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15

GUIDANCE NOTE

Cook-chill Systems in the Food Service Sector (Revision 2)

Guidance Note No. 15: Cook-chill Systems in the Food Service Sector (Revision 2)

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Guidance Note No. 15
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1. INTRODUCTION

1.1 Definitions

A cook-chill food is a food product produced using a cook-chill system with a shelf life not greater than five days.

A cook-chill system must include the steps of cooking to a core temperature of 75 °C instantaneously (or equivalent time/temperature combination), followed by rapid chilling to ≤3 °C in not greater than 150 minutes, storage at ≤3 °C and regeneration to ≥70 °C prior to service and consumption.[1–3]

Cook-chill foods are typically produced in batches, in advance of regeneration, service and consumption, and produced in hospitals, institutions and catering establishments.

1.2 Scope

This guidance note **applies** to those food businesses producing cook-chill food as defined above for service and consumption in either a private or public capacity in hospitals, institutions and catering establishments.[4–5]

This guidance note **will not apply** to ready-to-eat foods.[6] Such businesses should consult the Food Safety Authority of Ireland (FSAI) Guidance Note No. 20.[7]

This guidance note **will not apply** to cooked and chilled or frozen food which is packaged for direct sale to consumers or another food business, including Internet and mail order sales. Such businesses should consult FSAI Guidance Note No. 20.[7]

This guidance note **does not deal** with the general or specific aspects of food hygiene, including training. However, it is essential that the highest standards of hygiene are maintained at all stages within a cook-chill system.[4–5, 8]

This guidance note **does not deal** with the introduction and implementation of a food safety management system based on the principles of Hazard Analysis and Critical Control Points (HACCP). However, food businesses must comply with the requirements of HACCP under the current legislation.[4–5, 8]

1.3 Pre-planning

A cook-chill system should not commence operation until the Health Service Executive (HSE) is satisfied that the necessary structural and operational facilities are in place.

It is essential that suitable expertise is available, either from within the business operating the cook-chill system or, if this is not available, from an external expert.

The introduction and operation of a successful cook-chill system requires adequate pre-planning. It is strongly recommended that the following should be considered, in detail, when planning a cook-chill system:

- The amount of cook-chill food to be prepared at any one time *(will vary, depending on customer orders)*
- Final consumer of the cook-chill food *(e.g. vulnerable group)*
- Quality, hygiene, food safety and staff training requirements
- Suitability of existing premises for the cook-chill operation
- Design of preparation area and related facilities
- Specialist equipment requirements
- Distribution and transport requirements
- Financial cost.

2. DESIGN OF THE COOK-CHILL SYSTEM

The cooking step in a cook-chill system is designed to eliminate or reduce to safe levels pathogens which may be present in that food. The cooking step will also help to maintain product shelf life and quality *(e.g. taste, aroma and appearance)*.

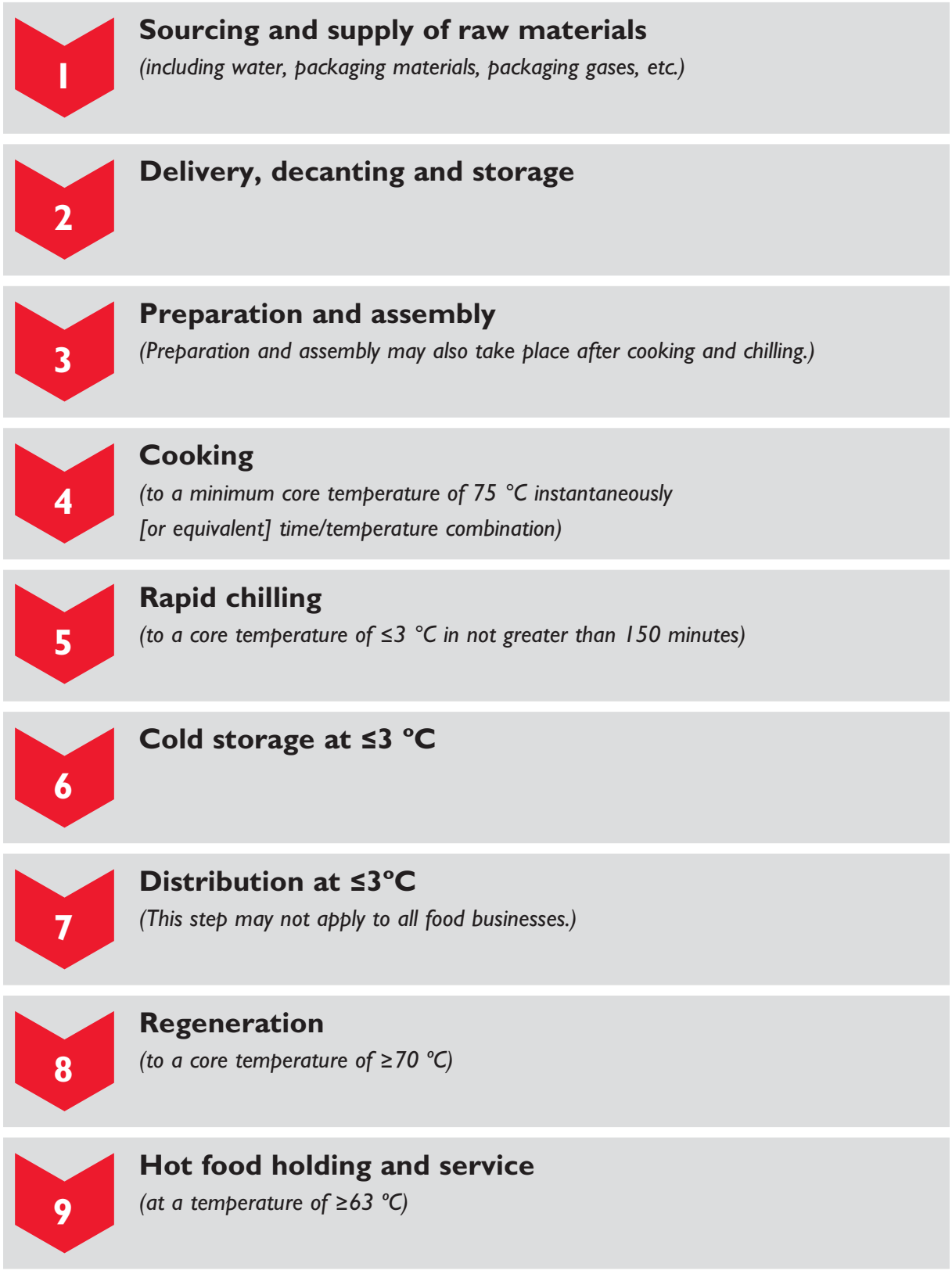
The chilling step in a cook-chill system is designed to minimise/prevent the outgrowth of spore-forming pathogens which may be present in that food, by rapidly reducing the temperature of the food to a low-storage temperature. The chilling step should also help maintain product shelf life and quality.

To ensure the design and implementation of a safe cook-chill system, the following is recommended before food businesses begin production:

1. Inform your supervisory authority *(e.g. HSE)*
2. Ensure that all good hygiene and manufacturing practices have been considered
3. Ensure that procedures based on HACCP principles are designed, documented and recorded.

An outline of the typical steps in a cook-chill system is given in Figure 1. However, it should be noted that the steps outlined may differ, depending on the nature of the food business using the cook-chill system.

Figure 1 Typical steps in a cook-chill system



2.1 Sourcing and supply of raw materials

Raw materials (*e.g. food ingredients, packaging, etc.*) and services (*e.g. distribution*) should only be sourced from reliable suppliers (*i.e. approved suppliers*). The use of poor-quality raw materials and inadequate services will affect the safety of all food products. As such, the purchase and supply of good-quality raw materials and reliable services is crucial. The following is recommended as good practice in sourcing, purchasing and supplying raw materials and services for use in a cook-chill system:

- Develop a method for approval of suppliers of raw materials and services.
- Stipulate to suppliers your requirements for safety and quality by way of a supplier approval form, which they must complete and update as required.[5, 8–9]
- Document and maintain an up-to-date list of approved suppliers.
- Keep records for the purposes of recall and traceability.

2.2 Water supply

Water should not represent a significant risk to human health through its consumption and use. As the definition of food under (EC) Regulation 178/2002 includes water (and ice) intentionally incorporated into food during its production, preparation or treatment, food businesses have a responsibility for the safety of water used directly, (*e.g. as an ingredient in food production*), or indirectly, (*e.g. in cleaning or processing*) during the manufacture of foods.[4–5]

All water (including ice) used by a food business for food production must meet the basic standards governing the quality of drinking water (i.e. potable water) intended for human consumption, as set out in Council Directive 98/83/EC and implemented in Ireland under SI No. 122 of 2014.[10, 29]

Where water entering a food premises is not of a drinking water quality (i.e. fit for human consumption), appropriate treatment should be applied to the water before use.[5]

If a food business is using or planning to use its own private water supply *(e.g. well or borehole*) in the production of food, that food business is responsible for ensuring the quality and safety of that water supply. Likewise, a food business operator (FBO) on a public water supply is also responsible for ensuring the quality and safety of the water after the point of compliance *(i.e. the point where the water is used in the premises)*.[5]

It is widely recognised that the construction, nature and location of many private water supplies in Ireland means that there is an increased risk of contamination. It is recommended that food businesses consult the Environmental Protection Agency (EPA) EPA website for detailed guidance on private well construction.

It is also recommended that food businesses use the services of a hydrogeologist before constructing any new well or borehole. Further information on the requirements for water quality is available from the FSAI in its factsheet on potable water quality for food businesses.[11]

2.3 Delivery, decanting and storage

On delivery, all raw materials should be inspected to ensure that they are:

- In an appropriate condition for intended use *(e.g. not damaged)*
- Appropriately packaged and labelled[5, 8–9]
- Accompanied by the appropriate documentation *(e.g. traceability information)*
- Within their shelf life *(i.e. use-by or best-before dates)*[12]
- In the case of food contact materials and packaging gases, ensure that these are appropriate for their intended use. Further information is available in the FSAI factsheet on food contact materials[9]
- Stored at the appropriate temperature during transport *(e.g. signs of temperature abuse)*:[8, 13–14]
  - Frozen food ≥ –18 °C
  - Chilled food ≤5 °C
  - Unopened ambient food, normally 10 °C to 20 °C *(e.g. canned and dried foods)*
- The transport used for delivery should also be inspected to ensure:
  - Hygiene and appropriateness of vehicle used
  - Raw food is segregated from cooked or ready-to-eat foods, if delivered in same vehicle
  - Personal hygiene of delivery personnel is appropriate.

All raw materials, in particular food ingredients stored on the business premises, should be clearly identified and stored under conditions that will prevent damage, cross-contamination and spoilage.

Stocks of raw materials, but in particular food ingredients, should be used by the food business with appropriate stock control procedures.[1, 14] Regular temperature monitoring is recommended for all frozen and chilled food ingredients.[1]

2.4 Preparation and assembly

The preparation and assembly of foods must be carefully controlled, monitored and documented by food businesses. Preparation and assembly may involve processes such as portioning, thawing, mixing, slicing, chopping, mincing, cutting, etc. It is, therefore, important that good hygiene is observed at all stages in the preparation and assembly of foods to be produced using a cook-chill system.

As the risk of contamination of food and equipment cannot be totally eliminated, handling and further treatment should always be carefully controlled. The following is recommended as good practice:[1, 3, 13–18]

- All preparation should take place under appropriate hygienic conditions and temperatures, and in appropriate surroundings on suitable working surfaces.
- Where possible, preparation and assembly should be carried out before cook-chill (to avoid post-cook and/or post-chill contamination), and it should be at a controlled temperature of ≤10 °C or completed within 30 minutes followed by immediate cooking and chilling.
- If cook-chill food is portioned or assembled into smaller quantities after cook-chill, the procedure should be carried out under controlled temperatures (i.e. ≤10 °C) in a suitable portioning area and/or be completed within 30 minutes, if handled at ambient temperature, followed by immediate chilled storage at ≤3 °C.

Some pathogenic bacteria and/or their toxins can contaminate food and survive cook-chill procedures. The portioning of food and assembly into smaller amounts is an important step to minimise cooking, chilling and regeneration times and the subsequent survival and/or growth of bacteria. The following is recommended as good practice:[1, 3, 13–18]

- Limit the weight and thickness of foods to match the performance capacity of the equipment (when fully loaded) used for cooking and chilling *(e.g. ≤2.5 kg in weight and ≤100 mm in thickness)*.
- In some food businesses, large meats, *(e.g. whole meat joints on the bone)* will often be prepared. In these cases, it may be necessary to portion the meat before cooking or chilling, depending on the capacity of the equipment. In addition, reformed or restructured[a] meat and poultry products, made with good-quality ingredients under hygienic conditions, can be portioned into smaller units to ensure that adequate cooking and chilling conditions are achieved.

[a] Reformed and restructured meats are processed meat products. Reformed meat products use intact meat pieces which are physically or chemically bound together to resemble whole unprocessed meats, whereas restructured meat products use minced/diced or chopped meat pieces physically or chemically bound together in a restructured shape.

- In certain circumstances it is also possible to portion poultry products *(e.g. removal of the legs on a chicken)* before cooking, which will help heat to penetrate into the product during cooking, and allow more efficient cooking and chilling (See Section 2.6.1).
- Consider how food is packaged *(e.g. netting, mould, casing, etc.)* during cooking and chilling, as this can affect the efficiency of these processes. For example, portioning and packaging in a sealed package prior to cooking and chilling can help decrease the risks of post-cook contamination and microbial growth, provided that the packaging does not inhibit cooking or chilling efficiency.
- Plan properly to make sure that you do not produce more food than you have the capacity to handle and/or store.

2.4.1 Thawing

Many frozen products, such as frozen vegetables, can be cooked without thawing. However, large pieces of meat, fish or poultry carcasses will require thawing prior to cooking.[14] Hazards associated with thawing include cross-contamination from drip and growth of microorganisms. Thawed meat and poultry products should be checked to make sure the thawing process is complete before further processing, or the processing time should be increased to take into account the temperature of the meat.[14]

It is recommended that food businesses follow suppliers' instructions, where provided, for thawing of frozen food. In the absence of such instructions, the following is recommended as good practice:[13–14]

- Thawing of food should only be carried out under conditions which protect the food from physical and chemical contamination and minimise the growth of microorganisms, including:
  - A refrigerator operated under controlled temperature *e.g. ≤5 °C*
  - A dedicated thawing unit operated under controlled conditions
  - Microwave oven with a thawing or defrost option. If using this option, the food should be immediately cooked following thawing.
- Thawed food to be used in the production of a cook-chill food should not be refrozen prior to cooking.

2.5 COOKING

Cooking should begin immediately after preparation, to limit the growth of microorganisms. The time and temperature of cooking should be sufficient to ensure adequate heat penetration at the core or thickest part of the food.

In Ireland and many other countries, *Listeria monocytogenes* has historically been taken as the target organism to ensure thorough cooking of foods. This is because *L. monocytogenes* is considered to be the most heat-resistant of the vegetative or non-spore-forming foodborne bacterial pathogens.[b] Therefore, cooking processes that are effective in destroying *L. monocytogenes* should destroy other non-spore-forming pathogens such as *Salmonella* spp. and *verocytotoxigenic Escherichia coli* should they be present in the food.[7, 18]

It is recommended that food should be cooked until its core or thickest part reaches a temperature of 75 °C instantaneously. This is considered effective in achieving a 6-D reduction (*i.e. 6-decimal reduction*)[c] in the number of *L. monocytogenes* cells (*i.e. assuming the z-value for inactivation of L. monocytogenes is 75 ºC*)[d] should they be present in the food.

The following is recommended as good practice to ensure that the cooking step of a cook-chill system achieves a 6-D reduction in the number of L. monocytogenes cells should they be present in the food:[3, 7, 19]

- Limit the weight and thickness of foods to match the performance capacity of the equipment (when fully loaded) used for cooking *(e.g. ≤2.5 kg in weight and ≤100 mm in thickness)*.
- Identify any cold-spots in the cooker *(e.g. place a temperature probe at different locations in the oven and monitor its temperature readings at these points)*.
- Use the reference time and temperature combination of 75 °C instantaneously (or equivalent) at the centre or thickest part of the food.
- The temperature of the food during cooking should be monitored using a calibrated temperature probe to ensure that it reaches the required time/temperature combination with an accuracy of ± 0.5 °C. Care should be taken to avoid cross-contamination when checking the temperature.

[b] The active growing stage of bacteria is known as the vegetative stage. Spores are the dormant stage of the bacteria and are much more resistant to heat than the vegetative cells. However, vegetative cells can survive refrigerated temperatures and freezing. Spores typically develop from a vegetative cell during unfavourable environmental conditions.

[c] The D-value is the time required in a given food/medium, at a given temperature, for a tenfold (1 log or 90% of the population) reduction in the number of organisms. A 6-D value means that if the food, for example, contains 1 million *L. monocytogenes* cells before cooking, only 1 *L. monocytogenes* cell should remain after cooking.

[d] The z-value is defined as the number of degrees Celsius by which the temperature has to change in order to achieve a tenfold (i.e. 1 $\log_{10}$) change in the D-value.

- When cooking is complete, the food should be portioned (if required) and placed in the chilling equipment within a maximum of 30 minutes of completion of cooking. Where portioning takes place, care should be taken to avoid cross-contamination.

In some circumstances, food businesses may wish to use different times and temperatures to cook their food. In these instances, food businesses may use different time/temperature combinations so long as they achieve the same lethal effect as 75 °C instantaneously. Scientifically accepted equivalent time/temperature combinations for L. monocytogenes can be found in the FSAI Guidance Note No. 20[7,e]

2.6 Chilling

Bacteria grow best at temperatures between 5 °C and 63 °C, more commonly known as the danger zone. If cooked foods take too long to cool down, surviving bacteria may be allowed sufficient time in the danger zone to grow. As such, minimising the time the food is in the danger zone will reduce the risk of surviving bacteria growing.[15, 17] The following is recommended as good practice in the chilling step of a cook-chill system:[13–16]

- Invest in rapid chilling equipment, such as blast chillers, to ensure that rapid reduction of temperature is achieved. The capacity of this chilling equipment must be sufficient to match peak demands for chilling.
- Limit the weight and thickness of foods to match the performance capacity of the equipment (when fully loaded) used for chilling *(e.g. ≤2.5 kg in weight and ≤100 mm in thickness)*. It is important to note that the speed of chilling the food will be affected by the following:
  - Size, shape and weight of food and construction material of the container or packaging the food is placed in
  - Whether the container is provided with a cover/lid or not
  - Properties of the food itself
  - Design of the chilling equipment
  - Temperature of the food entering the chilling equipment *(e.g. placing very hot food in a cooler can result in a large temperature rise within the cooler)*.

[e] In 2018, an FSAI Scientific Committee report examined z-values used in calculating equivalent time/temperatures for cooking beef burgers served by FBOs. This report concluded that in relation to beef burgers a z-value of 6 °C was appropriate for calculating time/temperature combinations for cooking beef burgers between 60 °C and 75 °C. The report states that if alternate time-temperature combinations to those supplied in the report of the scientific committee are to be employed, they must first be scientifically validated.[30]

- Once the cooking of the food is complete, rapid chilling should start within a maximum of 30 minutes (which allows time for hot portioning, if required, prior to chilling).
- Food should be chilled to a temperature of ≤3 °C at the centre or thickest part of the food within a further 120 minutes of completion of cooking *(i.e. a maximum of 150 minutes following completion of cooking)*.
- The temperature of the food during chilling should be monitored using a calibrated temperature probe with an accuracy of ± 0.5 °C. Care should be taken to avoid cross-contamination when checking the temperature.
- When chilling is complete, the food should be placed in chilled storage, also at ≤3 °C.

2.6.1 Large whole meat joints

Due to the nature and characteristics of some large whole meat joints or cuts *(e.g. ≥2.5 kg in weight and 100 mm in thickness)*, an alternative chilling regime can be recommended. However, this alternative chilling regime will not apply to boned and rolled joints, stuffed joints, and reformed or restructured meat products.[f]

Whole meat joints or cuts are typically considered internally sterile, with microorganisms only associated with the surface of the product. However, reforming or restructuring meat products will have microorganisms redistributed from the surface throughout the product where they are more difficult to destroy during cooking, and may then grow if inadequately chilled. Therefore, reformed or restructured meat products must always be chilled following cooking (as outlined in Section 2.6).

It is best practice to portion large whole meat joints or cuts to smaller portions *(i.e. ≤ 2.5 kg in weight and ≤100 mm in thickness)* before cooking and chilling. However, if this is not possible, the following alternative chilling regime is recommended for cooked large whole meat joints or cuts:[7, 15]

- Chilled to ≤3 °C at the centre or thickest part of the meat joint within a maximum of six hours, with a final storage temperature of ≤3 °C
- The time spent between 50 °C to 12 °C during chilling must be ≤4 hours.

[f] **Reformed meat products** use intact meat pieces physically or chemically bound together to resemble whole unprocessed products. **Restructured meat products** use minced, diced or chopped pieces of meat physically or chemically bound together into a restructured shape. **Boned and rolled meat joints** are convenient for cook-chill processes, but the operation of removing the bone and rolling the meat will transfer microbes from the surface to the centre.

- The temperature of the meat during chilling should be monitored at the centre or thickest part of the meat using a calibrated temperature probe with an accuracy of ± 0.5 °C. Care should be taken to avoid cross-contamination when checking the temperature.

Specifications for chilling outside the recommendations given above may be suitable to ensure product safety *(e.g. cured whole meats, such as ham, which contain salt and nitrate may have longer chilling times, but the onus is on the food business to prove the safety of the product. If high levels of spores are present in raw meat before cooking, a reduction in the safe chilling time may be necessary. Products which contain spices may have an increased spore count)*.[15] However, in all cases appropriate microbiological risk assessment data are required to ensure the safety of the process. The responsibility for the provision of such risk assessment data lies with the food business.

2.7 Chilled storage

As soon as the chilling step of the cook-chill process is complete, the food should be transferred from the chilling unit to cold storage at ≤3 °C.[17, 19–20] The following is recommended as good practice in the cold storage:

- A separate cold storage area should be provided for cook-chill food.
- The area should have sufficient capacity for all cook-chill foods.
- The area should allow for:
  - Access and pre-chilling of clean, empty trolleys, where used
  - Storage of packs on shelves, as required
  - Racking, for stock rotation, handling methods, and segregation of raw and cooked products (if a separate cook-chill storage area is not available).
- Perform regular monitoring of the air temperature and the food temperature *(i.e. between packs)* using a calibrated temperature probe with an accuracy of ± 0.5 °C during cold storage.
- Ensure that the temperature of the food does not exceed 3 °C in any part of the food and that it is maintained at this temperature until regeneration begins.
- Ensure that a strict system of stock control is operated so that stored foods are consumed in proper sequence.
- For traceability, stock rotation and food safety purposes, an identification system (e.g. labelling) should be implemented for all food in cold storage. This information must be clearly visible and understood by all staff who may handle the food. In particular, cook-chill food should be conspicuously marked and/or accompanied by documentation which includes:

- Name of the food
- Date of production
- Batch number (if applicable)
- List of ingredients (if applicable)
- Allergens (if applicable)
- Nutritional information (if applicable)
- Regeneration and service instructions (if applicable)
- The product shelf life indicated by a use-by date (See Section 3).

2.8 Distribution

In the distribution of food prepared in a cook-chill system it is essential that the temperature of the food does not rise above 3 °C, particularly if the storage period is to be extended up to the end of the food's shelf life at the service or display centre after distribution.

In some food businesses, it is necessary to transport the food from a central chilled store to points of regeneration, service and consumption. Distribution trolleys/vehicles are available with facilities for maintaining the cold-chain during transport. Typically, there are three main methods of distribution:

- The food is portioned/assembled and distributed under chilled conditions (i.e. ≤3 °C) and regenerated to ≥70 °C at the point of service and consumption.
- The food is not portioned/assembled, but is distributed in bulk under chilled conditions (i.e. ≤3 °C) and portioned/assembled and regenerated to ≥70 °C at the point of service and consumption. In the case where portioning/assembly is carried out, it is recommended that this be carried out at a controlled temperature of ≤10 °C and be completed within 30 minutes of the regeneration start time.
- The food is removed from cold storage, regenerated to ≥70 °C and distributed hot for service and consumption. This method of distributing the food is particularly common in hospitals, where the food is regenerated where it has been produced and is distributed in hot-holding trolleys to patients on the hospital wards.

The following is recommended as good practice in the distribution of the food:[13–14]

- If using a distribution vehicle, perform regular monitoring of the vehicle temperature *(e.g. normally air temperature)*; ideally, before during and after distribution, using a calibrated temperature probe with an accuracy of ± 0.5 °C.

- Where possible, temperature monitoring of the food should be carried out before and during transportation and at its destination, in order to check the effectiveness of the temperature-control equipment of the vehicle and/or containers.
- Where the distribution period is very short *(i.e. ≤30 minutes)*, and is to be followed by immediate service or regeneration and consumption, pre-chilled insulated containers *(i.e. to ≤3 ºC)* will be adequate for temperature preservation.

2.9 Time/temperature limitations in storage and distribution

All chilled foods are vulnerable to temperature abuse during cold storage and distribution. It is, therefore, essential that possible temperature abuse is minimised. The temperature of cook-chill food should be maintained at ≤3 °C throughout storage and distribution, including storage in vending machines, if applicable, or until regeneration begins. The following is recommended as good practice:

- Should the temperature of the cook-chill food during storage and distribution, but before regeneration, exceed 5 °C but not 10 °C, the food should be consumed within four hours of the temperature abuse occurring.[1]
- Some foods, such as canned/jarred, pouch or dried foods, can be safely stored unopened at ambient temperatures *(i.e. normally 10 °C to 20 ºC)*. In the case of canned/jarred or pouch foods, once opened the product must be stored following manufacturer's instructions.

It must be clearly understood that the tolerances contained in the above are not alternative systems of holding cook-chill foods, allowing foods to be kept at higher temperatures for shorter times.

2.10 Regeneration and service

Regeneration of the food is the last step in the cook-chill process before service and consumption. The following is recommended as good practice for the regeneration and service of cook-chill food:[13–18, 20–21]

- Cook-chill food should be kept under chilled storage at ≤3 °C until regeneration commences.
- Cook-chill foods sampled prior to regeneration should generally achieve the microbiological criteria set down in Appendix 1.
- The temperature of the cook-chill food before and after regeneration and during service should be monitored using a calibrated temperature probe with an accuracy of ± 0.5 °C. Care should be taken to avoid cross-contamination when checking the temperature.

- Use appropriate equipment for regeneration, which may include microwaves, forced air and steam convection ovens. Check with manufacturers for further information.
- Regeneration should take place immediately at, or close to, the point of service and consumption.
- Regeneration should begin no longer than 30 minutes after food is removed from chilled storage.
- Cook-chill food should not be regenerated at a single central point and distributed hot, unless distribution times are ≤30 minutes to the commencement of display/service, or temperature of the food can be maintained at ≥63 °C during distribution.
- The temperature of the cook-chill food at its centre or thickest part should reach a minimum temperature of ≥70 °C after regeneration. It should be noted that regeneration to these temperatures will, like cooking, destroy most bacterial pathogens, but it will not eliminate bacterial toxins such as those from *Clostridium botulinum*, *Staphylococcus aureus* or *Bacillus cereus* or bacterial spores.
- Regeneration should not be used as a procedure to minimise the effects of inadequate cooking, chilling or poor food hygiene.
- Do not regenerate cook-chill food more than once.
- If the regenerated cook-chill food is to be held hot for service, it must be held at ≥63 °C in suitable temperature-control equipment, typically for no longer than two hours (for quality reasons), after which the food should be discarded. If foods are held at inappropriate temperatures for a sufficient period of time, bacterial pathogens, if present, may grow.
- During hot service, heat loss to the surrounding environment will be greatest at the surface of the regenerated cook-chill food. This is known as evaporative cooling, and is particularly important if the food is particulate in nature (e.g. *soups*, *stew*, *curries*, etc.) and is not mixed regularly during service. If the food is not mixed, evaporative cooling can lead to a significant reduction in temperature at the surface of the food in comparison to the centre of the food. Frequent mixing, using designated utensils and good hygienic practice, or placing covers on the food is recommended to create a more even overall temperature throughout the food.
- Regenerated food should not be distributed hot, unless distribution times are ≤30 minutes to the commencement of display/service, or the temperature of the food can be maintained at ≥63 °C during distribution.

3. PRODUCT SHELF LIFE

The shelf life of foods produced in a cook-chill system must not be longer than five days. This shelf life of five days should include both the day of production *(i.e. cooking, chilling and cold storage of the cook-chill food)* and the day of regeneration, service and consumption of the cook-chill food.[14] However, the safety and the shelf life of the food produced in a cook-chill system is the responsibility of the food business producing it.[4, 6]

The shelf life of foods produced in a cook-chill food system must be indicated by a use-by date. Should any cook-chill food exceed its use-by date, it should be discarded.

Further information on the shelf life of food is available from the FSAI in Guidance Note No. 18 (Rev. 3) on Validation of Product Shelf-life[12]

4. RECORDS

Food businesses must maintain and retain records and, in particular, records relating to measures put in place to control hazards through good hygienic practice and procedures based on HACCP principles.[5] All records should be retained by the food business in a format that allows access in a timely manner, particularly if requested by an authorised officer. For food businesses supervised by the HSE, the following is required:

- General records related to general hygiene and HACCP (non-exhaustive list):[5]
  - Approved suppliers and customers
  - Temperature monitoring in preparation, thawing, cooking, chilling, storage, distribution, regeneration and service of food
  - Calibration of temperature measurement equipment *(i.e. this equipment should be calibrated and traceable to a national or international standard and records of calibration kept on file)*
  - Certificates of conformance for food contact materials and packaging gases[9]
  - Cleaning and sanitation operations for facilities and equipment
  - Staff training and experience
  - Laboratory testing as appropriate *(e.g. water analysis)*.
- In relation to the retention of the above general records *(i.e. excluding those related to traceability)* they should be maintained for the following periods:[23]
  - In the case of foods for immediate consumption, the documents and records should be retained for three months after the sale of the food.
  - In the case of foods requiring the indication of a use-by date, the documents and records should be retained for three months after the expiry of the relevant use-by date.
  - In the case of foods requiring the indication of a best-before or best-before end date, the documents and records should be retained for one year after the expiry of the relevant best-before or best-before end date, as the case may be.

- Records of officially approved waste hauliers used for waste collection and records of collection agreements
- General records for traceability and recall procedures, including all raw materials (i.e. food ingredients, water, packaging and packaging gases).[4, 22] For food businesses supervised by the HSE, the following is required as a minimum:[24]
    - In relation to food and raw materials supplied to the food business operator:
        - Name of supplier
        - Address of supplier
        - Nature of products supplied
        - Date of transaction/delivery.
- In relation to the retention of the above traceability records, they must be kept available at least until it can be reasonably assumed that the food has been consumed.[24]

Please note that for some foods, such as foods of animal origin, genetically modified organisms and sprouted seeds, there are additional traceability requirements.[25–27] Further practical advice and good practice on traceability and recall is available from the FSAI in Guidance Note No. 10 (Rev. 3) on Product Recall and Traceability.[22]

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APPENDIX 1 MICROBIOLOGICAL GUIDELINES FOR COOK-CHILL FOODS SAMPLED PRIOR TO REGENERATION

Levels of bacteria which may be acceptable for healthy adults may present an unacceptable risk to those with compromised immunity. To take this into account, any microbiological guidelines should be set at very low levels in healthcare settings.[28]

Even though cook-chill food produced for service in healthcare settings are to be regenerated by thoroughly heating to reach a core temperature of ≥70 °C before consumption, the presence of pathogens such as *L. monocytogenes* or *Salmonella* spp. is considered a serious risk given the nature of the vulnerable groups that may be the final consumers of the cook-chill food.

Cook-chill foods sampled prior to regeneration should generally achieve the microbiological criteria set down in Table 1, in particular in health care settings. While failure to meet these limits does not necessarily mean the batch of food should be considered unsafe, it does indicate that a thorough check should be made of all stages in the process and, if there is any doubt, the food should be destroyed.

When testing a batch of cook-chill food prior to regeneration, it is suggested to take a sample weight of approximately 100 g for testing. The samples should be taken immediately before the food is due to be regenerated. In this way, the results will reflect any abuse conditions to which the cook-chill food sampled has been subjected during storage and distribution following the cook-chill cycle. A rolling programme of testing to cover all menu items and catering processes is suggested.

The guideline microbiological limits set down in Table 1 only apply to cook-chill food immediately prior to regeneration, as defined under Section 1.1 of this document *(e.g. ham cooked, sliced, chilled and sampled prior to being thoroughly regenerated before service and consumption)*.

Note: The testing requirements, microbiological criteria and interpretation of results for ready-to-eat foods *(e.g. ham, cooked, sliced, chilled and served cold as a ready-to-eat food)* are set down in EU Regulation 2073/2005, as amended.[6]

Guideline microbiological limits for ready-to-eat foods for which no legal microbiological criteria exist are available from the FSAI in Guidance Note No. 3 (Rev. 2) on Guidelines for the Interpretation of Results of Microbiological Testing of Ready-to-Eat Foods placed on the Market.[18]

Table 1 Guideline limits for specific pathogens and indicator microorganisms in cook-chill foods tested immediately prior to regeneration[a]

Microorganism	Result based on CFU/g *or* Absence/Presence in 25 g		Actions for unsatisfactory results
	Satisfactory	Unsatisfactory	
Aerobic colony count (ACC) *at 30 °C*[b]	$<10^5$	$\geq 10^5$	Investigate cause and put corrective action in place (**See Table 2**)
Escherichia coli	<10[c]	≥ 10	
Coagulase-positive staphylococci	$<10^2$ [c]	$\geq 10^2$	
Clostridium perfringens	$<10^2$ [c]	$\geq 10^2$	
Listeria monocytogenes	Not detected	Detected	Withdraw food from use and investigate cause immediately
Listeria spp. (Non *L. monocytogenes*)	Not detected	Detected	Unsatisfactory isolate(s) should be processed for further speciation Investigate cause and put corrective action(s) in place (**See Table 2**)
Salmonella spp.	Not detected	Detected	Withdraw food from use and investigate cause immediately

[a] Table adapted from[1, 3, 18 and 28]

[b] Variations in ACC are the most useful guide to hygiene and temperature control of the processes.

[c] Presence of this organism at lower levels (which comply with the limit for a satisfactory sample) may require investigation, depending on local experience and risk assessment.

Table 2 Recommended corrective action(s) required for unsatisfactory results of pathogen or hygiene indicator tests

<table>
<tr><th>Microorganism</th><th>Action(s) for unsatisfactory result(s)</th></tr>
<tr><td>Aerobic colony count (ACC) at 30 °C [b]</td><td rowspan="5">Food businesses should:

1. Investigate the cause of the unsatisfactory result

2. Carry out the necessary actions to ensure that counts in subsequent batches of cook-chill food are at satisfactory levels, e.g.:

a) Review cooking times/temperatures to ensure adequate heat treatment

b) Review chilling times/temperatures to ensure adequate refrigeration

c) Review selection and origin of raw materials

d) Review cleaning and sanitising procedures to ensure that they are effective

e) Review staff hygiene practices to ensure that they are adequate

f) Review staff training to ensure that staff are appropriately trained

g) Review and update their HACCP-based procedures and good hygiene practices

h) Test further samples of cook-chill food environmental samples from the cook-chill preparation and assembly areas.</td></tr>
<tr><td>Escherichia coli</td></tr>
<tr><td>Coagulase-positive staphylococci</td></tr>
<tr><td>Clostridium perfringens</td></tr>
<tr><td>Listeria spp.</td></tr>
<tr><td>Listeria monocytogenes</td><td rowspan="2">Immediately withdraw the cook-chill food from use, investigate cause and implement corrective actions.</td></tr>
<tr><td>Salmonella spp.</td></tr>
</table>

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