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GUIDANCE NOTE

Cook-Chill Systems in the Food Service Sector (Revision 1)

Guidance Note No. 15
Cook-Chill Systems in the Food Service Sector (Revision 1)

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1. INTRODUCTION

1.1 Definition

A cook-chill system is defined under the scope of this Guidance Note as a catering process whereby meals or meal components are fully cooked, then cooled by controlled chilling, e.g. blast chilling, and subsequently stored at a temperature above freezing point (i.e. ≤ 3°C), prior to regeneration and/or service [1-3].

1.2 Scope

This Guidance Note shall apply to all food businesses where food is prepared as a cook-chill food, and served to consumers for consumption in either a private, e.g. deli counter, sandwich bar etc. or public, e.g. restaurant, hotel etc. capacity as outlined by current legislation [4-5]. Mail order, internet and businesses producing pre-packed cook-chill products for resale by another business come under the scope of Guidance Note 20 [6]. Activities of food service businesses may include the following:

1. Purchase and delivery
2. Decanting and portioning
3. Preparation
4. Cooking and chilling
5. Storing
6. Transporting
7. Distributing
8. Handling
9. Offering for sale or supply.

This Guidance Note provides information on water quality (Section 3.2). It does not deal with the general or personnel aspects of food hygiene, including training. However, it is essential that the highest standards of hygiene are maintained at all stages within the food service sector. Food businesses must comply with the requirements of the new Regulation (EC) No. 852/2004 of the European Parliament on the hygiene of foodstuffs [5], and follow the Irish Standard for hygiene in the catering sector published by the National Standards Authority of Ireland (NSAI) [7]. Further information on the new food hygiene regulations is also available from the Food Safety Authority of Ireland (FSAI) [8].

This Guidance Note does not provide information on 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 covered under the current legislation [5]. Relevant staff members, e.g. managers, supervisors should demonstrate an understanding of the principles of HACCP. Consultation is recommended with regulatory authorities, e.g. FSAI on food safety management incorporating HACCP where expertise is required, but not available internally, within the food business. The FSAI has also produced a suite of publications with further information on HACCP [9].

The Guidance Note gives recommendations, in terms of times, temperatures and other operating requirements, necessary to operate a safe cook-chill system. It is strongly recommended that any proposal(s) to adopt alternative procedures should be discussed and agreed, with the appropriate regulatory authorities.

1.3 Pre-planning

A cook-chill operation should not commence until the relevant authority, such as the Health Service Executive 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 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:

1. Amount of cook-chill food to be prepared at any one time (will vary depending on customer orders)
2. Final consumer of the cook-chill food
3. Quality, hygiene, food safety and staff training requirements
4. Suitability of existing premises for cook-chill operation
5. Design of preparation area and related facilities
6. Specialist equipment requirements
7. Distribution and transport requirements
8. Financial cost.

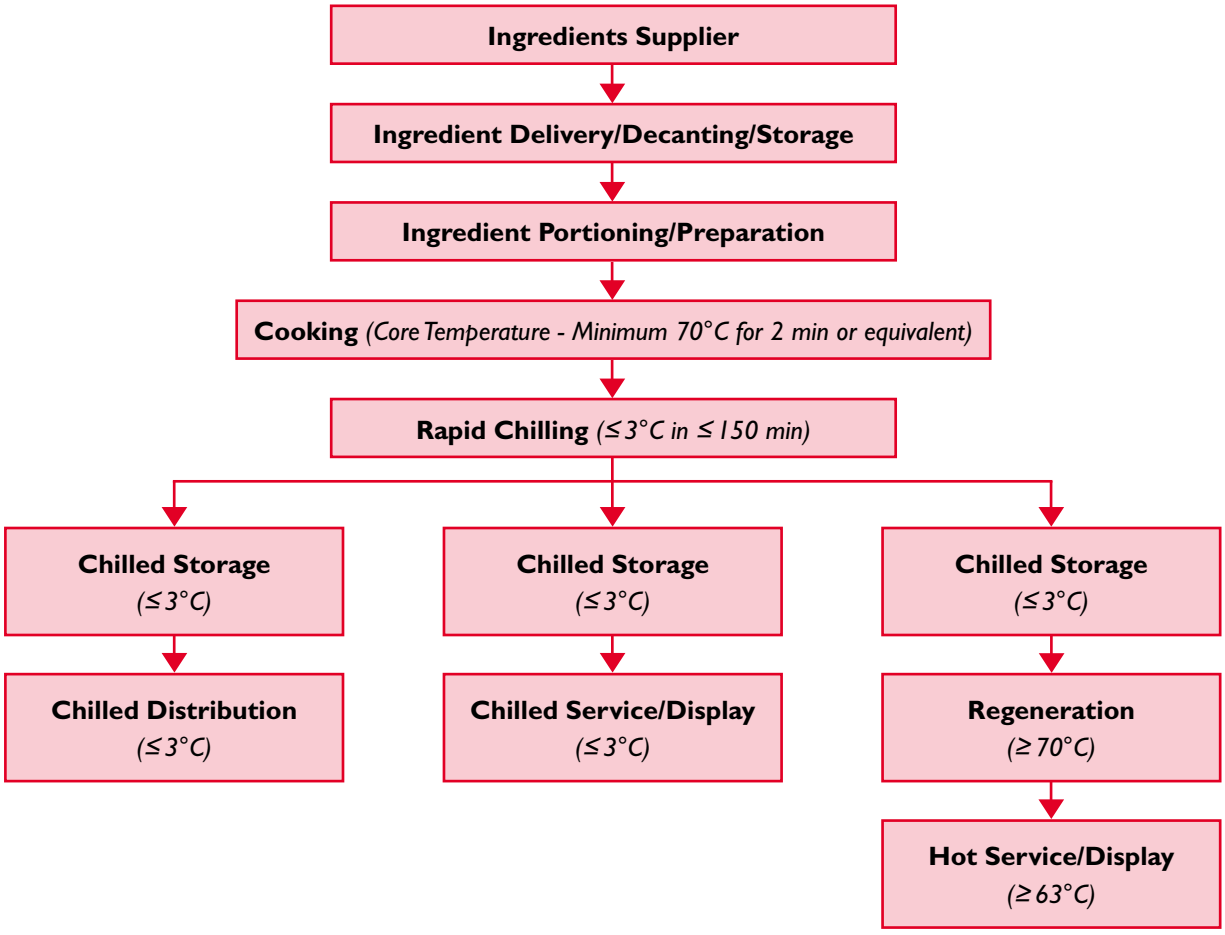
2. COMPONENTS OF A SAFE COOK-CHILL SYSTEM

To ensure the safety of cook-chill foods, the following components are necessary:

1. Ingredients should be of good microbiological quality and be sourced from approved suppliers. The storage conditions, including times and temperatures of all ingredients, should be closely monitored and regulated
2. Cooking should ensure the destruction of the vegetative stages of any pathogenic microorganisms present
3. Cooking should be followed by controlled chilling to control growth of microorganisms
4. Cross contamination should be avoided at all stages, particularly between raw and cooked food
5. Storage and distribution conditions for cook-chill food should ensure its microbiological safety
6. Regeneration and service procedures for cook-chill food should ensure its microbiological safety is maintained through to consumption
7. A food safety management system incorporating HACCP.

A summary of a typical cook-chill system for food service businesses is given in Figure 1.

Figure 1. Typical Cook-Chill System used in Food Service Businesses*



*The above flow-diagram is an example. All cook-chill systems will not necessarily follow the same procedures.

3. DESCRIPTION OF SYSTEM COMPONENTS

3.1 Purchasing and Delivery of Ingredients

1. Ingredients must only be sourced from reliable, i.e. approved/registered suppliers. Particular care should be taken with ingredients, such as raw vegetables, salads, raw meat, poultry, fish and dairy foods. In addition, spices are a common source of bacterial spores.
2. Maintain a list of reliable suppliers [10].
3. Provide information, i.e. a specification, to suppliers for each ingredient, where necessary, to ensure the desired safety and quality of those ingredients on delivery.
4. Ingredients and/or services should be controlled and recorded for the purposes of recall and traceability [4,10].
5. Inspect all ingredients on delivery to ensure:
   - **i.** ingredient is in appropriate condition for intended use
   - **ii.** ingredient is accompanied by appropriate documentation
   - **iii.** transport is suitable
   - **iv.** appropriate temperature control is observed [7,11-12]
     - frozen food ≤ -18°C
     - perishable food and ingredients (i.e. chilled) ≤ +5°C
     - chilled minced meat ≤ +2°C
     - cook-chill food and ingredients ≤ +3°C
     - ambient foods, e.g. dried food, bread, room temperature (i.e. 10°C - 20°C)
     - hot food ≥ +63°C
   - **v.** personal hygiene of delivery personnel is appropriate
   - **vi.** food is within 'use-by' or 'best-before' dates [13-14]
   - **vii.** food is packaged/labelled appropriately
   - **viii.** raw food is segregated from cooked foods, if delivered in same vehicle [15].
6. Store and control ingredients appropriately after delivery.

3.2 Water Supply

Water should not represent a significant risk to human health through its consumption and use. The legal definition of food includes water intentionally incorporated into food during its manufacture, preparation or treatment [4]. All water (including ice) used in any food production undertaking for the manufacture, processing, preservation or marketing of products or substances intended for human consumption must meet the requirements of Council Directive 98/83/EC on the quality of water intended for human consumption [16]. Where water entering premises is not of potable quality (i.e. fit for human consumption) [5] appropriate treatment should be applied to the water before use (Appendices 2-3).

3.3 Food Preparation

Food preparation must be carefully controlled, monitored and documented by food businesses [7]. Preparation may involve processes such as thawing, mixing, slicing, chopping, mincing and cutting. Preparation should take place under hygienic conditions in appropriate surroundings on suitable working surfaces (Section 1.3). Preparation of perishable foods should be carried out under controlled temperatures (≤ 10°C) and/or be completed within 30 minutes followed by immediate cooking and chilling [12]. Every effort should be made to ensure that quantities of foods, in excess of available capacity, are not prepared. Proper planning can help avoid preparation of excess quantities of food [1].

Perishable ingredients (i.e. unless otherwise indicated) should be held at temperatures ≤ 5°C prior to cooking. Foods placed in storage prior to cooking should be covered and segregated to avoid cross contamination, and be clearly identified by labels to include a food name, batch code and a 'use-by' or 'best-before' date [13]. Regular temperature and hygiene monitoring, in addition to microbiological sampling of ingredients and prepared finished foods, is recommended [1].

3.4 Portioning and Assembly

Portioning of food and assembly of meals into smaller amounts is an important step in ensuring safe cooking and chilling, and should be practiced, as necessary, to meet the requirements of this Guidance Note [7]. If pathogens contaminate food, their spores and/or their toxins, where applicable, may survive cooking and chilling [17-18]. It is therefore imperative that the strictest conditions of hygiene are observed at all stages in the preparation of cook-chill foodstuffs. As the risk of contamination of food and equipment cannot be totally eliminated, handling and further treatment should always be carefully controlled.

Portioning and assembly of food prior to cook-chill is best practice, but not always possible, to avoid post-cook and/or post-chill contamination typically through inappropriate handling. However, as food is often portioned or assembled into smaller quantities, e.g. slicing cooked meat, after cooking or chilling in food catering, the procedure should be carried out under controlled temperatures (≤ 10°C) in a suitable portioning area and/or be completed within 30 minutes, if handled at ambient temperature [12] (Section 3.3).

In many cases, portioning food into smaller amounts helps to minimise cooking, chilling and regeneration times (Section 3.11). Some foods are more easily portioned than others, and these foods should be portioned as necessary. Whether portioning is carried out or not, it must be demonstrated by the catering business that the cook-chill process can meet the requirements of the guidance note to ensure the safety of the food (Sections 3.6-3.7).

3.4.1 Meat and meat products

Meat and meat products which pass through a cook-chill system should be limited in weight, thickness and height, e.g. ≤ 2.5kg in weight and 100mm in thickness or height, equivalent to the performance capacity of the equipment used [1,3]. In some catering 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 (Section 3.4). Alternatively, reformed or restructured* 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 [17].

In certain circumstances, i.e. depending on the product and practices of the food business, it is possible to portion meat products, e.g. removal of the legs on a chicken, before cooking which will help heat penetrate into the product during cooking, and allow more efficient chilling after cooking.

Portioning of meat and poultry products following cooking, but prior to chilling, is also possible under certain circumstances, i.e. depends on the product and practices of the food business, to improve efficiency of cooking and chilling. However, whenever portioning of cooked meat and poultry products takes place, it must be carefully controlled to prevent product contamination. Meat and poultry products, immediately following cooking and/or chilling and after, are high risk products, and are therefore prone to contamination, if handled inappropriately.

* 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 while restructured meat products use minced/diced or chopped meat pieces physically or chemically bound together in a restructured shape.

If food businesses are preparing reformed or restructured meat products for a cook-chill process, great care should be taken particularly as they receive more handling than whole meat, and are therefore of greater risk to contamination (Section 3.7.1).

In preparing reformed or restructured meat products, size should be minimised or kept equivalent to the performance capacity of the equipment used, e.g. ≤ 2.5kg in weight and 100 mm in thickness or height [1]. This is achievable as there is control of product dimensions due to the nature of the ingredients used. In addition, how a meat is packaged, e.g. netting, mould, casing, during cooking and chilling should be considered, as this can affect cooking and chilling safety and efficiency. 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 providing that the packaging does not inhibit cooking or chilling efficiency. Furthermore, it is strongly recommended that the service of rare or undercooked, reformed or restructured meat is avoided.

3.5 Cooking Method

Improvements and advances in catering equipment have seen the use of more industrial style cooking techniques, by modern cook-chill food businesses. The selection of a particular cooking method is based on considerations, such as, product type, customer requirements and available equipment and premises.

3.6 Cooking Process

Ideally, cooking should take place immediately following preparation (Section 3.3) and/or portioning (Section 3.4) to limit and prevent any microbial spoilage or pathogenic growth. The time and temperature of the cooking should be sufficient to ensure that heat penetration at the core of a food will result in the destruction of the vegetative stages of any pathogenic microorganisms present. This is normally achieved when a food reaches a minimum temperature of ≥ 70°C for two minutes or equivalent, e.g. 75°C instantaneously, at the core of the food [19-20]. The core is taken as the centre or thickest part of a food [3]. It is important that the temperature is checked regularly by inserting a calibrated thermometer into the slowest heating point, normally the core of a product, and monitoring the temperature readings recorded (Appendix 1). Further information on calibration is available in FSAI Guidance Note 20 [6].

3.7 Chilling Process

In order to ensure the optimum safety of cook-chill food, chilling should begin within a maximum of 30 minutes following completion of cooking and/or portioning. Following completion of cooking and/or portioning, all cook-chill food must be chilled to ≤ 3°C within a total time of ≤ 150 minutes (i.e. a maximum of 30 minutes following completion of cooking and/or portioning plus a maximum of 120 minutes for chilling), followed by chilled storage to ensure a final storage temperature of ≤ 3°C (Adapted from [12, 17-18]). Some, large whole, non-reformed or non-restructured meats may be an exception to this rule, as outlined in Section 3.7.1.

Slow-chilling of foodstuffs can represent a hazard if, during the chilling period, pathogenic vegetative microorganisms, pathogenic spore-formers, and/or toxin forming species are allowed sufficient time and temperature conditions to proliferate. Pathogens may be present due to the following:

1. Poor hygiene conditions
2. Pre cook contamination
3. Inadequate cooking/chilling procedures
4. Survival and subsequent growth of microorganisms
5. Post-cook contamination.

The temperature range (5°C to 63°C), at which these surviving pathogens can readily multiply, must be traversed as quickly as possible to minimise growth during chilling, after cooking or on regeneration, display and service [7,15]. Most non-spore forming pathogens will not multiply readily at < 10°C [21]. A temperature of ≤ 5°C is required primarily to reduce growth of spoilage organisms and achieve extended storage life. However, because some non-spore forming pathogens, particularly *Listeria monocytogenes*, can grow at these temperatures (≤ 5°C) during extended storage, which is common with cook-chill food, it is strongly recommended that caterers ensure a final storage temperature of ≤ 3°C for all cook-chill food [22]. In addition, the preparation of quantities of foodstuffs necessary to fulfil specific customer orders will also limit storage times.

3.7.1 Special Circumstances

Due to the nature and characteristics of some specific meat products, an alternative chilling regime can be recommended. Special consideration is therefore given to large non-reformed or non-restructured e.g. ≥ 2.5kg in weight and 100 mm in thickness or height, whole meat joints, cuts and roasts (Section 3.4.1).

Whole, non-reformed or non-restructured meat products must be chilled to ≤ 3°C within six hours, with a final storage temperature of ≤ 3°C. However, there are three stipulations on this alternative chilling regime for non-reformed or non-restructured whole meat joints, cuts or roasts:

1. The time spent between 50°C to 12°C during chilling time must be ≤ 4 hours (Adapted from [17]). Beyond this chilling time, the onus is on the food business to prove the safety of the meat*
2. Whole, non-reformed or non-restructured meat products, chilled in this way, must not be portioned until completion of chilling
3. Appropriately calibrated time/temperature data logging devices must be used to provide evidence of all times and temperatures of meat products during chilling.

Typically with whole meat joints, cuts and roasts, microorganisms are only associated with the surface of the product. However, meat products which receive processing such as reforming, restructuring, mincing etc. will have microorganisms redistributed from the surface throughout the product where they are more difficult to destroy during cooking, and may survive inadequate chilling. Therefore reformed, restructured, minced etc., meat products must always be chilled following cooking like other cook-chill foods, to ≤ 3°C in ≤ 150 minutes followed by chilled storage to ensure a final storage temperature of ≤ 3°C.

3.7.2 Chilling equipment

Specially designed rapid chilling equipment, such as blast chillers, are normally required if rapid reduction of temperature is to be achieved, particularly in large food service businesses. In food service businesses with large volume throughput, it is strongly recommended that there is investment in specialised rapid chilling equipment, such as blast chillers. The capacity of chilling equipment must be sufficient to match peak demands.

In order to achieve the recommended chilling times, the chilling equipment must have a performance capacity capable of reducing the temperature of food from 70°C (or equivalent) to ≤ 3°C in a period ≤ 150 minutes, unless otherwise stated (Section 3.7.1) when fully loaded. With certain foods, due to their size, it may not be possible to achieve this temperature reduction. If this is the case, the food should be portioned so the required performance can be achieved (Section 3.4). While there are many types of chilling equipment and variations within a given category, common methods used by food service businesses include:

1. Chilling with cold air, such as air-blast chilling, which circulates low temperature air at high velocity over the surface of the foodstuff
2. Chilling with liquids, such as water immersion chilling, which circulates low temperature water or brine over the surface of the foodstuff.

*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 [17].

Chilling and chilled storage equipment (Section 3.8), i.e. with a capacity of ≥ 0.5m³, should be fitted with a calibrated thermometer and/or a temperature recording device with an accuracy of ± 0.5°C to measure equipment temperature [7]. Calibrated hand-held thermometers or temperature recording devices should be used to determine product temperature during chilling and storage (Appendix 1). It is important to note that the speed of chilling a food will be affected by the following:

1. Size, shape and weight of food and construction material of the container or packaging the food is placed in
2. Whether the container is provided with a cover/lid or not
3. Properties of the food itself
4. Design of the chilling equipment
5. Temperature of the food entering the chilling equipment (placing hot food in a cooler can result in a large temperature rise within the cooler).

3.8 Cook-Chill Food Storage

The chilled storage area will be capable of holding all prepared cook-chill foods at ≤ 3°C. It is strongly recommended that chilling equipment, e.g. air-blast chill, used to initially reduce temperature of cooked food from 70°C (or equivalent) to ≤ 3°C (Section 3.7.2) is not used for chilled storage.

Temperature, normally air-temperature, in the chilled storage area should be monitored using calibrated temperature recording equipment, the accuracy (± 0.5°C) of which should be checked at least annually. Air temperature of the chilled food storage area should be between -1°C to 5°C, and the temperature of the cook-chill food itself should also be monitored (Section 3.7.2). There should be an audible alarm device, which will indicate if the temperature within the chilled store (not food) rises above 5°C. The chilled store, used for holding cook-chill foods in quantity, should be specially designed for the purpose. It should allow for:

1. Access and pre-chilling of clean empty trolleys, where used
2. The storage of packs on shelves, as required
3. Racking, for proper stock rotation, handling methods, and segregation of raw and cooked products.

Foods coming from the chilling equipment should be placed immediately into chilled storage. In order to avoid the risk of food contamination and temperature fluctuations due to frequent opening of doors, the chilled store should be used solely for cook-chill foods. An identification system must be adopted. It is recommended that a colour coding labelling system on the food packaging is used to easily identify food for use on a particular day. This information must be clearly visible and understood by all staff who may handle the food. A strict system of stock control should

be operated so that stored foods are consumed in proper sequence. In particular, all food should be conspicuously marked with:

1. Name of the food
2. Date of production
3. Storage instructions
4. The safe shelf-life indicated by a 'use-by' date, i.e. typically 2-5 days*.

The safe shelf-life, i.e. indicated by a 'use-by' date of a cook-chill food stored at ≤ 3°C should never exceed five days (including both the days of preparation and consumption) unless its safety under expected storage conditions has been determined and can be demonstrated by the food business [1,12]. Should any food exceed its shelf-life, it should be discarded. Further information on shelf-life determination is available in FSAI Guidance Note No. 18 [13].

3.9 Distribution of Cook-Chill Foods

In the distribution of cook-chill food, temperature fluctuation can be difficult to effectively control. However, it is essential that the temperature of the food does not rise above the designated storage temperature, i.e. ≤ 3°C, particularly if the storage period is to be extended up to the end of the food's shelf-life, i.e. maximum of five days, at the service or display centre after distribution. The air temperature of the distribution vehicle should be between -1°C and 5°C, and maintain the temperature of the cook-chill food at ≤ 3°C during distribution [7].

3.9.1 Distribution from central preparation area to service area

Where the distribution period is very short (≤ 30 minutes), and is to be followed by immediate service or regeneration and consumption, insulated containers will be adequate for temperature preservation, although the temperature rise which occurs in such situations should be regularly monitored. Insulated containers will be chilled, i.e. ≤ 3°C, before use.

It is recommended that distribution containers or vehicles will be refrigerated, i.e. between -1°C and 5°C, where the distribution period is ≥ 30 minutes, or when ambient air temperatures are high and where distribution is to be followed by further storage in chilled stores at the central retail/service/display point. All vehicles used for transportation must be fitted with temperature control equipment. Temperature monitoring of food should be carried out before and during transportation, where possible, and at its destination in order to check the effectiveness of the temperature control equipment of the vehicle.

*The shelf-life of cook-chill food is the responsibility of the food business producing it [4,13].

3.9.2 Distribution from a central preparation area to consumers

In some food businesses, it is necessary to transport cook-chill food from a central chilled store to points of service, regeneration and consumption. Distribution trolleys/vehicles are available with facilities for maintaining the cold-chain during transport. There are two main methods of distributing cook-chill foods. Either the food is portioned/assembled and distributed under refrigerated conditions and regenerated, where applicable, at the point of consumption/service, or the food is not portioned/assembled but distributed in bulk, under refrigerated conditions, and regenerated, where applicable, at the point of consumption or service. Where portioning/assembly is carried out, it is recommended that this be carried out in a suitable temperature controlled area at ≤ 10°C and/or be completed within 30 minutes of the regeneration start time.

3.10 Time and Temperature Limitations in Storage, Display and Distribution of Cook-Chill Foods

All chilled foods are vulnerable to temperature abuse during distribution, display and storage. It is, therefore, essential that temperature abuse be minimised. The temperature of cook-chill food should be maintained at ≤ 3°C (Section 3) throughout storage, distribution and display (including holding in vending machines, if applicable), or until regeneration begins.

1. Should the temperature of the cook-chill food during storage, distribution, or display and before regeneration exceed 5°C but not 10°C, the food should be consumed within four hours of the temperature abuse [1].
2. Some processed, canned and dried foods can be safely stored at ambient temperatures, i.e. normally 10°C - 20°C, including canned meats, such as corned beef. However, in the case of a canned meat, such as corned beef, once the can has been opened, the product must be stored at ≤ 3°C, as outlined in Section 3.
3. Cook-chill foods intended to be eaten cold should be consumed within 30 minutes of removal from chilled storage.

The chill storage part of a cook-chill system is intended to hold food at ≤ 3°C. 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.

3.11 Regeneration

If cook-chill foods are held at inappropriate temperatures for a suitable period of time, pathogens, if present, may have the opportunity to grow (Sections 3.6-3.7). Regeneration of cook-chill food should begin no longer than 30 minutes after food is removed from chilled storage, and the core temperature of the food should reach a minimum temperature of ≥ 70°C before serving [7]. If the cook-chill food is to be held after regeneration, the food must be held at ≥ 63°C in suitable temperature control equipment, such as display units, for no longer than two hours, i.e. best industry practice, after which the cook-chill food should be discarded.

Regeneration to ≥ 70°C, at the core of the food, will destroy most pathogens. However, it will not eliminate bacterial toxins, e.g. *Clostridium perfringens, Clostridium botulinum, Staphylococcus aureus or Bacillus cereus* toxins, and bacterial spores [21]. Regeneration should not be used as a procedure to minimise the effects of inadequate cooking, chilling or poor food hygiene.

Cook-chill foods must not be regenerated more than once. It is important that 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. Failure to observe this defeats the basic objective of the cook-chill system. Suitable types of regeneration equipment include microwaves, forced air, and steam convection ovens. Equipment used to regenerate and display cook-chill food should only be used for purposes, as per manufacturer's instructions.

Regeneration of cook-chill food should take place immediately at, or close to, the point of consumption, or the food should be placed under chilled storage at ≤ 3°C until regeneration commences (Section 3.8). Suitable temperature control equipment should be provided in this area, if holding of food before regeneration is necessary. Suitable calibrated temperature recording devices must also be fitted to such equipment, where necessary.

After cooking or regeneration, heat loss to the surrounding environment will be greatest at the surface of a food. This is known as evaporative cooling, and is particularly important if the food is particulate in nature, such as meat and sauce dishes when the food is not mixed regularly during holding in display and 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.

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21. **Doyle E.** (2002). Survival and growth of *Clostridium perfringens* during the cooling step in thermal processing of meat products: a review. Food Research Institute, University of Wisconsin, United States http://www.wisc.edu/fri/briefs/cperfsurvivgrow.pdf

22. **Food Safety Authority of Ireland** (2005). The Control and Management of *Listeria Monocytogenes* Contamination of Food http://www.fsai.ie/publications/index.asp

23. **National Standards Authority of Ireland** (1998). Hygiene in Food Retailing and Wholesaling. I.S. 341

24. **Food Safety Authority of Ireland** (2001). Code of Practice No. 4. Code of Practice for Food Safety in the Fresh Produce Supply Chain in Ireland

5. SUGGESTED READING

1. **National Standards Authority of Ireland** (1990). Code of Practice in the Food and Drink Manufacturing Industry I.S. 319

2. **Her Majesty's Stationery Office (HMSO)** (1993). Assuring Safe Catering - A Management System for Hazard Analysis

3. **Food Safety Authority of Ireland** (2001). Guidance Note No. 3. Interpretation of Results of Microbiological Analysis of Some Ready-to-Eat Foods Sampled at Point of Sale

4. **Food Safety Authority of Ireland** (2006). Guide to Food Safety Training Level 1 Induction Skills and Level 2 Additional Skills

5. **Food Safety Authority of Ireland** (2003). Guide to Food Safety Training Level 3 – Food Safety Skills for Management

6. **Food Safety Authority of Ireland** (2004). Business Start-Up Pack: Food Service Sector

7. **Food Safety Authority of Ireland** (2002). The Labelling of Food in Ireland 2002

6. SELECTED WEBSITES OF INTEREST

Teagasc
www.teagasc.ie

Department of Agriculture and Food
www.agriculture.gov.ie

Department of Enterprise, Trade and Employment
www.entemp.ie

Department of Communications, Marine and Natural Resources
www.marine.gov.ie

Department of Health and Children
www.doh.ie

National Standards Association of Ireland (NSAI)
www.nsai.ie

Office of the Information Commissioner
www.irlgov.ie/oic

Office of the Attorney General
www.irishstatutebook.ie

European Union
www.europa.eu.int

European Union Legislation On-Line
http://europa.eu.int/eur-lex/lex/en/index.htm

APPENDIX 1. TEMPERATURE MEASUREMENT

An adequate number of calibrated thermometers, with a selection of probes, should be available for monitoring temperature. Precautions should be taken against transferring microorganisms from raw to cooked foods using temperature probes. Separate probes must be used for raw and cooked food, and they must be cleaned and disinfected after each use. Never use glass or mercury thermometers for food temperature measurement. Temperature probes for use with raw foods should be clearly distinguishable, e.g. by colour coding the temperature probes.

The temperature of food will not necessarily be the same as that of the surrounding environment. Some temperature variations are likely to occur at different points in the preparation of a food. All records of temperatures and other monitoring results should be kept for audit and inspection purposes. Indications of temperature abuse should be investigated and corrected promptly.

Types of Thermometer

1. Digital thermometers provide a digital readout of a specific temperature using a long metal sensing probe, and are the most commonly used thermometers in the food service sector.
2. Instant-read dial thermometers have a range of temperatures featured on a round dial on top of a long metal stem. These thermometers are normally used in small food service businesses and in domestic circumstances for large meat joints and whole poultry, and also for spot-testing food during, and at the end of, the cooking. The thermometer senses the temperature using a long metal probe which is inserted into the food. Most instant-read dial or digital food thermometers are accurate to within ± 1°C.
3. Disposable probes or sticks contain a temperature sensor at the end of a stick. They are designed to turn a particular colour when a food reaches a specific temperature. These thermometers are normally accurate to within ± 2°C.
4. Microwave-safe temperature probes are especially designed for use in microwave ovens. Always follow the manufacturer's instructions.
5. Thermocouples are especially designed for use in continuous temperature monitoring via a data logger. Thermocouples are relatively inexpensive, have a wide temperature range with reasonable repeatability, and accuracy normally ± 0.5°C.

Accuracy and Calibration

Accuracy and calibration of all thermometers should be examined at least annually or whenever inaccuracy is suspected, e.g. if the thermometer is dropped on the ground, and should form part of a maintenance contract. To check the accuracy of a thermometer, immerse the thermometer in a mixture of crushed ice and water, previously held for approximately 10 minutes, in a thermos-flask. The thermometer should read 0°C ± manufacturers stated accuracy, i.e. typically ± 0.5 to 1°C. Next take boiling water and add to another thermos-flask, hold for 10 minutes and immerse the thermometer. The thermometer should read 100°C ± manufacturers stated accuracy, i.e. typically ± 0.5 to 1°C.

Some instant-read dial thermometers have a calibration nut under the dial that can be adjusted. In all cases, follow manufacturer's instructions. If the thermometer is not reading the correct temperatures, it should be discarded or sent for repairs and/or calibration. External calibration of thermometers should be carried out at least annually by calibration against a national standard normally through a certified external service provider. Records of all calibrations should be kept, and the date of next calibration should be indicated on the thermometer itself.

Maintenance

Thermometers, temperature recording devices, refrigerators, chillers, cooking equipment and other devices and equipment should be checked and maintained regularly.

1. An adequate number of probes must be provided to ensure availability of probes at all times.
2. Heat treatment is by far the most effective way of achieving disinfection of probes.
3. Thermometers should preferably be selected with the smallest range commensurate with their function in order to maximise sensitivity and legibility.

APPENDIX 2. WATER QUALITY

While the supply of water to most food businesses is controlled by the local authority, a responsible proprietor should implement measures to ensure water quality. To assess the safety of the water supply, regular contact with the local water authority should be made, and/or on-site microbiological analysis should be carried out on samples taken from a designated sampling point. Frequency of water samples to be taken for analysis should be representative of the quality of the water used throughout the year.

To ensure that the sample gives a true picture of the microbiological quality of the water supply, it is essential that the correct sampling technique be used. Where the water supply has been chlorinated, the sample bottles should contain sodium thiosulphate to neutralise the chlorine. Analysis of the water should include Aerobic Colony Counts (ACC) at 22°C and 37°C, total coliforms and *Escherichia coli*. Consultation with a competent authority is recommended [7,23].

If a water sample tests positive for faecal organisms, e.g. *E. coli*, the use of the sampled outlet or storage tank must be suspended and must not be resumed until sampling has demonstrated that the cause of the problem has been rectified. All other unsatisfactory results must be followed by an investigation to determine the cause. This will include physical examination of storage tanks, pipe work and outlets and intensified sampling of the entire water supply system on the premises. Appropriate corrective action must be taken to rectify any defects noted. Records of all water sampling, investigations and corrective actions must be retained on file.

Where necessary, treatment of the water supply on-site should be performed. If alternative disinfection systems are used, such as ultra violet, membrane filtration, etc., then the facilities and the system testing regime may differ considerably from those required for chlorination. In all cases, the facilities must be designed to provide evidence to the operators that the water quality is maintained. Chemicals used in conjunction with water to wash foods, such as fruit and vegetables, must be permitted for use with those foods [24].

Organic matter may build up in the water distribution system which may interfere with water quality. Once per year, the entire water supply system should be drained. All water storage tanks should be cleaned and sanitised. The system should be then flushed with clean water before it is used. Reference to appropriate literature and consultation with a competent authority is recommended.

APPENDIX 3. WATER LEGISLATION

Drinking water, i.e. potable water, in Ireland originates from groundwater sources, surface water sources, including rivers and lakes, and springs. Groundwater originates from under the earth's surface and quality depends on local circumstances, i.e. geology, agricultural practices and surface water influences. Surface waters originate from a combination of sources, such as rainfall on adjacent lands, direct rainfall to a river or lake, and groundwater contribution to the water body. All waters will have their own unique characteristics depending on the actual source. Typical variations in raw water quality would be as follows:

1. Peaty nature of upland waters
2. Excessive iron and manganese levels of some ground waters
3. Excessive hardness of waters of limestone origin.

Water for public consumption is required to meet the standards set out in European and National Legislation. The revised Drinking Water Directive was recently transposed into Irish law by European Communities (Drinking Water) Regulations, 2000 (S.I. No. 439 of 2000), and is effective from January 1, 2004 [16]. Part VII of the Hygiene of Foodstuffs Regulations (S.I. No. 165 of 2000) deals specifically with water supplies to food premises [5].

In order for these standards to be met, treatment of the raw water may have to be applied. Statutory Instrument (S.I. No. 294 of 1989), entitled European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations 1989, sets out the requirements and definitions of the standard methods of treatment for transforming surface water of three categories of quality into drinking water.

NOTES

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