Understanding High Risk and High Care

BRC Global Standard for Food Safety issue 6

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Understanding High Risk and High Care

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1. Introduction

The terms “High risk” and “High care” have been used in the BRC Global Standards for many years to define areas where chilled foods, which are particularly vulnerable to microbiological contamination, are handled.

Issue 6 of the Food Standard has defined more closely the definitions of high care and of high risk chilled and frozen products, and includes some additional requirements for the areas where the handling of these products takes place. The changes have been made to reflect the lessons learned about food safety following recent high profile food poisoning outbreaks, and to ensure a consistent approach to auditing against the Standard.

This guideline is intended to help sites to understand whether the chilled and frozen products they produce will require handling in a high care or high risk environment, and how the specific clauses for high care and high risk areas should be interpreted.

2. Defining Products to be processed in High risk or High care zones

Most food processing activities consist of taking a raw material or unprocessed food product and processing to make a product which is closer to a condition for consumption, be it as simple as washing or grading of vegetables, to the creation of a ready meal. It is usual to find increasingly more demanding environmental standards as the products become closer to a consumer ready product.

There have been well publicised food poisoning incidents in recent years associated with a wide range of products which had not previously been considered a concern e.g. chocolate, peanut butter, canteloupe melons. This emphasises that processors need to thoroughly understand their products and configure their food safety systems accordingly.

Within the BRC Standard issue 6, particular attention is focused on the group of products most often associated with food poisoning incidents i.e. chilled or frozen, ready to eat foods. The Standard defines minimum hygiene and environmental standards to prevent contamination of these foods after the final process step classified in the Standard as high care or high risk areas. The guidelines for defining products to be considered for processing in high care or high risk areas are based principally on the ability of the food to support the growth of Listeria species. Listeria was chosen as the indicator organism because

- a relatively low infective dose is required to cause food poisoning
- it is able to grow at a lower temperature range than most food pathogens
- food poisoning caused by the organism can be particularly severe and has a relatively high mortality rate amongst vulnerable consumers.

On this basis high care or high risk zones are applicable for the handling of products which fulfil all of the following conditions:

- the products are ready to eat or heat and therefore there is no intended final microbiological kill step undertaken by the customer to make the products safe to eat.
the final products are stored and distributed chilled or frozen. Although there are a number of ambient products which may require special handling the particular definitions within the meaning of the Standard apply to chilled and frozen products.

- the products are vulnerable to the growth of pathogens – i.e. the characteristics or formulation of the products is suitable to support growth e.g. water activity (Aw), absence of preservatives, suitable pH etc.
- The products are open and therefore vulnerable to contamination i.e. neither packaged nor enclosed within equipment.

It is important to note that the high care or high risk production zone usually only applies to a part of a factory’s production processes; usually following a microbiological kill step and up until the products are enclosed in packaging.

Products have been further divided within the Standard into those requiring high care process environmental conditions and those requiring high risk environmental processing conditions. This is based on whether processing has eliminated Listeria through cooking or reduced the likely incidence through other control measures such as chlorine washing of vegetables. This ensures that products which have been processed are not placed at risk by other products within the same area which have only received a partial process.

The decision tree within the Standard, and reproduced as appendix 1 to this guideline, helps to define the production zone for products.

Typical products and the applicable final processing zone are given in Appendix 2
3. High Risk Area – Specific Requirements

High risk areas require the highest levels of hygiene, working practices, fabrication, design of facilities and equipment to prevent product contamination with regard to microbiological hazards.

High risk areas contain only components/foods which have undergone a cook or similar process to achieve a 6 log reduction for listeria (See appendix 3 for time/temperature combinations achieving this).

Where a single area has by necessity, to include some components which have not received a full cook as well as fully cooked components, (for instance, in a sandwich preparation area), this will be classed as high care.

This section contains the interpretation for the specific requirements which are highlighted for high risk areas.

3.1 Physical Segregation (clause 4.3.6)

The Standard requires that, ‘Where high-risk areas are part of the manufacturing site, there shall be physical segregation between these areas and other parts of the site’.

The purpose of the physical segregation is to provide a self-contained area where uncovered (i.e. unprotected) high risk products are handled after the microbiological kill step (e.g. thermal processing), until fully protected, usually by means of final packaging.

The segregating barrier must be capable of preventing the risk of cross contamination from:

- All people moving between the high-risk area and other areas except through designated changing areas (Refer to section 3.5 below).
- The movement of all equipment, utensils or materials into the high risk area except through designated ports with sanitising controls in place.
- Water or other liquids on the floor washing into the high risk area.
- Air borne contaminants e.g. dust particles or water droplets.

The ideal barrier is a full height wall separating the high risk area from other areas.

Time segregation is not an acceptable alternative for high risk areas, except for the transfer points noted below.

3.2 Transfer Points (clause 4.3.6)

The location and operation of all transfer points must not compromise high risk and low risk segregation. For example, where raw materials or staff move into a high risk area, consideration shall be given to whether this introduces a contamination hazard and therefore requires procedures such as:

- the use of disinfection
- removal of outer packaging
- Double door ovens, blast chillers or freezers (i.e. those with separate entrance and exit) – Refer to information below on the use of single door ovens/smoke houses
- Controlled air flow (refer to section 3.4 below)

Where there is a cook step in the production of high risk products, the best practice is that the cooker becomes the transfer point into the high risk area via a double door system (the cooker is loaded in the low risk area and unloaded directly into the high risk area).

Whilst new cooker installations and new build sites shall incorporate double door cooking systems, many existing plants are equipped with single door cookers and have established risk based procedures for the loading and unloading of the cookers to prevent cross contamination of cooked products.

The Standard will therefore accept the use of single door cooking systems (including smoke houses) where a thorough risk assessment has been completed as an interim prior to eventual upgrading. Operating practices must be consistently achievable, effective and prevent cross contamination of cooked products. The risk assessment must have considered and controlled potential risks from:

- cross over between cooked and raw products in the cooker loading/unloading area
- operators and their clothing e.g. operators handling cooked products who have previously worked with raw products
- hand contamination resulting from touching surfaces such as common equipment, cooker control panels and cooker door handles
- equipment used for transferring product in and out of cookers.
- air borne contamination from low risk processes e.g. the loading and unloading area should be separate from the main low risk processing area
- the floor e.g. contamination of the wheels of trollies transferring cooked products to the high risk area.

When cooked products are unloaded from the cooker they must be moved immediately to a designated high risk area meeting the requirements of the Standard.

The procedures in operation where single door cookers are in use will be assessed by the auditor to ensure they are adequate, effective and understood by operators. The audit report shall describe the procedures in place to protect the cooked products from contamination.

3.3 Drainage (clause 4.4.4)

The flow of drains shall not present a risk of contamination to the high risk area.

Drains should flow from high risk to low risk areas.

There shall be a plan of the drains for these areas which shows the direction of flow and location of any equipment fitted to prevent the back up of waste water
3.4 Ventilation for High Risk Areas (clause 4.4.13)

High risk areas shall be supplied with sufficient changes of filtered air, the aim being to ensure air introduced does not contain micro-organisms of concern and not be the source of additional contamination (for example by the formation of airborne water droplets).

A risk assessment shall be completed which considers the following:

- source of air (the air inlet needs to be located to minimise intake of contaminated air, e.g. located, as a minimum, upwind of potential contaminants such as dust and chemical vapours)
- frequency of air changes
- specification of filter used – there is no absolute standard for the filters however, the grade required will depend on the source of the air and the time of exposure of high risk products/ingredients
- frequency of replacement of filters.
- the need to maintain positive pressure compared to adjacent areas particularly where there is an interface with low risk areas.

The effectiveness of the filter and system employed should be checked by the use of periodic sampling of air close to the outlet of the air ducts for microbiological quality.

3.5 High Risk Changing Facilities (clause 4.8.5)

Where facilities manufacture high risk products, personnel shall enter the high risk area via a specific designated changing facility (i.e. separate from other lower risk changing areas) and shall follow documented instructions to:

- apply specific dedicated protective clothing (i.e. not worn in other areas of the factory)
- use visually distinct protective clothing (e.g. different colour or style) including clean overalls, headwear and footwear
- apply clothing in a given order (e.g. hairnet first, then shoes, wash hands then put on protective overall)
- wash hands during the changing procedure

Footwear to be worn in high risk areas must be dedicated to the factory (i.e. factory issued and not worn outside the factory). The use of clean footwear worn only in the high risk area and effective measures for changing into such footwear is the preferred option to meet the requirements of the Standard i.e. the site has procedures to ensure that the footwear is captive to the area (worn only in the high risk area) and that the changing area is laid out with an effective system to differentiate areas for wearing high risk footwear (e.g. use of a barrier or bench system).
The **use of boot wash facilities** at the entrance to a high risk area will be acceptable where this is managed and validated to effectively prevent the introduction of pathogens. The site shall have undertaken a risk assessment to identify the suitability of the boot wash facilities and controls to manage the effective sanitation of footwear. The controls shall have been validated by microbiological swabbing of footwear, floors and the drains in the high risk area, to demonstrate the absence of Listeria species.

For such controls to be effective it would be expected that this includes the following:

- The footwear shall be company issued and of a design which is easily cleaned (i.e. smooth upper surfaces, cleats on soles shall be sufficiently spaced so as not to trap dirt which may not easily be removed by boot wash equipment)
- Consideration of the potential for gross contamination of boots prior to boot washing (i.e. the footwear shall not be worn outside of the facility or in low risk processing areas prior to entering the high risk area)
- The boot wash equipment shall be suitably designed, well maintained and demonstrably effective to clean and sanitise the footwear.
- The minimum cleaning time and levels of detergent and sanitiser used shall be determined, documented and controlled to ensure effective cleaning of footwear.

Records shall be maintained of detergent/sanitiser checks, and effectiveness of cleaning of the boot wash facilities.

All visitors and contractors entering the area will need be provided with company issued footwear and follow the company rules; shoe covers are not satisfactory for high risk areas.

On entry to high risk areas, all staff, visitors and contractors shall wash and disinfect their hands.

**3.6 Cleaning (clause 4.11.5)**

The objective of the use of dedicated high risk clothing (refer to section 3.5 above) is to prevent the potential contamination of products. If the cleaning team (or indeed anyone else such as engineers/visitors) are entering a high risk area whilst production is in progress or when open products are present they must follow the same clothing rules as for production staff.

Equipment used for cleaning high risk areas shall be dedicated for use in that area.

Engineers’ tools for routine maintenance and minor breakdowns should be kept captive within the high risk area. Cleaning of these tools should be included in the cleaning schedule.

It is expected that wherever practical, auditors will observe the cleaning in high risk areas, to ensure the practices used are effective and that controls are in place to prevent the introduction of new risks.

**3.7 Waste Disposal (clause 4.12)**
Waste disposal systems shall ensure that the risk of contamination to products is minimised through control of cross-contamination and the control of pests.

Risk assessment shall consider the movement and flow of waste (e.g. bins shall be dedicated to either high or low risk areas and shall not move between the two. High risk waste should be transferred to other containers at the high risk transfer point).

3.8 Laundry Services for High Risk Protective Clothing (clause 7.4.4)

The Company will need to assess and monitor the laundry (e.g. visual inspection, regular audits, complaints procedure) to ensure that the process is maintained and under control.

The laundry must be able to demonstrate that they have processes to ensure:

- a suitable level of cleanliness for example, microbiological validation and verification tests have been completed.
- Clothes are commercially sterile. Commercially sterile means the removal of vegetative forms of micro-organisms associated with food poisoning and/or spoilage. (For example processed at a temperature no lower than 65°C for a minimum of 10 minutes or a garment processed at a temperature of no lower than 71°C for a minimum of 3 minutes).
- Adequate segregation between dirty and cleaned clothes
- Cleaned clothes are protected from contamination until delivered to the site, (e.g. by the use of covers or bags)

Home laundering is not acceptable for protective clothing worn in high risk areas.

New overalls should be issued every shift, and be available on demand should they become soiled.

3.9 Documented inspections (clause 3.4.4)

The Standard requires a programme of documented inspections to ensure that the factory environment and processing equipment is maintained in a suitable condition. These inspections are different from the internal audit programme (specified in clauses 3.4.1 -3 which are examining practices against documented procedures). These hygiene and fabrication based inspections are assessing the standards of cleaning, equipment, building fabrication and personal hygiene to ensure that high standards are maintained and a safe hygienic production environment is in place.

The frequency of the inspections should be based on risk. For open product areas inspections need to be at least monthly. Inspections in high care and high risk areas could be daily or weekly.
4. High Care Requirements

High care areas require high levels of hygiene, working practices, fabrication, design of facilities and equipment to minimise product contamination with regard to microbiological hazards.

Products produced in high care areas will have undergone a process to reduce any microbiological contamination prior to entering the high care area for example, a chlorine wash of salad materials.

This section contains the interpretation for the specific requirements which are highlighted for high care areas.

4.1 Physical Segregation (clause 4.3.5)

It is important that the high care area is effectively protected from recontamination from the low risk zones. The segregation is most effectively achieved by full physical segregation by means of walls which separate the high care area from other factory areas. Access to the area should be restricted, (the segregation should take into account possible routes of contamination for example, airborne, personnel, tools, equipment and footwear, etc.).

Where a separate fully walled off area is not available for high care, alternative procedures shall be in place to segregate the high care area and prevent access to unauthorised people, transfer of materials or equipment (except via a controlled route) and microbiological contamination from airborne particles or water droplets. This may include time or space separation, control of movement or other restrictions. The method employed must be validated to demonstrate controls are effective in preventing cross contamination and documented.

The auditor will critically examine the arrangements to ensure that potential risks for contamination have been addressed and that the alternative controls are consistently workable before the solution is considered acceptable (this will be recorded in the audit report).

Where the solution is time segregation the changeover between standard and high care operations should be as infrequent as possible, as it is unlikely that a sufficient standard of cleaning could be reached if changes occur frequently during a day. Fully validated procedures to change the area from low risk to high care are required. These activities need to be taken into account when scheduling production, to ensure effective transformation of the area, including personnel. If the same personnel are responsible for the area during low risk and high care operations, they must undergo a complete change of protective clothing.

Where product characteristics meet the description of high care but the systems are fully enclosed (for example dairies filling milk into cartons) the production area is considered an enclosed production area. However, additional precautions are required when breaking into the lines or filler (for example for maintenance, to free product jams or cleaning). Wherever equipment integrity is compromised the necessary hygiene requirements must be completed before packing can recommence.
4.2 Drainage (clause 4.4.3)

The flow of drains shall not present a risk of contamination of the high care area.

Drains should flow from high care to low risk areas.

There shall be a plan of the drains for these areas which shows the direction of flow and location of any equipment fitted to prevent the back up of waste water.

4.3 Ventilation for High Care Areas (clause 4.4.13)

Whilst there is no specific requirement for an air over pressure in high care areas good practice requires that the ventilation system is in balance such that there is no large movement of air from low risk into high care.

4.4 High Care Changing Facilities (clause 4.8.4)

The objective of the clause is to ensure that protective clothing once applied is not contaminated before entry into the high care area. Documented instructions shall be available to:

- apply dedicated personal protective (i.e. not worn in other areas of the factory)
- use protective clothing which is visually distinct (e.g. different colour or style) including clean overalls, headwear and dedicated footwear (by exception shoe coverings can be provided for visitors but these are only to be worn in the high care area).
- apply clothing in a given order (e.g. hairnet first, then shoes, then overall).
- wash hands during the changing procedure e.g. after handling shoes and before entering the production area.

Normally these changing facilities are physically segregated from other changing areas; however, in exceptional circumstances it may be possible for a site to use time segregation, (i.e shared changing facilities with low risk staff, but with different shift patterns to ensure that low care staff are not using the facility at the same time as high care personnel). It may be necessary for changing facilities to be cleaned between different groups of workers depending on the risk.

The auditor must be satisfied that the potential risks have been assessed and procedures are capable of being consistently operated without abuse.

There shall be an effective system to differentiate areas for wearing high care footwear (eg barrier or bench system) or there shall be an effective boot wash on entrance to the high care area.

On entry to high care areas, all staff, visitors and contractors shall wash and disinfect their hands.

4.4 Cleaning (clause 4.11.5)

Equipment used for cleaning high care areas shall be dedicated for use in that area.
4.5 Waste Disposal (clause 4.12)

Waste disposal systems shall ensure that the risk of contamination to products is minimised through control of cross-contamination and the control of pests.

Risk assessment shall consider the movement and flow of waste (e.g. bins shall be dedicated to either high care or low risk areas and shall not move between the two. High care waste should be transferred to other containers at the high care transfer point)

4.6 Laundry Services for High Care (clause 7.4.4)

The Company will need to assess and monitor the laundry (e.g. visual inspection, regular audits, complaints procedure) to ensure that the process is maintained and under control.

The laundry must be able to demonstrate that they have processes to ensure:

- a suitable level of cleanliness for example, microbiological validation and verification tests have been completed.
- clothes are commercially sterile. Commercially sterile means the removal of vegetative forms of micro-organisms associated with food poisoning and/or spoilage. (For example processed at a temperature no lower than 65°C for a minimum of 10 minutes or a garment processed at a temperature of no lower than 71°C for a minimum of 3 minutes).
- adequate segregation between dirty and cleaned clothes
- cleaned clothes are protected from contamination until delivered to the site, (e.g. by the use of covers or bags)

4.7 Documented inspections (clause 3.4.4)

The Standard requires a programme of documented inspections to ensure that the factory environment and processing equipment is maintained in a suitable condition. These inspections are different from the internal audit programme (specified in clauses 3.4.1 - 3 which are examining practices against documented procedures). These hygiene and fabrication based inspections are assessing the standards of cleaning, equipment, building fabrication and personal hygiene to ensure that high standards are maintained and a safe hygienic production environment is in place.

The frequency of the inspections should be based on risk. For open product areas inspections need to be at least monthly. Inspections in high care and high risk areas could be daily or weekly.
Appendices

Appendix 1 Production Zone decision tree

**PRODUCTION ZONE DECISION TREE**

**STEP 1**
Are products or ingredients within the area open to the environment i.e. neither packaged nor fully enclosed in tanks or pipes etc

- **YES**
  - Enclosed product areas e.g. warehouses, dispatch areas, piped liquids e.g. milk, fruit juice, wine.

- **NO**
  - Low Risk Area - Ambient foods such as bread, pastries, fresh fruit and vegetables, dried food, foods stored chilled or frozen solely to extend shelf life e.g. frozen fruit and vegetables, hard cheese

**STEP 2**
Does the product support the growth of pathogens unless stored chilled or frozen

- **YES**
  - Low Risk Area - raw meats, vegetables e.g. potatoes, prepared meals containing raw protein, frozen pizza, unbaked frozen pies

- **NO**
  - HIGH CARE AREA - Fresh prepared salads, sandwiches, cured meats, cold smoked salmon, dairy desserts with uncooked components, prepared meals with garnishes**, chilled pizza

**STEP 3**
Does the area contain products which on the basis of cooking instructions undergo full cooking prior to consumption*

- **YES**
  - HIGH RISK AREA - Cooked meats, pate, houmous, prepared meals without garnishes, dairy desserts with cooked components

- **NO**
  - Low Risk Area - raw meats, vegetables e.g. potatoes, prepared meals containing raw protein, frozen pizza, unbaked frozen pies

**STEP 4**
Have all vulnerable products received, prior to entry into the area, a heat treatment equivalent to 70°C for 2 minutes

- **YES**
  - HIGH RISK AREA - Cooked meats, pate, houmous, prepared meals without garnishes, dairy desserts with cooked components

- **NO**
  - Low Risk Area - raw meats, vegetables e.g. potatoes, prepared meals containing raw protein, frozen pizza, unbaked frozen pies

**Notes**

* Thermal treatment equivalent to 70°C for 2 minutes.

** Raw or not pH/a_w stabilised so will support the growth of L. monocytogenes

This decision tree provides a guide only to the categorisation of production zones and cannot take account of specific product characteristics (e.g. pH, a_w) or the vulnerability of particular products to pathogens or spoilage which may result in exceptions. A detailed risk assessment should be undertaken where necessary to support the decision and documented. Reference shall be made to the more detailed explanations of product zones in the guideline.
Definitions

*Cook – is a thermal process undertaken by the user of the product which is designed to achieve typically a 6 log reduction in Listeria monocytogenes equivalent to 70°C for 2 minutes. Alternative cooking processes may be accepted where these meet recognised national guidelines and are validated by scientific data (for example those listed in Appendix 3).

**Reheat – products that are designed to be safe to be consumed without the need for a full cook; the reheating of the product is intended to make the product more palatable and is not a microbiological kill step.
Appendix 2 – Example Product and typical product Zone

The table below indicates typical production zones applicable to the post process handling stages for the food groups. This provides a guide only because sometimes within a particular food group there may be a number of different specific product types which have different characteristics or filling methods which may result in a different risk zone categorisation. Yogurts for instance will have variable pH values which may make them susceptible to Listeria or not and therefore High Care or Low risk. It is essential that sites understand the product characteristics and safety rationale for the products produced. If there is any concern they should ensure adequate validation or support is available for their decision. Unique products and formulations need to revert to best practice and risk assessment, rather than try to “fit” the product into current slots or examples. Sites discuss this with their certification body in advance of the audit.

<table>
<thead>
<tr>
<th>Category</th>
<th>Example products</th>
<th>Zone</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Raw Red Meat</td>
<td>High risk or high care production zones are not applicable for products in this category.</td>
<td>Side of Beef</td>
<td>Low risk</td>
</tr>
<tr>
<td>2. Raw Poultry</td>
<td>High risk or high care production zones are not applicable for products in this category.</td>
<td>Whole Chicken</td>
<td>Low risk</td>
</tr>
<tr>
<td>3. Raw Prepared Products</td>
<td>High risk or high care production zones are not applicable for products in this category.</td>
<td>Sausages</td>
<td>Low risk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beef Burger</td>
<td>Low risk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Uncoked Pie</td>
<td>Low risk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pizza - Frozen</td>
<td>Low risk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pizza - Chilled</td>
<td>Low risk/High care</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fish Fingers</td>
<td>Low risk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prepared meals</td>
<td>Low risk</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Meals within this category require a full customer cook</td>
</tr>
<tr>
<td>4. Raw Fish Products</td>
<td>High risk or high care production zones are not applicable for products in this category.</td>
<td>Fish Fillets</td>
<td>Low risk</td>
</tr>
<tr>
<td>5. Fruit Vegetables and Nuts</td>
<td>High risk or high care production zones are not applicable for products in this category.</td>
<td>Potatoes</td>
<td>Low risk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Apples</td>
<td>Low risk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Banana</td>
<td>Low risk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nuts in shell</td>
<td>Low risk</td>
</tr>
<tr>
<td>6. Prepared Fruit and vegetables</td>
<td>Products in this category divide between high care and Low risk dependent on expected customer usage i.e. whether the customer is instructed to cook the products.</td>
<td>Prepared fruit pieces</td>
<td>High care</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Washed salads</td>
<td>High care</td>
</tr>
</tbody>
</table>

Although this product meets the definition for a low risk product some customers may require this to be produced in a high care environment.
<table>
<thead>
<tr>
<th>Product</th>
<th>Risk Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ready to eat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coleslaw – Mayonnaise based</td>
<td>High care</td>
<td>Low pH coleslaws may be low risk but require protection from spoilage organisms.</td>
</tr>
<tr>
<td>Frozen Chips</td>
<td>Low risk</td>
<td></td>
</tr>
<tr>
<td>Prepared frozen vegetables</td>
<td>Low risk</td>
<td></td>
</tr>
<tr>
<td>Frozen Sweetcorn</td>
<td>Low risk</td>
<td>High hygiene standards will be required where the corn is expected to be used without further cooking.</td>
</tr>
</tbody>
</table>

### 7. Dairy

The dairy category includes many products which depending upon product characteristics may be either low risk or high care. Often even the products classified as low risk require an environment with high hygiene standards to protect products from spoilage organisms e.g. yeasts and moulds. Some dairy processes are fully enclosed from pasteurisation to filling. In such circumstances these are classed as requiring enclosed product zones although the high care precautions must be applied when opening fillers or lines.

<table>
<thead>
<tr>
<th>Product</th>
<th>Risk Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh Pasteurised Milk</td>
<td>High care</td>
<td>Note where the line and filler are fully enclosed this is considered as an enclosed area.</td>
</tr>
<tr>
<td>Yoghurt</td>
<td>High care</td>
<td>Yoghurts with a low pH may be low risk but require protection from spoilage organisms.</td>
</tr>
<tr>
<td>Hard Cheese – Cheddar, Parmesan</td>
<td>Low risk</td>
<td>Based on low Aw, pH and salt content.</td>
</tr>
<tr>
<td>Soft cheeses e.g. Mozzarella, Brie</td>
<td>High care</td>
<td></td>
</tr>
<tr>
<td>Cheese from unpasteurised milk</td>
<td>Low risk</td>
<td>High standards of hygiene may be required depending on the type of cheese however this should be handled separately from other high care products</td>
</tr>
<tr>
<td>Fromage Frais</td>
<td>High care</td>
<td></td>
</tr>
<tr>
<td>Butter (salted)</td>
<td>Low risk</td>
<td>Unsalted butters may need to be produced in a high care zone.</td>
</tr>
<tr>
<td>Ice Cream</td>
<td>High care</td>
<td></td>
</tr>
<tr>
<td>UHT Milk</td>
<td>Enclosed/Low risk</td>
<td>These products are either sterilised in pack or enclosed for sterile fill.</td>
</tr>
<tr>
<td>Dried Milk Powder</td>
<td>Low risk</td>
<td>Note packing areas usually operate to near high risk requirements because of salmonella risks.</td>
</tr>
<tr>
<td>Freshly squeezed Fruit Juice</td>
<td>High risk</td>
<td>Low pH provides protection for some juices however high standards required to reduce spoilage</td>
</tr>
<tr>
<td>Pasteurised juice</td>
<td>Low risk</td>
<td>Low pH provides protection however high standards required to reduce spoilage</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Fruit Smoothies</td>
<td>Low risk</td>
<td>Where pH is not sufficiently low to provide protection products would be packed in high care or enclosed product zones</td>
</tr>
</tbody>
</table>

### 8. Cooked Meat/Fish

This group of products are all cooked and unless additional preservatives are added to extend shelf life and prevent the growth of pathogens these products would require handling in a high risk area after cooking.

- **Ham**: High risk
- **Cooked chicken**: High risk
- **Meat Pate**: High risk
- **Cooked meat with preservatives**: High care
- **Hot smoked Fish**: High risk

### 9. Raw cured fermented meat

This group of products rely upon a combination of chemical characteristics in the final product rather than cooking to change an otherwise raw product to a ready to eat product typically, salt, low pH, preservatives and smoking. Preparation and packing of finished products require high care production zones.

- **Parma Ham**: High care
- **Cold Smoked fish e.g. Salmon**: High care
- **Salami**: High care

### 10 Ready Meals

All products in this category will require either high risk or high care environment for the preparation and packing of finished products.

- **Sandwiches**: High care
- **Ready Meals to reheat**: High risk
- **Soup chilled to reheat**: High risk
- **Quiche**: High risk
- **Cream Cakes**: High care
- **Egg custard**: High risk
- **Dairy Desserts**: High risk
- **Baked Cheesecake with no additional toppings**: High risk
- **Cheesecake with topping**: High care
- **Hot eating pies-reheat only**: High care

### 11 Low/high acid in cans/glass

High risk or high care production zones are not applicable for products in this category.

- **Canned Fish**: Low risk
- **Pickled Vegetables**: Low risk

### 12 Beverages

High risk or high care production zones are not applicable for products in this category.

- **Soft Drinks**: Low risk
### 13 Alcoholic Drinks

<table>
<thead>
<tr>
<th>Product</th>
<th>Risk Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>Low risk</td>
</tr>
<tr>
<td>Wine</td>
<td>Low risk</td>
</tr>
<tr>
<td>Beer</td>
<td>Low risk</td>
</tr>
</tbody>
</table>

High risk or high care production zones are **not** applicable for products in this category.

### 14 Bakery

<table>
<thead>
<tr>
<th>Product</th>
<th>Risk Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bread</td>
<td>Low risk</td>
</tr>
<tr>
<td>Madeira cake</td>
<td>Low risk</td>
</tr>
<tr>
<td>Decorated cake-ambient</td>
<td>Low risk</td>
</tr>
</tbody>
</table>

Cakes decorated with butter creams, jam fillings, chocolate, icing etc for ambient sale.

### 15 Dried Food Ingredients

<table>
<thead>
<tr>
<th>Product</th>
<th>Risk Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dried Soup</td>
<td>Low risk</td>
</tr>
<tr>
<td>Flour</td>
<td>Low risk</td>
</tr>
<tr>
<td>Instant Coffee</td>
<td>Low risk</td>
</tr>
<tr>
<td>Dried Herbs</td>
<td>Low risk</td>
</tr>
</tbody>
</table>

All products are classified as low risk in this category however some products may be susceptible to the survival of pathogenic organisms such as Salmonella and appropriate environmental controls should be in place after any kill step.

### 16 Confectionery

<table>
<thead>
<tr>
<th>Product</th>
<th>Risk Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chocolate</td>
<td>Low risk</td>
</tr>
<tr>
<td>Boiled Sweets</td>
<td>Low risk</td>
</tr>
<tr>
<td>Jellies</td>
<td>Low risk</td>
</tr>
</tbody>
</table>

All products are classified as low risk in this category however some products e.g. chocolate may be susceptible to the survival of pathogenic organisms such as Salmonella and appropriate environmental controls should be in place and segregation in place between raw bean processing areas and chocolate production.

### 17 Breakfast Cereals Snacks

<table>
<thead>
<tr>
<th>Product</th>
<th>Risk Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crisps/Snacks</td>
<td>Low risk</td>
</tr>
<tr>
<td>Cornflakes</td>
<td>Low risk</td>
</tr>
<tr>
<td>Muesli</td>
<td>Low risk</td>
</tr>
</tbody>
</table>

All products are classified as low risk in this category however some products may contain ingredients such as dessicated coconut, chocolate, skimed milk powder the may be susceptible to the survival of pathogenic organisms such as Salmonella and appropriate raw material controls should be in place.

### 18 Oils and Fats

<table>
<thead>
<tr>
<th>Product</th>
<th>Risk Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olive Oil</td>
<td>Low risk</td>
</tr>
<tr>
<td>Salad Dressings</td>
<td>Low risk</td>
</tr>
<tr>
<td>Mayonnaise</td>
<td>Low risk</td>
</tr>
<tr>
<td>Lard</td>
<td>Low risk</td>
</tr>
</tbody>
</table>

High risk or high care production zones are **not** applicable for products in this category.
Appendix 3 – Process Table

Equivalent processes to achieve 70°C for 2 minutes calculated using a z value of 7.5°C

<table>
<thead>
<tr>
<th>Temperature at the slowest heating point</th>
<th>Lethal rate (equivalent mins to 1 minute at 70°C)</th>
<th>Number of minutes required at the reference temperature to achieve an equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>61</td>
<td>0.063</td>
<td>31.74</td>
</tr>
<tr>
<td>62</td>
<td>0.086</td>
<td>23.26</td>
</tr>
<tr>
<td>63</td>
<td>0.116</td>
<td>17.24</td>
</tr>
<tr>
<td>64</td>
<td>0.158</td>
<td>12.66</td>
</tr>
<tr>
<td>65</td>
<td>0.215</td>
<td>9.30</td>
</tr>
<tr>
<td>66</td>
<td>0.293</td>
<td>6.83</td>
</tr>
<tr>
<td>67</td>
<td>0.398</td>
<td>5.02</td>
</tr>
<tr>
<td>68</td>
<td>0.541</td>
<td>3.70</td>
</tr>
<tr>
<td>69</td>
<td>0.735</td>
<td>2.72</td>
</tr>
<tr>
<td>70</td>
<td>1.00</td>
<td>2.00</td>
</tr>
<tr>
<td>71</td>
<td>1.36</td>
<td>1.47</td>
</tr>
<tr>
<td>72</td>
<td>1.85</td>
<td>1.08</td>
</tr>
<tr>
<td>73</td>
<td>2.51</td>
<td>0.80 (48 seconds)</td>
</tr>
<tr>
<td>74</td>
<td>3.41</td>
<td>0.60 (36 seconds)</td>
</tr>
<tr>
<td>75</td>
<td>4.64</td>
<td>0.43 (26 seconds)</td>
</tr>
<tr>
<td>76</td>
<td>6.31</td>
<td>0.32 (19 seconds)</td>
</tr>
<tr>
<td>77</td>
<td>8.58</td>
<td>0.23 (14 seconds)</td>
</tr>
<tr>
<td>78</td>
<td>11.66</td>
<td>0.17 (10 seconds)</td>
</tr>
<tr>
<td>79</td>
<td>15.85</td>
<td>0.13 (8 seconds)</td>
</tr>
<tr>
<td>80</td>
<td>21.54</td>
<td>0.09 (5 seconds)</td>
</tr>
</tbody>
</table>

For example, if heating at 68°C, it can be seen from the above table that 1 minute of heating at 68°C is equivalent to 0.541 minutes at 70°C. Therefore, to achieve the equivalent of 2 minutes at 70°C, it would be necessary to heat at 68°C for 3.70 minutes (2÷0.541=3.70).

This table is reproduced with permission from Campden BRI Guideline 51 – Pasteurisation: A Food Industry Practical Guide (Second edition). It is for illustrative purposes only. The equivalent times given are dependent on the z value of the organism in question, which in this example is given as 7.5°C. Z values vary from one strain to another, and can also change with temperature. Copies of the document are available from the Campden BRI publications section (telephone: +44 (0)1386 842048, email: pubs@campden.co.uk).