid test kits are used, it is recommended that samples are sent to a NATA-accreditation periodically for verification.

### Actions due to positive results

When *L. monocytogenes* is detected in an environmental sample, corrective actions should commence immediately to eliminate it from the environment. The corrective actions taken due to a positive result should be documented as part of the HACCP/ food safety program and treated as a whole system approach.

Whenever there is a positive environmental sample for *L. monocytogenes* from either Zone 1 or Zone 2 surface, the business shall increase the frequency of environmental testing to daily until three consecutive negative results are obtained. The purpose for increase testing is to monitor the effectiveness of the corrective action undertaken. Consideration should also be given to whether the frequency of environmental testing or the sites of testing need to be altered for the future.



At a minimum, the following should occur (see Figure 1):

*Zone 1 sites positive results:*

1. Production should cease immediately.
2. The surrounding area and equipment are cleaned and sanitised.
3. All batches of product produced since the day of swabbing should be tested as per Standard 1.6.1 of the *Australian New Zealand Food Standards Code*. If the products are positive for *L. monocytogenes*, depending on whether they can support the growth of *L. monocytogenes* or not, appropriate actions should be taken (see Figure 1)<sup>1</sup>.
4. Prior to recommencing production, swabbing is repeated (Zone 1 and 2)
  - a) Negative result – recommence production, increase environmental monitoring.
  - b) Positive result – dismantles all equipment and conduct a deep clean of area and equipment. Reassemble equipment and sanitise. Repeat swabbing, cleaning and sanitising until negative result obtained. It may be necessary to test sites other than the normal environmental monitoring sites in order to determine the source of contamination with *L. monocytogenes*.

*Zone 2 sites positive results:*

5. The implicated areas are cleaned and sanitised.
6. Prior to recommencing production, swabbing is repeated (Zone 2)
  - a) Negative results – increase environmental monitoring.
  - b) Positive results – conduct a deep clean of area. Repeat swabbing, cleaning and sanitising until negative result obtained.

## Review of results

The overall results should be reviewed at least monthly and quarterly to detect problems or trends over the period. This can be achieved by recording results on a map of the facility and examining to see if there are areas or equipment where contamination is re-occurring. If problem areas or equipment are identified, a concentrated effort of monitoring around the area may assist with identifying the source of contamination. Further, a thorough cleaning of the area may be needed to eliminate any potential source. The environmental monitoring program may require modification to ensure that these problem areas are swabbed more frequently, especially if they are considered to be high risk food contact sites.

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<sup>1</sup> Refer to Standard 1.6.1 of the Code and also the FSANZ 'Guidance on the application of microbiological criteria for *L. monocytogenes* in RTE food'.

If the product needs to be recalled, see FSANZ website on conducting a recall (<http://www.foodstandards.gov.au/industry/foodrecalls/conduct/pages/default.aspx>)

## Product testing

End product testing for *Listeria* is a useful activity that forms part of the verification of the control measures. Product testing alone is not sufficient to demonstrate the safety of food because it has a high probability of not identifying contaminated product even when large sample numbers are tested. Keep in mind that if product contaminated with a low level of *Listeria*, not all units in the batch may be contaminated.

Food should be tested according to Standard 1.6.1 of the Code. The Standard specifies the microbiological safety criteria for certain foods, including the sampling plans and limits. Foods that fail to meet those limits may pose a risk to human health and must not be offered for sale.

## Conclusion

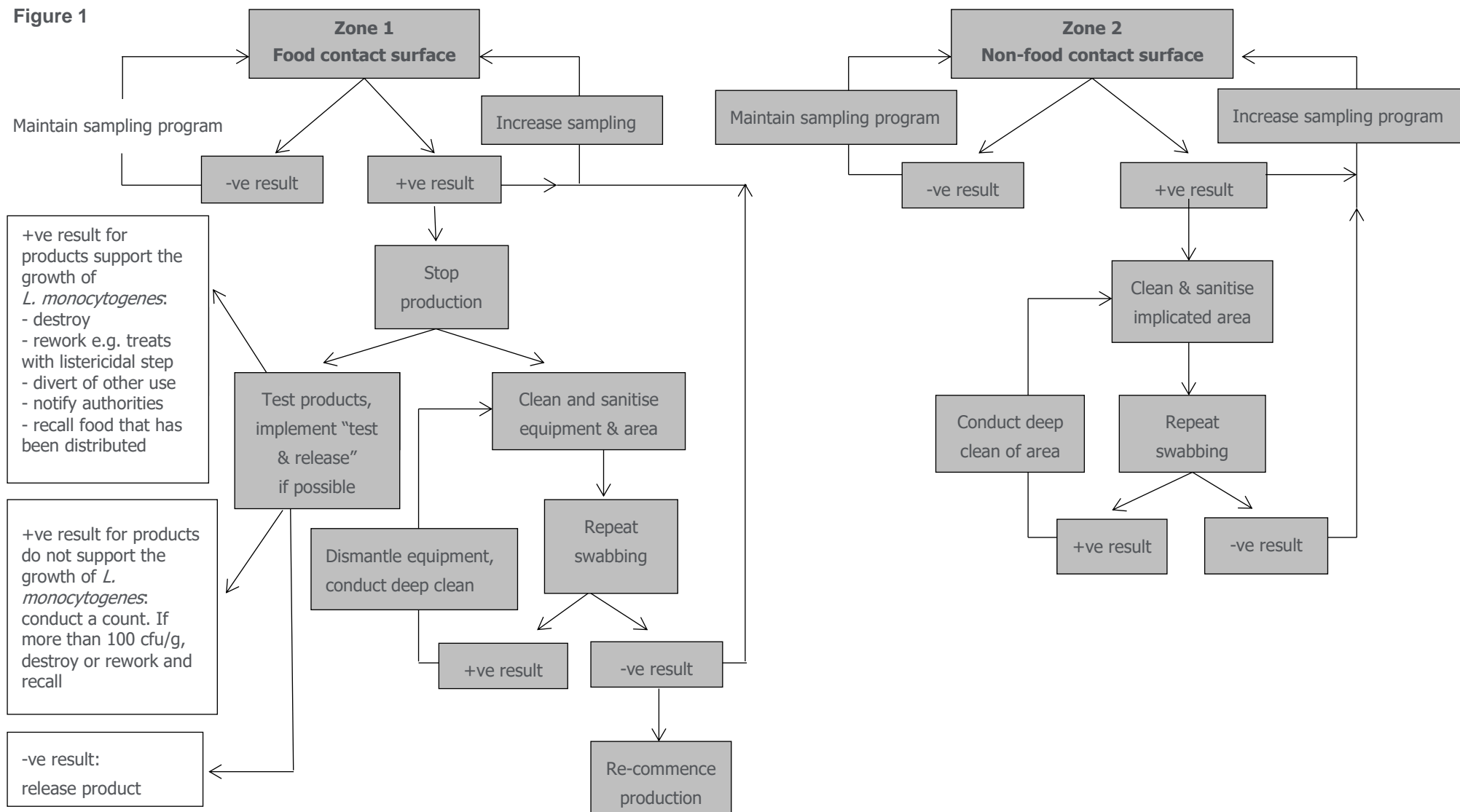
The adoption of a testing program that encourages frequent and targeted testing of *L. monocytogenes* in the environment, followed by appropriate corrective actions for positive results will result in a better consumer protection. It may also provide a financial benefit due to reduction in product losses, or loss of confidence in the brand and subsequent financial loss following a product recall.



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Figure 1



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