Controlling *Listeria* in the Supply Chain

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This guidance was originally developed by Tom A. E. Hollands and Karolina Rustkowska of Raynor Foods who were awarded the BSA Technical Excellence Award for it in 2015. The current version has been subject to detailed scrutiny by leading experts from the sandwich and food-to-go industry as well as both the Food Standards Agency and Public Health England.

Main Authors: *Tom Hollands CSci FIFST BSc (Hons), Karolina Rutkowska MSc BA (Hons) (Raynor Foods) and Dr Sally Higgins (British Sandwich Association).*

Contributors: *Nigel Richards (ALS), Gary Hilton (Byotrol), Gen Frost (Waitrose), Nicola Wilson (Westward Laboratories), Dr John Holah (Holchem), Kaarin Goodburn (CFA), Norma Fennemore (Bradgate Bakery), Peter Cleghorn (Adelie Foods), Andy Muirhead (ALS), Greg Hunn (Greencore).*

Introduction

This guidance has been produced from advice and research available in the public domain. We have drawn together multiple sources of information to help assist management and their individual supply chains to reduce and control *Listeria* in Ready to Eat (RTE) chilled foods. The guidance is aimed at enhancing and building upon existing HACCP systems.

This guidance takes a realistic practical approach. It accepts that *Listeria* can never be fully removed from food processing environments, but also states that all members of the supply chain have an equal responsibility to help reduce the incidence of *Listeria*.

Within the supply chain of RTE foods the final manufacturer (the last link in the supply chain where the food product is made and deemed ready for consumption), is where the majority of the risk of *Listeria* contamination can occur. For this reason, our guidance offers practical and scientifically backed advice for the final manufacturer and the other members of the supply chain.

It is vital that the final product manufacturer and its suppliers of ready to eat ingredients have robust monitoring regimes and systems for both the foods they produce and the production environments and investigate and rectify each and every *Listeria* detection.
The guidance MUST be incorporated into your HACCP system that must clearly identify where you are supplying product to the health service.

Sandwich producers MUST foster relationships up and down the supply chain, to embrace the principles of this guidance document, and encourage their suppliers to embrace them as well. **Compliance is a prerequisite for supply to health care settings.**

We hope you find this guidance useful and welcome any feedback to further enhance the advice we have provided, please send comments to the British Sandwich Association.

The British Sandwich & Food to Go Association
18c Moor Street
Chepstow NP16 5DB
Tel: 01291 636338

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Introduction to *Listeria*

Listeria, specifically *Listeria monocytogenes* is widely dispersed in the environment and is commonly found in food processing plants[1]. It is a food poisoning pathogen that can cause serious and sometimes fatal consequences in humans, especially vulnerable individuals such as the elderly and immunocompromised (people with a weakened immune system)[2].

EFSA recently reported that most cases of listeriosis (>95%) are attributed to *Listeria monocytogenes* doses of greater than 1000 cfu/g[3] (colony forming units per gram i.e. the number of viable bacteria per gram), the minimum infective dose is thought to be less than 20 cfu/g in very vulnerable individuals[4] with an incubation period of 1 to 90+ days[5].

Listeria is ubiquitous in the environment, so it is extremely challenging[6] to eradicate it completely from food processing environments[7]. This is further compounded by many of *Listeria*'s characteristics:

Biofilm formers *Listeria* can produce a protective film known as 'biofilm'[8]. This film acts like a glue and protects the bacteria from being readily removed by surface cleaning and chemical cleaning treatments.
A biofilm can be produced relatively quickly and, even if the *Listeria* bacteria itself are killed, unless all traces of the film are also removed then *Listeria* can easily re-contaminate the film. *Pseudomonas sp*. are also prolific producers of a biofilm and *Listeria* has also been shown to co-habit this environment. Furthermore, bacteria protected by a biofilm are 100 times more resistant to cleaning chemicals[9].
Listeria biofilms will mainly form in harbourage sites where routine cleaning and disinfection will not access the biofilm (e.g. in conveyor webbing or equipment 'dead areas' e.g. bearings). Biofilms will not form on exposed food contact
surfaces subjected to thorough and effective interim and daily cleaning operations.

As biofilms are resistant to disinfectants, control is by exposing the biofilm to thorough cleaning with detergents and then disinfection, preferably with an oxidising biocide applied using the correct concentration and contact time.

Persistent– *Listeria* is adaptable when it comes into contact with hostile environments. It has been shown to be able to adapt to **sub lethal** doses of cleaning agents and develop a tolerance to them[10]. *Listeria* may persist within food factories harbouring for many years within the infrastructure of the processing equipment or environment often through poor hygienic design.

Psychrophilic (cold loving) – unlike many other pathogens, *Listeria* continues to grow at cold temperatures (-1.5°C), albeit slowly[11]. Psychrophiles are characterised by lipid cell membranes chemically resistant to the stiffening caused by extreme cold, and often create protein 'antifreezes' to keep their internal space liquid and protect their DNA.

Pernicious – even very low levels of *Listeria monocytogenes* contamination in foods (<20 cfu/g) can cause Listeriosis in **susceptible** individuals such as pregnant women, and the immunocompromised (people with a weakened immune system e.g. HIV and Cancer patients.)[4].

There are a number of different species of *Listeria*, of which only one (*Listeria monocytogenes)* is regarded as pathogenic[12]. However, as all strains of *Listeria* require similar survival conditions, and the presence of one type does not exclude the presence of others, it is ***strongly recommended*** that if a non-pathogenic species is identified, a deep

cleaning regime is actioned in a similar manner to that you would undertake if you found a pathogenic strain. The experience from sandwich industry over the last 30 years shows that our factories will support the survival and growth of *Listeria*.

All species of *Listeria* are now considered to be transient and can enter factories individually and do not enter routinely as clusters.

This does not require formal notification to the local authority but does require internal investigation.

If *Listeria monocytogenes* is detected however, a deep cleaning regime **is required** targeting the source or potential harbourage point, with post-hygiene swabbing being carried out confirming that it has been eradicated. This should then be re-verified 6-8 weeks later to confirm continued effectiveness.

Listeria is destroyed by temperatures above 70 $^{0}C^{C}$ for 2 minutes referred to as 'heat treatment' [3]. Thereby, foods which are chilled ready to eat (and do not receive a heat treatment or an organoleptic reheat just prior to consumption), are a more common source of infection[2].

Note – an organoleptic reheat may not reach the time or temperature to kill listeria.

Examples of ready to eat foods include pâté, soft cheese, smoked meats and fish, cooked meats, cured meats, fruit, vegetables and herbs as well as ready to eat products that might contain these ingredients (such as sandwiches) [1 2 4 5 6 11 14]. It is important to note that combining ingredients on which *L. monocytogenes* may be present but not actively growing (e.g. salad leaf), when combined with other, especially proteinaceous, ingredients, will generally trigger growth.

Foods that are stored at or below $5^{0}C$ and have a long shelf life and are not heat treated or are prone to contamination post heat treatment, have a high-water activity and low acidity levels (greater than pH4.4), provide perfect conditions for *Listeria* to flourish. For this reason, these foods are categorised as high risk foods[6 15] and should be handled with High care.

The EU Microbiological Criteria for Foodstuffs Regulation (2073/2005/EC) states that foods are not considered to support the growth of *Listeria monocytogenes* if[15]:

- Their pH is less than or equal to 4.4 or
- Their water activity is less than or equal to 0.92 or
- Their pH is less than or equal to 5.0, with the water activity being less than or equal to 0.94

1) As *Listeria* is found in soil and water, plants that grow in the soil can be contaminated with *Listeria*[12 16]. Onions, red onions, spring onions and shallots are particularly prone to *Listeria* as the bacteria survives in the layers of the bulb and are extremely difficult to fully remove during further processing[16]. It is appropriate to monitor ingredients from suppliers for the presence of *Listeria* and react with interventions to eliminate/reduce opportunities for product contamination on any detections. This shows due diligence with respect to serving the end customers.

Developing an in-house strategy for the control of *Listeria* MUST go hand in hand with your HACCP system. Typically, a HACCP programme will include a number of CCPs that are "critical" to the process of food production. Additional Pre-requisites (PRPs) to the system are ensuring measures are in place to provide the basic environmental and operating conditions that are necessary for the production of safe and wholesome food. These include, for example, cleaning and disinfection and personnel hygiene. However, typically the controls in place extend only to ensuring cleaning procedures are in place and check-sheets for inspections to be recorded; some may also use ATP as an indicator of the cleanliness and environmental swabbing to provide added reassurance. Despite these measures most processing facilities will encounter *Listeria* within their environment and sometimes within finished product from time to time. *Listeria* control requires an in-depth study of the pre-requisites identified.

Listeria risk areas can be reduced or even eliminated providing a more secure environment for sandwich production. Typically, this is referred to as a High Care environment and is defined as:

"An area designed to a high standard where practices relating to personnel, ingredients, equipment, packaging and environment aim to minimize product contamination by pathogenic micro-organisms".

In the processing environment it is important to not only minimise cross-contamination of food safety hazards into the product, but also to control cross-contamination within the processing environment. There are several routes by which pathogenic bacteria can enter food processing areas; the external environment via the air, water, raw materials and people (workers and visitors). Once within the processing environment pathogens can be temporary or sporadic (being present until they lose their viability) or are removed through cleaning and disinfection, or they may persist for long periods of time.

When they do persist, it is generally because they survive in a harbourage point and are protected from the actions of cleaning and disinfection. This may be due to poor hygienic design of processing equipment or damaged areas of the fabrication of the buildings, reducing the ability to effectively clean and disinfect. Where these areas have a food source, water and oxygen they will readily support growth of *Listeria*; even temperatures of 5°C or less than freezing (-1.5°C)[22] will support slow growth. Harbourage points can therefore act as a potential **SOURCE** of contamination. In order for *Listeria* to move from the source harbourage point to other locations (including to product) they need a **VECTOR** to transfer the pathogen from one place to another, for example through water droplets, air, physical objects and people. It should be noted that cross contamination usually involves a number of events with a number of vectors being involved. An engineer may for example contaminate his hands through the interaction with a source (harbourage point), subsequently transfer contaminants to a tool and then via the tool to a food contact surface. Alternatively, there may only be a single vector e.g. contaminated water droplets from an evaporator unit dripping directly onto stored product in a chiller, or a slicer spreading contamination to the food it is slicing[23].

Potential *Listeria* sources and cross contamination vectors in a processing plant MUST be identified by detailed physical examination of the processing environment and may involve microbiological sampling. These sources and vectors may involve a specific processing step (e.g. contaminated harbourage point within a mixing machine) or may affect the process as a whole (e.g. a contaminated air source). In much the same way as you establish the process flow of product for your HACCP a similar exercise MUST be conducted using a multidiscipline team to walk the line and examine equipment and the environment for potential sources of contamination. This MUST involve the dismantling of equipment to identify potential harbourage points as well as a physical inspection of the environment and building structures. Although historical microbiological data may be useful it should be noted that negative test results for a pathogen does not indicate that the site is not a potential source for other pathogens, or that it could become a potential source in the future and especially if there are identified hygiene design faults. Interviews of line operators, maintenance staff, quality personnel and personnel responsible for plant hygiene may also be helpful in determining potential cross-contamination sources and vectors. It is unlikely that the sampling of vectors would be helpful, as the likelihood of observing a pathogen on a potential vector would be very small unless there is gross contamination (e.g. as has been observed on captive footwear inadequately washed and sanitised in badly managed boot washers). Identification of the potential sources and their vectors MUST be incorporated into your food safety plan and specific measures taken to limit potential sources and reduce the opportunity for vectors to cause cross-contamination. These measures MUST then become part of the pre-requisite programmes operated alongside the CCPs of your HACCP plan. Where the risk of contamination to the finished product is deemed to be high these critical points are generally termed Operational Pre-requisites (OPRPs) and they require the establishment of control limits (or operating limits), monitoring activities and corrective actions where a control limit is not met. These MUST then be reviewed in the same way as the CCPs for your food safety systems.

Certain places in a building will be more prone to *Listeria* contamination than others. Areas where there is sitting water, damp or condensation (such as drains, sink holes, floors, walls and ceilings) are especially susceptible to *Listeria* contamination[1]. These areas can provide harbourage points that can act as a **source** of contamination. Furthermore, items that come into direct contact with these areas will also be prone to contamination, for example brushes, mops,

scrapers, pipe cleaners and even the bottoms of bins. These in turn can assist the spread of bacteria and act as **vectors** for cross contamination of product either directly on food contact surfaces or through air, condensate, splashes etc. [22]

We have provided a non-exhaustive list of typical areas (either sources or vectors) which have been commonly highlighted in the literature as being prone to *Listeria* contamination, these are:

General Areas

- Walls and doors
- Floors
- Ceilings via condensation from the ceiling
- Air vents, cooling fans, air handling units (where there are condensing units allowing water to accumulate) and also the air can act as a vector dispersing small water droplets contaminated with *Listeria*.
- Sinks and taps
- Drains
- Leaking pipes
- Refrigerated storage units and chillers
- Waste areas

Equipment

- Difficult to clean, dead areas, harbourage sites (e.g. grease traps)
- Cleaning equipment, such as: boot washing machines, floor cleaning machines, brushes, squeegees, dishwashers (including parts recognised as dead areas: rims, handles, nozzles, perforated surfaces)
- Cracks in equipment or surfaces (e.g. in the tables)
- Conveyer belts (especially in biofilms in exposed conveyor webbing or hollow rollers)
- Equipment used to prepare food (e.g. knives, cutting boards)
- Slicers (e.g. meat slicer)
- Packaging equipment (e.g. vacuum packing machinery)
- Equipment used to transport and store food (storage crates, wheels used to move crates, racks)
- Dispensers (e.g. soap, hand towels, hand sanitiser) at hand contact points with the dispenser
- Bins and other waste contact surfaces e.g. waste hatches
- Equipment control panels and hand touch points
- Door Handles,
- Machine cables
- Rubber seals

Personnel

- Poor personal hygiene e.g. improper hand washing
- Employees can be natural carriers of the pathogen (up to 10% of UK population are thought to be carriers of *Listeria* within their gut without showing any symptoms[2]), and they can spread the bacteria for example by inadequate hand washing after using the toilet.

- Dirty uniforms
- Personal belongings brought to production areas e.g. phones
- Employee footwear

Materials

- Raw food, such as: fruit and vegetables, meat, poultry, seafood
- Outer packaging of raw materials
- Food grade lubricants

Controlling *Listeria*

Effective monitoring and controlling of *Listeria* should be a common goal throughout the supply chain. Each link in the supply chain MUST be proactive in monitoring *Listeria*, and put controls in place to reduce the likelihood of passing *Listeria* down the supply chain.jo

There are three main areas where *Listeria* growth is a possibility in the ready to eat supply chain:

The Suppliers of Raw Materials – Every supplier who provides the ready to eat raw materials that go into the final product.

Final Manufacturer – The manufacturer who makes the actual ready to eat product, for example a sandwich, prepared salad or pack of sliced ham.

Customer supplying consumer – The outlet where the product is sold to the consumer. This could be a café, coffee shop, school, hospital or supermarket etc.

Fundamental Supply Chain Principles

There are 3 key principles that should underpin all the actions each member of the supply chain takes:

1) **Acceptance** – *Listeria* is present in our environment (and sometimes in products and raw materials) and can never be fully eradicated. However, knowing it is there means we MUST vigilantly take actions to reduce the chance of creating a persistent source of contamination.
2) **Responsibility** – We are equally responsible for controlling *Listeria*, regardless of where we are in the supply chain.
3) **Proactive** – *Listeria* is very good at adapting to the local environment, so we MUST continuously challenge our systems and environments. What works today may not work tomorrow.

We encourage businesses to embrace these principles and to foster relationships both up and down their own supply chains so as to encourage everybody within the supply chain to embrace these principles too.

The next part of this guidance document examines specific members of the supply chain and the additional controls that MUST be put in place to monitor and reduce the incidence of *Listeria*.

Supply Chain - Suppliers of raw materials

Definition - *A supplier is an organisation that supplies your business with materials or a service which enables you to carry out your business's functions. For the purpose of this guidance, a supplier is defined as an organisation that supplies you with food or food contact packaging.*

The supplier can further be spilt up into three main categories:

1) **Primary producer** – examples include farmers and growers (agriculture) and fishermen. This type of producer supplies foods unprocessed or with minimal processing, that is harvested, reared or caught from nature.
2) **Processor** – A processor brings in raw materials, typically from the primary producer and processes them into food products or food contact packaging. This is broad category and covers millers, chilled food processors, bakeries, diaries, slaughterhouses and packers etc.
3) **Storage and distributors** – these types of suppliers hold food (but do not produce either the food or food contact packaging) and delivers it between members of the supply chain. Examples include warehouses and transport firms.

Primary Producers – primary producers deal directly with the natural environment and so inevitably will have high levels of *Listeria* spp. in their environments[16]. There are three main aims that primary producers MUST achieve:

1. To identify which areas/processes/foodstuffs are prone to harbouring *Listeria* and monitor/review them.
2. To then set target levels and put in place controls (or adapt current controls) to reduce the levels of *Listeria* in order to achieve those targets (at least to legal standards).
3. To identify route of contamination (principally from the environment) and instigate measures to reduce the risk of contamination. E.g. Washing and decontamination of baskets/trays used for harvesting.

Processors – processors source foods from primary producers, other processors and storage and distribution businesses. These processors prepare food ingredients that are eventually supplied to the final manufacturer. There is a large array of different manufacturing and processing methods within this group, and therefore individual businesses may operate enhanced *Listeria* controls depending on the nature of the business.

However, processors also act as gate blockers for *Listeria* and play a key role in helping the supply chain control *Listeria* contamination. **In addition** to sharing the Primary Producer's aims there are a number of other requirements that processors MUST meet:

1. All processors MUST aim to actively and aggressively monitor sources for *Listeria* contamination from their suppliers and react with interventions to eliminate/reduce opportunities for product contamination.

2. The processor should foster closer relationships with their suppliers, learning which foods and processors are prone to *Listeria* contamination and understanding how the supplier controls them. Processors MUST confirm in writing to their suppliers if they produce any high-risk foods or supply high risk consumers such as care settings, so they can take account of that when reviewing their own systems. Sharing best practice and knowledge is **essential** to keep ahead of the persistent nature of *Listeria*. For example, do your suppliers monitor the concentrations of cleaning chemical applied and the contact times? Are disinfectants verified as being effective in controlling *Listeria*? Sharing information ensures that your suppliers are working towards the same goals as you are.

3. All chilled storage areas including vehicles MUST be capable of keeping temperatures below 5°C (especially when fully stocked)[14 17]. It is, however, important that these places are cleaned and disinfected regularly since, if *Listeria* manages to attach to surfaces and grow biofilms, it will proliferate at temperatures below 5ºC.

4. Checks of these storage areas MUST be undertaken (at least three times per day) to verify temperatures and/or use data loggers. Temperature monitoring equipment MUST be calibrated at least annually and checked weekly.

5. This processor could also be equivalent to the final manufacturer, if the end product is ready to eat, therefore they need to have the same controls in place.

Storage and distributors – these types of suppliers rarely process foods and will only store and distribute foods and food contact packaging to their customer base. As such Storage and Distributor companies should aim for the following; All suppliers of food to the storage and distribution company should comply with the following control measures with respect to:

a) Ensuring chilled storage areas including vehicles are capable of keeping temperatures below 5°C (especially when fully stocked) [14 17]. Periodic checks of these storage areas MUST be undertaken (at least three times per day and based on risk associated with frequency of access/use) to verify temperatures. The temperature probes MUST be calibrated annually and checked weekly.
b) Developing an understanding of how internal activities may cause *Listeria* problems for their customers and then how these problems can be reduced. Examples of problems could be delivering in re-useable crates, pallets or containers that are stored outside and then enter the customer premises. Re-useable crates should be cleaned and disinfected prior to use and in a manner demonstrated to effectively remove any *Listeria spp*. present.
c) Are cleaning activities in warehouse areas or vehicles suitable for reducing *Listeria*? Note that dry cleaning in warehouses is best practice and provides a hostile environment for *Listeria* growth.

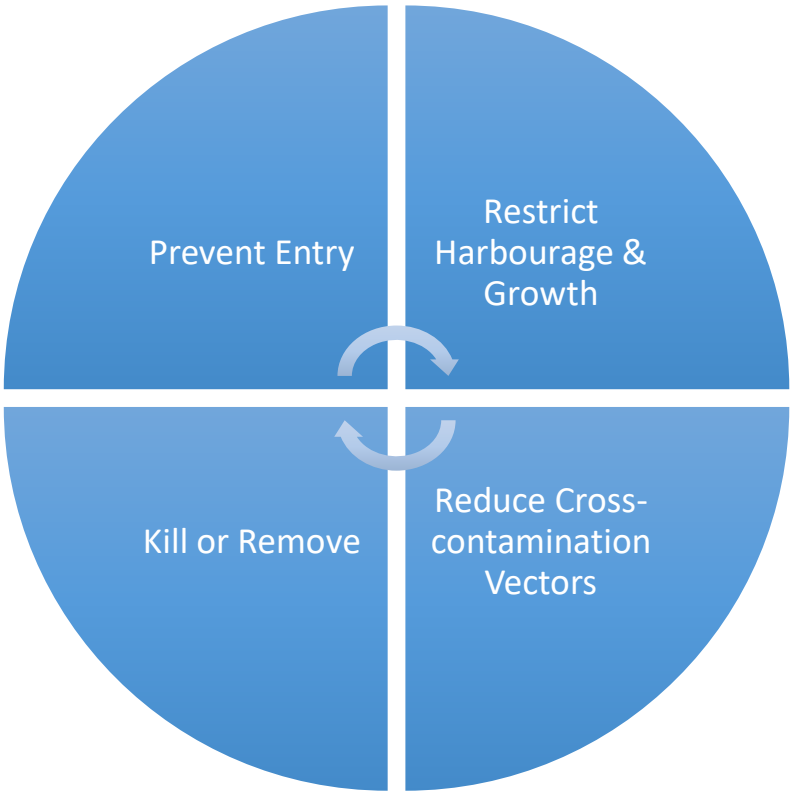
Final Manufacturer - For the purpose of this guidance, the final manufacturer is the last step in the supply chain where the food product is made and deemed ready for consumption.

*Please bear in mind that this part of the guidance **only** applies to foods that are ready to eat (including defrost and serve) and do not require a thermal kill step (to fully cook) before eating.*

If the food item is manufactured utilising ready to eat ingredients, and is heated by/for the consumer for enhanced eating quality only (e.g. panini, filled breakfast rolls, breakfast pots) and where this is not defined as a cooking stage, then guidelines for ready to eat foods are applicable.

There are three key areas which underpin the final manufacturer's control of *Listeria*. These are shown in the diagram that follows. These areas will typically form part of the final manufacturers HACCP and quality management system (QMS), so this guidance is aimed at enhancing and building upon existing controls, rather than creating them.

Principles of Controlling Listeria



Suppliers and the Supply Chain

Section	Guidance	Help
1.0	Ensure agreements are in place with each of your suppliers of ready to eat foods (excluding raw and unwashed fruit, vegetables & frozen **fruit, herbs and** vegetables), salads and herbs) the microbiological **target** for any foodstuffs with regards to *Listeria monocytogenes* is not detected i.e. Reported as <20cfu/g.) **When detected investigation and corrective actions MUST be taken and verified**.	This target can be stipulated in the food material specification. NOTE frozen vegetables require cooking to ensure they are "ready to eat".
1.1	Raw and unwashed fruit, vegetables, salads and herbs are particularly prone to *Listeria* contamination[16]. Ensure that these types of food are fully segregated during transport and preferably covered to reduce the chance of cross contamination. Monitoring is still required for the raw material and communicated to the supply chain, so further controls can be deployed.	Remember that these products are often grown in soil and so will have higher levels of bacteria.
1.2	Incorporate into your documented supplier approval process the following conditions: ✓ Through a documented risk assessment, has the supplier identified areas which are prone to harbour *Listeria*? If yes what are they? ✓ Has an effective cleaning and disinfection schedule been validated and verified? ✓ How are the identified areas monitored and at what frequency? ✓ Has the supplier set targets to reduce these levels? And how often are these reviewed? ✓ Does the supplier request the above 4 conditions of their own suppliers?	These questions can be asked in a due diligence questionnaire or by direct written correspondence. If answers are no, request supplier to operate all of the 5 conditions.
	Best Practice – Visit your supplier without prior notification, so your supplier can explain how they achieve each of these conditions, and you can review their systems and practices.	Ensure records are kept of the exchange.
	Request chemical information from your supplier on what cleaning chemicals are widely used on site: 1) What biocides are in the cleaning chemicals? 2) Are they suitable for killing *Listeria*? Ask for testing certificate 3) Are chemicals used as per the manufacturer's instructions, particularly concentration and contact time? 4) Are cleaning chemicals rotated to tackle biofilms? (The most commonly used chemical used to tackle biofilms is per acetic acid) 5) Ask for any chemical cleaning validation documents Ask for evidence of chemical concentration checks, including frequency and training certificates.	The suppliers cleaning chemical supplier can help with this section. Be wary that tests on the effectiveness of chemicals should be undertaken in "dirty" conditions. More guidance for cleaning chemicals is given in the cleaning section.

1.3	In addition to operating a first in first out system (FIFO), try to ensure that raw materials are used as close to their production date as possible. Ensure that raw materials' shelf life does not expire before that of the final product (sandwich).	This will reduce the potential growth period that *Listeria* in long shelf life foods has.
1.4	Ensure that suppliers store and transport RTE foods at <5°C (product temperature) [14] [17], and temperatures are verified at least daily. Review receipt of foods procedure and ensure your target acceptance limit is 0-5°C for chilled RTE foods[14] [17].	Keeping the chill chain at <5°C is a key control in limiting *Listeria* growth[14] [17]. (Note that it WILL still grow slowly so good hygiene is also key).
	Your Customers; Working alongside your customers to control and limit the growth of *Listeria* is a critical aspect of this guidance. You can assist your customer by offering them storage and handling information: • Provide guidance that RTE chilled products MUST be stored and transported <5^{o}C for the duration of the product shelf life[14] [17]. • Inform customer that your products will be delivered at <5^{o}C. Provide details that high-risk consumer groups (immunocompromised and pregnant women) should avoid eating high risk *Listeria* prone products (see NHS guidance).	These details could be incorporated into a customer welcome pack. You could also include or reference FSA, NHS or guidance from other bodies, if your customers want to learn more.

Surveillance and Challenge

Section	Guidance	Help
	Starter project - Carry out a detailed risk assessment for both your low risk and high care/risk areas with specific regard for the harbouring of *Listeria* spp. For the risk assessment assume that *Listeria* is present and assess the **risk of transferring** it to food or food contact surfaces (use historic data if available). Score the possibility of *Listeria* being present and the risk of transfer, then multiply the numbers to give you the total risk rating. This should look at each and every step in the production process. "Walk the line" and observe all processes examining potential areas as **sources** of contamination. Be especially careful to examine any piece of equipment that comes into contact with food and also where there is a strong possibility of a **vector** being present e.g. tray wash gross debris removal (source), aerosols, soles of boots of personnel entering and exiting the area, and air flow around this area can all act as vectors. After completing the risk assessment, swab those areas (starting with the highest risk rating) and carry out remedial action on any positive results. Then review your risk assessment again taking into account any positive detections. Using the reviewed risk assessment produce a *Listeria* monitoring program that covers every area identified across the year on a frequency based on risk.	Swabs MUST always be taken by trained personnel and must be taken during production and post clean. For the best accuracy of results only use laboratories accredited to ISO17025, and for legally recognised *L. monocytogenes* methods that have been validated for the food materials being tested. Pathogen testing should be carried out by an external laboratory (BRC version 8, clause 5.6.2.3). Don't forget personnel can unwittingly spread *Listeria* from one area to another e.g. on footwear, or hands.
2.1	Incorporate the following aspects into your corrective action procedure when *Listeria* is detected: ➢ Detection of non-pathogenic strains of *Listeria* in the environment and food MUST be treated in the same manner as pathogenic strains (except for recalling/withdrawing product where >100cfu/g are detected in either final product or its ingredients). ➢ Describe what corrective actions MUST be carried out if *Listeria* is detected in any food, equipment, machines etc. ➢ Stipulate what further swabbing is carried out after corrective actions have been completed Describe actions to be taken if *Listeria* is still **persistent (**i.e. you still detect *Listeria* even after following these actions)**.** Examples may include auditing cleaning method and checking chemical concentrations and contact times used are as specified by the manufacturer and are effective, reviewing cleaning method, serotyping to identify where the *Listeria* population is coming from, exposing any areas where *Listeria* may be harboured (e.g. extensive equipment dismantling) so that they can be effectively cleaned or replacing items such as damaged conveyor belts where such control is not possible; spread deliveries of ingredients to obtain the longest possible remaining life on ingredients, or even modifying the production process.	Serotyping may allow you to identify a **persistent strain**. However, there are a limited number of serotypes and there is a high likelihood of non-related isolates sharing the same serotype. Instead you may want to consider RFLP analysis or PCR that looks at DNA fragments. For more information talk to your microbiology laboratory. (See Appendix 1 & 2)

2.2	Using your *Listeria* monitoring program establish achievable targets for detections of high-risk areas and review progress every quarter, or more frequently where *Listeria* has been detected and is persistently detected in the same place.	
2.3	Create a floor map of your low risk and high care/risk areas and mark on the maps the area where *Listeria* spp. are detected. Consider how these relate to the drains, air flow etc and address vectors by implementing effective controls Over the year this will build up a map of "hot spots" to inform your annual review. It is not uncommon to find listeria as part of your monitoring, typically you would find <1% for food contact swabs and <3% non-food contact swabs (during production) and <1% post cleaning.	Simple maps work best that only show perimeters of the room with any fixed equipment, overlay with plans of drains etc.
2.4	Trend **all** *Listeria* detections as you receive them and take actions as required and continually review the effectiveness of these actions. You will also use this data during your annual review.	Highlight positive detections on your program, this makes it easier to trend and spot.
2.5	**Annual Review** - annually challenge your *Listeria* Monitoring Program to see if it is still fit for purpose. Ask questions such as; ○ Have we often picked up *Listeria* in areas which have a low risk rating? ○ Are our corrective actions effective? ○ Are certain raw materials more prone to *Listeria*? What actions can be taken, e.g. substitution for lower risk, change to better-performing supplier? ○ Is there a relationship between *Listeria* detections in raw materials and our suppliers? Engage with suppliers providing contaminated raw materials and ensure they are working to best practice. ○ Are any specific areas/equipment showing persistent detections? If yes how can we reduce this? ○ If applicable – what effect has changing cleaning chemicals (biocides) had? ○ How are our suppliers doing with regards to *Listeria* controls? ○ Have we met our *Listeria* targets? Amend the *Listeria* Monitoring Program and its risk assessments as required. You may also need to review your *Listeria* corrective action procedures or initiate an investigation of a particular concerning area. To carry out the annual review, ensure you have the following results to hand: Trending results (section 2.4) Floor map (section 2.3) Targets (section 2.2) Chill chain records Representatives from production, quality, transport, warehouse etc. Supplier targets (section 1.2) ○ Other relevant documentation including published guidance	If you initiate a further investigation of a particular area where you are detecting multiple incidences of *Listeria*. You can tackle this in a similar manner to 2.0 but on a smaller focused scale. **Persistent detections may be due to lack of control of vectors and is not always related to the cleaning.** Review any new guidance available to the food industry on the control of *Listeria* prior to the annual review. *Note: Sites should not be led into a false sense of security by*

		repeated negative results as they may not be swabbing in the correct places or swabbing in the correct way. (see BRC V8, 4.11.8.3)

Cleaning

Section	Guidance	Help
3.0	Review cleaning schedules while considering the risk rating scores from the *Listeria* Monitoring Program. Areas that are more prone to harbouring *Listeria* that are at higher risk of cross contamination of food and food contact equipment should be cleaned at a higher frequency and subject to periodic cleaning practices (which may involve more extensive dismantling, use of descaling agents or the use of heat).	Carry out this section following your annual review. Note modifications to equipment may be required to make them easier to clean.
3.1	Audit and then review cleaning methods while considering the risk rating scores from the *Listeria* Monitoring Program. Focus on areas with the highest risk rating first. Key areas to examine are: 1) Are cleaning staff following documented cleaning method? 2) Are the chemicals being used in the correct concentration? 3) What is the recommended contact time of the cleaning chemical and the disinfectant and do staff observe these recommendations? 4) Has the cleaning and disinfection programme been validated? 5) Is cleaning carried out according to the cleaning schedule? 6) Is the correct cleaning equipment being used for the job? 7) Is the operator trained in the cleaning method? 8) Does cleaning take place near open food or food contact packaging? If so then water spray and aerosol may contaminate the food and packaging. 9) *Listeria* grows best in damp conditions[1] Check that water use and condensation is kept to minimum levels. 10) Is the cleaning equipment itself cleaned after use and is it fit for purpose?	Please remember that if disinfectant concentrations are too weak or contact time is too short then bacteria will not be killed and *Listeria* can then develop a tolerance to the chemical. A detergent removes dirt. A disinfectant kills bacterium. Check that your cleaning methods utilise both types of chemicals. Often cleaning chemicals contain both, but check with your chemical supplier. A sanitiser is a specially formulated combination of both.

	When carrying out the review aspect of this section, bear in mind that persistent *Listeria* detections (excluding food) may indicate an ineffective cleaning method. Explore changing the cleaning activity to include: ❖ Scrubbing – *Listeria* is able to form biofilms[8] which protects it from most chemicals although some acid treatment can prove effective, vigorous scrubbing motions can remove the film[13 14]. ❖ Heat treatment – the best way to kill *Listeria* is through heat treatment[13 14]. Is it possible for hand tools, detachable parts etc. to be put through a pot/tray wash with a high heat treatment? This MUST be at least 70 ^{0}C for 2 min or equivalent but note that if biofilms have formed only scrubbing will remove them and prevent *Listeria* re- colonising the biofilm. If the biofilm has formed in mineral scale, then the use of an acid-based detergent may be useful to help dissolve the scale. Disinfectants– check with your supplier if the chemical is effective against *Listeria* at low temperatures. Disinfectant approval tests should be undertaken at 10^{O}C for disinfectant use in chilled food production areas. Remember that the efficacy of any changes made to cleaning methods or materials MUST be validated, by taking swabs before and after cleaning and disinfection, to determine whether the change of approach is effective. Please be aware that BS EN 13697:2001 is the current standard for disinfection agents and ALWAYS follows the manufacturer's instructions.	Please also remember that bacteria protected by a biofilm are 100 times more resistant to disinfectants chemicals[9].
3.2	Inspect cleaning equipment – at least weekly Damaged and worn equipment should be replaced as soon as possible and until replaced MUST not be used. Damage provides *Listeria* harbourage opportunities. Ensure that cleaning equipment is cleaned (if re-useable) after every use. If not adequately cleaned, contaminated equipment will contaminate every surface, piece of equipment and machine that it comes into contact with. If possible, the cleaning should also involve a heat treatment at the end of the day, after all other cleaning has taken place. If this is not possible then leaving cleaning equipment fully submerged in a sanitising agent is sufficient.	Pay special attention to bristles and check the bristle stems. Cleaning equipment can be a significant source of *Listeria* contamination and is often overlooked. Heat treatment could include an 80^{O}C water bath with a sanitiser.
3.3	Water is a common vector of contamination. Keep your factory as dry as possible. Pools of water are potential sources of contamination. During wet cleaning squeegee floors (with a single blade squeegee) frequently to avoid pooling of water.	Hosepipes MUST be locked off during production to avoid the creation of

		aerosols or their use restricted to contained areas where no product is exposed. Best practice is for single blade squeegee to avoid harbourage of *Listeria.*

Customer supplying to consumer

Definition – *This is where the actual ready-to-eat food product is sold to the consumer. This could be a café, coffee shop, school, hospital or supermarket etc.*

Appropriate controls should be implemented in order to help prevent the growth of *Listeria*, starting from selecting suppliers, to delivery of raw materials, storage and any further preparation measures. Although you may not produce the final ready to eat food, as a food handler you have a legal obligation (General Food Hygiene Regulation EC 852/2004)) to ensure the food you offer for sale is safe and fit for human consumption.(NOTE that where you are serving pre-prepared ready to eat chilled foods such as pre-packed sandwiches to hospital patients these foods should be kept below 5 ^{0}C until consumption and be eaten within 30 mins of removing from the refrigerator.)

Prior to receipt

- RTE products capable of supporting *Listeria* that are purchased from suppliers and then sold to the public MUST be covered within the HACCP plan.
- It is a legal requirement that RTE foods do need exceed 100 cfu/g *Listeria monocytogenes* at any point during their shelf life, and that shelf life assessment is carried out under expected storage (temperature) conditions.
- Set targets with your supplier(s) that RTE foods should aim to be free from detectable *Listeria (i.e. <20 cfu/g)* but accept the EU limit of 100 cfu/g at any point of the product's shelf life (Microbiological Criteria Regulation (EC) 2073/2005). (Quantified counts of *Listeria monocytogenes* = or >100 cfu/g MUST be reacted to with interventions to eliminate/reduce opportunity for product contamination and where appropriate reported to the FSA). This can be achieved by requesting product specifications with microbiological targets and limits and/or microbiological test results from the manufacturers. Be aware that typically <1% of all samples will be quantifiable for Listeria i.e. detected but <20 cfu/g. All detections MUST be investigated.
- Make it a condition of supply that your supplier(s) provide you with microbiological shelf life test results that their RTE foods reflecting temperatures from delivery to point of sale.
- Make it a condition of supply, that the suppliers MUST provide you with;
    - Trended data for *Listeria* from environmental and food products
    - Microbiological test results from critical raw materials e.g. chicken, cheese and cooked meats that support the growth of pathogens
    - Shelf life verification of finished product monitoring

It is advised Mandatory for Patient /Feeding of known vulnerable groups:-

Make it a condition of supply that your supplier(s)/manufacturers of sandwiches and of their high risk ready to eat ingredients are able to provide you, on a regular programmed schedule, with microbiological test results corroborating the level of control that they have over the production of their foods with microbiological test results that their RTE foods, noting that each and every detection of Listeria must be investigated and that RTE foods and their ingredients MUST not exceed 100 cfu/g at any point during their shelf life. In respect of the manufacture and handling of high risk ready-to-eat products the shelf-life testing MUST reflect the temperatures stored in client premises, including abuse temperature (when removed from 5 ^{0}C storage prior to consumption). As above you need a micro risk assessment or test results of Listeria detected at the end of life but <100cfu/g i.e. historical data (Ref CFA/FSA/BRC Shelf Life of RTE Food in relation to the control of Listeria monocytogenes). For this reason, shelf-life of RTE foods for vulnerable groups should be Production + 2days unless a further validated method of control has been approved (e.g. Frozen product ready to eat on defrost).

Receipt

The temperature of the product MUST be checked on receipt of each chilled delivery to ensure it does not exceed the limit (5^{o}C)[14 17].

Storage

Appropriate conditions MUST be provided for all materials during storage:

- All chilled storage MUST be capable of maintaining temperatures at or below 5^{o}C[17].
- Ensure the temperatures of storage areas are monitored and verified daily.
- RTE Products MUST not exceed the use by date stated by the manufacturer.
- Products MUST be rotated using FIFO ('first in first out') rule.
- Storage areas MUST be cleaned on a regular basis with effective chemicals and the foods should not be stored uncovered to prevent contamination from the environment. Keep the site clean and be extra vigilant with regards to difficult to clean places known as harbourage sites.

Preparation

Depending on the type of product and business, there may be a preparation stage before presenting the product to the final consumer (such as in a hospital or care home setting where the food is taken out of the packaging and presented on a plate).

If preparation occurs on a customer's site, all the steps detailed MUST be followed to prevent *Listeria* contamination on site.

- There MUST be accurate and regular cleaning in place and the chemicals used to clean utensils and equipment should be validated to be effective against *Listeria*, for example, has the disinfectant been approved against BS

EN 1276:199 and BS EN 13697:2001 (ask your chemical supplier to provide you with this information)

- If raw and ready to eat materials are handled on site, they MUST be separated and dedicated equipment, utensils and staff MUST be provided for each.
- If the products are heat treated before serving, they MUST achieve a sufficient temperature and time of cooking (70^{O}C core temperature for 2 minutes or equivalent) to act as a kill step. Where they are ready to eat, they may safely be re-heated for quality/organoleptic reasons. Always follow instructions on the label.
- Make sure there is no cracked or damaged equipment in use as it might be difficult to clean and therefore may be contaminated with *Listeria*.
- The personal hygiene of personnel responsible for preparation and serving of the product is also very important. If there are no personal hygiene policies in place, or if personnel do not follow these procedures, it is possible that food may be contaminated with *Listeria*.

Consumer

As an organisation that supplies food to the final consumer you MUST take account of the consumers that you serve. Most ready to eat products are intended for the general public, however, if you service consumer groups that are particularly vulnerable to listeriosis[2 4] and they are under your care, then **you have a legal duty** to take their vulnerability into account when you select the foods they eat.

This applies to you if you provide food to:

- ✓ Hospitals
- ✓ Care homes
- ✓ Day centres for the elderly
- ✓ Out clinics
- ✓ Surgeries
- ✓ Specialist schools
- ✓ Hospices
- ✓ Other organisations that look after pregnant women, young infants, people over 65 and those with a weakened immune system.

High risk foods that are prone to *Listeria* contamination should be avoided by those who are immunocompromised as they are especially vulnerable to Listeriosis. This is because the foods have not undergone a heat treatment during their processing or just prior to eating. Examples of high-risk foods include[1 2 4 5 6 11 14 19]:

- ➢ Soft, mould-ripened and blue-veined cheese (e.g. Brie, Camembert, Gorgonzola)
- ➢ Any other cheeses made from unpasteurized milk
- ➢ Pâté – including vegetable Pâté
- ➢
- ➢ Smoked fish including salmon
- ➢ Pre-packed salads, sandwiches, rolls and wrap **that contain the above foods**

Concluding statement

Thank you for taking the time to read through this guidance; we hope you find it useful and practical.

Although we detail multiple actions that an individual organisation can take, no single organisation works in isolation. Therefore, the full benefits of this approach can only be attained if members of your supply chain all work together through this framework.

Furthermore, as best practice changes, we encourage readers to contact us with suggestions and comments, to help us

keep this document up to date and relevant to the industry.

Glossary

- **BIOFILM -** An Extracellular polysaccharide + protein “glue” + *Listeria* (and any other micro-organism).

- **HIGH CARE AREA -** An area designed to a high standard where practices relating to personnel, ingredients, equipment, packaging and environment aim to minimize product contamination by pathogenic micro-organisms.

- **HIGH RISK AREA -** A physically segregated area, designed to a high standard of hygiene, where practices relating to personnel, ingredients, equipment, packaging and environment aim to prevent product contamination by pathogenic micro-organisms.

Acknowledgements, Disclaimer and References

We wish to acknowledge the contributions drawn from the public domain as well as the many authors who have been referenced within this guidance. Although every effort has been made to ensure the information contained in this document is accurate, we are unable to accept any responsibilities or liabilities for any error, omission or opinion contained within this guidance, regardless of how it has occurred.

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APPENDIX 1 - Investigating Out of Specification Listeria Results

It is very important that you understand where you might be at risk from out of spec results.

In order to do this, you have to understand:

- The ingredients you are using
- Where you are buying them from
- Whether they have been decontaminated before you take control of them
- What decontamination steps you are carrying out
- What equipment you are using to manufacture your sandwich
- How you are cleaning the equipment
- How you are maintaining the equipment
- The hygiene practises of the staff

As part of a Listeria Management Plan it is important that people in your organisation have been trained in Listeria controls.

This should cover how to prevent entry, how to prevent harbourage, how to prevent cross contamination and how to remove Listeria through cleaning and disinfection.

Should you identify that your product contains any listeria spp then a full investigation should occur. Based on the level of investigation required, a multi-disciplinary team may need to be involved (e.g. technical, engineering, hygiene and production).

Trace product back to identify all ingredients used in the product ensuring that you review cooking temperatures, transfer points, factory fabric and waste handling.

Review historical data and assess for trends / common factors.

Check the integrity of the transfer barriers to ensure that they are effective. Have there been any changes to process or products e.g. new equipment, chemicals, building work, raw material or supplier changes.

Identify if you have tested any or all of these ingredients – have they failed? What is the trend? What machinery is used in the manufacture of this product? Have any other fails been linked to this machinery? Have there been any modifications to processing equipment?

Raw material Issue – if you know which ingredient is likely to have caused the fail to resample and if it fails make sure you talk to the supplier and follow up either by getting their corrective actions or by visiting them.

Sample raw material at each step of the process.

Observe operators carrying out the task and ask open questions about how they would normally carry out the task
If the ingredients are made and stored, sample them again at point of use

Take start, middle and end of run samples

If you do not know which ingredient could have caused the issue, then look at what is likely to allow the growth of Listeria and sample each of these at point of prep and point of use

Any machine that has been used to produce the contaminated product could now be harbouring Listeria it is therefore important to review the condition of the equipment by doing an engineering strip on this machine looking for

harbourage points. Check condition of moving parts for wear, seals that are damaged. Any worn parts should be replaced – but swabs should be taken of any contaminated areas and photographs.

Once machine is sound from maintenance view it needs to be deep cleaned and post clean swabs also need to be taken either swab key inspection points or you may also introduce additional swabbing in area's not normally swabbed if required as part of the investigation. Set a timeline for additional swabbing / testing and set a review date to identify areas of concern or unrelated to the issue.

This will then review the effectiveness of cleaning (have biofilms been able to develop), schedules, methodologies, regime, level of dismantling, chemicals used and finished hygiene standards. The chemical provider can advise on best chemical to treat *Listeria* and to clean the affected areas.

If, during observations, you think that practises are an issue then think about Listeria awareness training.
Swab hands, utensils, scales, tables.

When observing you should be looking for

- Dry floors
- Condensation
- Cross contamination from other activities going on nearby.
- Poor function of the equipment – leaking depositors
- Poor practises

What else was happening on the day the fail occurred? Which shift? Which Team?

Document all results and make a measles map so you can track where fails are happening.

Once you have the results of all your investigation you can then discuss what you know did not cause the issue and what could have caused the issue. You can then go back to the start and go through the same thoughts to see where the answers point to.

During your daily, weekly, monthly swabbing plan you will be sampling equipment and environment for Listeria.
This should be done pre clean and post clean mainly so that if it is present after production you know you cleaned it and it was not present after it was cleaned.
Pre clean swab on a machine basically shows that:

- An ingredient that has gone through the machine was contaminated
- There is a harbourage point in the machine that is contaminating product
- Poor practises whilst using the machine
- Did the machine sit waiting to be cleaned allowing growth of contamination?

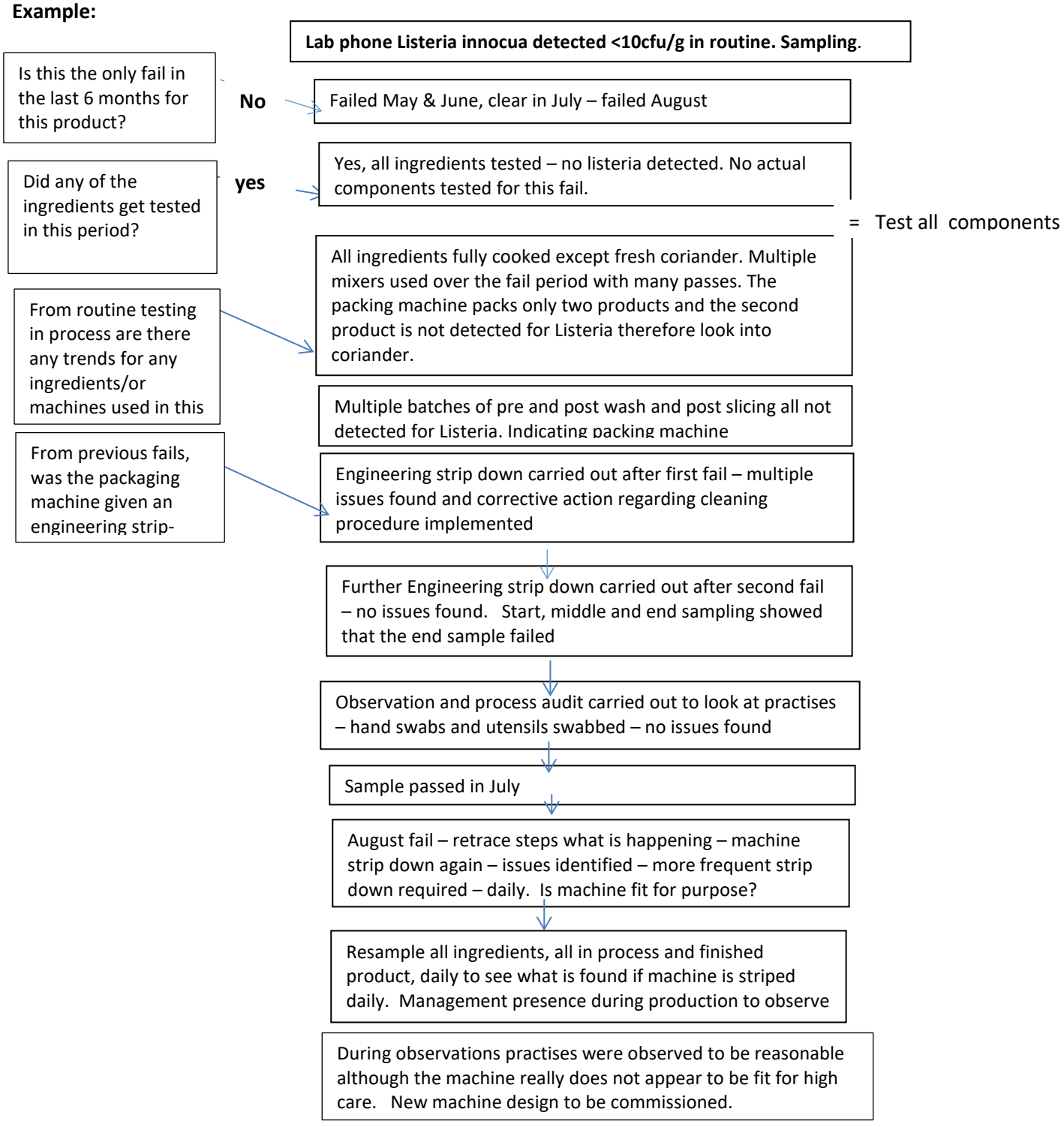
Time lapse swabbing or sampling e.g. Every 2 hours to see when the machine is contaminated. It is also worth sampling any debris that falls within the machine to see if this is contaminated
Training records and reviewing cleaning procedures also need to be considered during an investigation.

Conclusions should be reached, and remedial action taken to rectify any problems identified with a positive *Listeria* detection on a food contact surface which has been caused by a hygiene failure. Effectiveness of actions must be monitored and recorded for a set period e.g. this could be within the factory's monthly hygiene monitoring scheduled testing.

Should fails be occurring on floors / drains this is a concern but not abnormal. However, you need to understand the microbiological flora of your environment as this helps to control Listeria from getting onto product
The thought process here should be:

- What has brought listeria in?
- Frequency of clean? Did we squeeze the hygiene window?
- What is different to what we did previously?
- Time Lapse swabbing
- Section area of fails and do more swabs to see if it is all over or just in one area
- Keep measles map
- Record actions

Example:



APPENDIX 2 – Environmental Swabbing for Listeria

Introduction and General Principals

Swabs MUST be taken during production around entrances to high risk (e.g. staff entrance area, entrances for ingredients and packaging, etc.) and at possible 'collection points' (i.e. where the organism is likely to accumulate – e.g. drains, cleaning equipment, tote bin wheels, etc.).

Equipment and food contact surfaces MUST be swabbed following cleaning and disinfection at critical points in the process to demonstrate that the cleaning and disinfection programme is effective.

*Listeria s*wabbing is divided into 2 separate groups; the routine monitoring programme, and investigation swabbing, to investigate environmental failure or a positive result in a finished product.

Investigative swabbing should always follow a defined plan and have a pre-determined timescale as often investigative swabbing plans get incorporated into the routine swabbing which increases costs and makes interpretation of the data more difficult.

Investigative swabbing can take place from the finished product to raw materials and is followed backwards in an attempt to identify where the contamination is occurring.

Any laboratory being used for testing swabs from food environments where products are being manufactured must be accredited by an approved body to IS0 17025 (e.g. UKAS), and have the relevant methods listed on their scope of accreditation. All deviations from standard accredited methods MUST BE VALIDATED.

When requesting swabs from the lab, ensure you state what the swabs will be used for.

If it is suspected that residues/traces of cleaning chemicals may be present on the surfaces which are being swabbed, it is important to ensure that the swabs in use contain suitable neutralisers. This may involve reviewing the components of the neutralising buffer to ensure that they are affective against the chemicals in use, as there is no such thing as a universal neutraliser. You will have to consult both the testing laboratory supplying the swabs and your chemical provider to ensure that the correct neutralisers are being used.

The identification of a positive *Listeria spp* from the environment must **always** be followed up by confirmation of the presence or absence of *L. monocytogenes*.

Swab results must be reviewed on a regular basis to both identify trends, and also to ascertain whether the sampling programme needs amending.

Adverse trends must be identified, investigated, and actioned accordingly – *[please see Appendix 2]*.

For examples of possible investigations following positive food contact environmental or finished product results ***See Appendix 2*** *for more detail.*

Based on the level of investigation required, a multidisciplinary team may need to be involved e.g. Technical, Hygiene, Production & Engineers etc.

Conclusions should be reached, and remedial action taken to rectify any problems identified with a positive *Listeria* detection on a food contact surface which has been caused by a hygiene failure. Note that these findings are, in themselves, not reportable to the FSA or similar body but must be actioned. Effectiveness of actions must be monitored and recorded for a set period e.g. this could be within the factory's monthly hygiene monitoring scheduled testing.

Guidelines for Collecting Listeria Swab Samples

General Considerations

- Microbiological swabbing and sampling must only be carried out by trained personnel. It is vitally important that all staff who are carrying out the swabbing are doing it in a consistent uniform manner, as failure to adopt a consistent procedure will make trending of the data difficult.
- All environmental swabs should be taken with the purpose of seeking out the target organism, especially in the case when swabbing for *Listeria*. For any sample site, areas of obvious dirt, grease or condensate should be swabbed rather than obviously clean areas otherwise results may give a false sense of security.
- Before sampling commences, the hands of the person carrying out the swabbing must be washed and dried thoroughly.
- The swabs must be correctly stored according to the manufacturer's instructions and be within their expiry date.
- The timing of swabbing is important as different results should be expected, and are acceptable, if swabs are taken during/after production or after cleaning.
- Labelling of samples: All samples must be labelled with all the information to clearly identify the sample. This is likely to include:
    - Date and time taken
    - Description or ID of sample point
    - Type of sample, e.g. pre-clean Listeria, etc.
- Ensure swabs are sent to the laboratory within target 6hrs (maximum 24hrs or as directed by the laboratory) and ensuring the lab are able to process them within this timeframe. This will prevent both increased counts of other bacteria which may affect the laboratories ability and potential to detect *Listeria* through potential loss of viability of the target organism.
- Swabs must be transported under chilled conditions – where a refrigerated transport system is not available a cool box should be used in conjunction with ice packs, although care must be taken that samples do not become frozen.

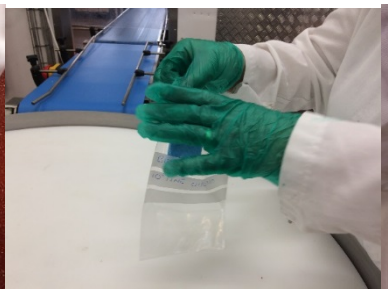
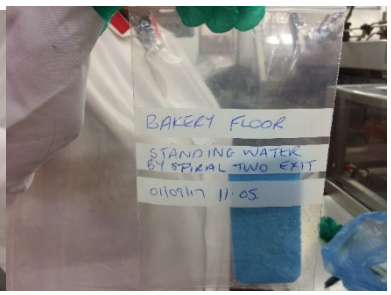
How to Take the Swab

Sponge swabs - are designed to swab a large area which increases the chance of *Listeria* coming into contact with the swab and being detected.

The timing of swabs is important as it makes a great difference to the interpretation of results if they are taken during production, before cleaning, or after cleaning. Therefore, this information must always be recorded.

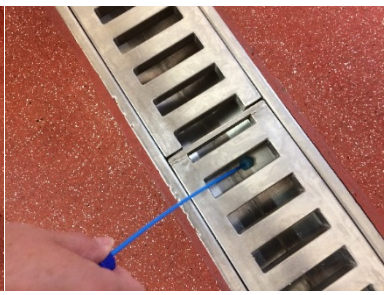
- Wash and dry hands thoroughly before swabbing begins.
- Check the swabs to be used must have been correctly stored and are not out of date.
- Sponge swabs are usually supplied pre-moistened.
- Swabbing must be done in a consistent uniform manner.
- Sponge only type: The instructions for using the blue rectangular sponge swabs are on the side of the packet, but it is often easier to put on a disposable glove to remove the sponge swab from its packaging and ensure that a large area is effectively and aseptically swabbed before returning to the packaging and disposal of the glove. Some brands of sponge swab come with disposable sterile gloves for this purpose. A fresh glove should be used for each swab to minimise the potential for cross contamination.

  Note: if sterile individually wrapped gloves are not available, disposable gloves may be used. Whilst the gloved hand will come into contact with the swab and it cannot be guaranteed to be sterile, it is highly unlikely that even an opened packet of disposable gloves will have become contaminated with *Listeria*.
- Sponge with handle type: Some sponge swabs are supplied with a handle. No part of the swab other than the handle should come into contact with hands before or during use. If there is any doubt as to whether the swab has been touched or if it may have come into contact with anything other than the area to swabbed discard the swab and start again. Carefully replace the sponge into its sterile bag, or into another suitable transport container.
- Label clearly with all the information to identify the sample, and store under refrigeration. Sponge swabs must not be frozen.
- Send sponge swabs to the laboratory within target 6hrs (maximum 24hrs or as directed by the laboratory).
- When conducting swabbing in high risk areas it may be appropriate to remove any residual diluent from the swabbed surface and re-sanitising with the approved sanitiser for the area

- Sometimes drains prove inaccessible with the traditional sponge swabs, so the jumbo foam swabs with a long handle are a better option when taking these types of samples.
- The procedure for using these swabs is the same as for the sponge with handle type described above (sponge swabs).





- On occasions when swabbing difficult to access areas such as gaps around the rollers on production belts, nozzles etc., it might be easier to use the stick swabs which are normally used for post clean verification tests.


Instructions for using stick swabs

- Wash and dry hands thoroughly before swabbing begins.
- Check the swabs to be used must have been correctly stored and are not out of date.
- If swabs are not supplied pre-moistened, they must be moistened before use.
- Swabs should always be moistened with a sterile fluid, e.g. 0.85% sterile saline, and typically a neutraliser, before use if not supplied pre-moistened.
- Swabs may be moistened shortly before use to prevent the need for taking a bottle of fluid out onto a production line. If it is likely that sanitiser is still present on the surfaces being swabbed, a neutraliser should be added to the moistening fluid.
- Swab the whole of the pre-determined area turning the swab so that every part of the swab comes in contact with the surface area.
- No part of the swab other than the handle should come into contact with hands before or during use. If there is any doubt as to whether the swab has been touched or if it may have come into contact with anything other than the area to be swabbed, discard the swab and start again.
- Carefully replace the swab into the protective tube, or into a container of transport medium if provided.
- Take care to avoid creating foreign body hazards.

  If the swab type being used includes a stick which is snapped off once the swab has been taken, the stick must be disposed of in such a way that it does not create a foreign body hazard. This is also true for any plastic wrappers or plastic seals removed from the swabs before use.
- Label clearly with all the information to identify the sample, and store under refrigeration. Swabs must not be frozen.
- Send swabs to the laboratory within target 6hrs (maximum 24hrs or as directed by the laboratory).

- When conducting swabbing in high risk/care areas it may be appropriate to remove any residual diluent from the swabbed surface and re-sanitising with the approved sanitiser for the area.

Guidance written by A Muirhead, ALS, 14/08/2019