Good Manufacturing Practice Guidance - Shellfish Cooking

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APPENDICES

1. Purpose and scope

This document provides guidance to seafood processors on good manufacturing practice (GMP) for shellfish cooking ashore[1]. Its purpose is to help both small and larger businesses produce safe, high quality products. It is targeted at the needs of processors carrying out basic cooking operations.

The guidance focuses on the cooking process but also covers relevant aspects of raw material supply, storage and preparation, and product handling, packaging, labelling and storage. Specialised cooking processes such as pasteurisation or sterilisation in sealed packages are described but businesses considering such operations will need to seek further specialist advice.

This document was produced in collaboration with industry and official bodies. Participants included the Food Standards Agency (FSA), the Local Authorities Co-ordinating Body on Regulatory Services (LACORS), Lyons Seafoods, Anchor Seafoods and the Shellfish Association of Great Britain (SAGB).

The guidance explains and takes account of food law but is purely advisory. Many of the recommendations and suggestions relating to GMP go beyond what might be required as a minimum by legislation in a small business.

[1] For cooking shrimp at sea see SR 466, SR426 and 'Basic Guidance on Good Hygiene Practice for the Inshore Shrimp Industry' Sea Fish Industry Authority

2. The need for care

Cooking is the traditional process by which many foods are made safe before they are eaten. Heating to a sufficiently high temperature destroys any harmful bacteria and viruses that may be present. Cooking may be required by law or used to facilitate shelling or shucking, or to produce desirable ready to eat products with a longer storage life, by inactivating spoilage enzymes and bacteria naturally present on the raw material.

There is a substantial market in cooked shellfish products. Many small businesses are involved in their production and handling. These businesses may lack the technical resources of large businesses but nevertheless are able to produce safe, high quality products if they apply good manufacturing practice.

Particular care must be taken in the production and handling of pre-cooked ready to eat products. The main risks with pre-cooked foods are:

- **that the initial cooking may not be sufficiently thorough to destroy all harmful micro-organisms;**
- **that the cooked product may be re-contaminated during its subsequent handling, and;**
- **that harmful bacterial growth may occur on the cooked product during the extended time period before consumption.**

A combination of adequate cooking temperature and time is required to guarantee destroying micro-organisms. Destroying viruses requires more thorough cooking than is required to kill bacteria. Sufficient heat must reach all parts of the product, although excessive cooking produces tough and less desirable products.

To avoid re-contamination by human pathogens, particular care has to be taken over hygiene during any handling after cooking.

Any harmful bacteria introduced may grow rapidly on cooked products. To minimise any bacterial growth, products must be rapidly cooled after cooking, frozen or effectively chilled during storage. The products must then be distributed, sold or consumed within their use-by or best before date.

3. The requirements of food law

3.1 General food safety requirements

The Food Safety Act 1990 and the EC General Food Law Regulation[2] establish fundamental obligations for all persons in the food industry, including only to sell food complying with food safety requirements. These requirements are that food should not be:

- **Injurious to health.**
- **Unfit for human consumption.**

In deciding whether the requirements are being met, account will be taken of:

- **the normal conditions of use of the food;**
- **the information provided to the consumer;**
- **the long-term or probable cumulative toxic effects;**
- **particular health sensitivities; and**
- **whether the food is unacceptable for reasons of contamination or through putrefaction, deterioration or decay.**

A failure to comply with food safety requirements is a strict liability offence; intent does not have to be proven in order to gain a successful prosecution. This is balanced by the availability of a "due diligence defence" – to be able to prove that he or she took all reasonable precautions and exercised all due diligence to avoid the commission of the offence.

Draft FSA guidance notes on the General Food Law Regulation are available online at http://www.food.gov.uk/multimedia/pdfs/guidanceonfoodlawconsult.pdf

3.2 Hygiene requirements

3.2.1 General hygiene requirements

EC Regulation 852/2004 on the hygiene of foodstuffs[3] lays down general hygiene rules to be complied with by all food business operators throughout the food chain from primary production to placing on the market or export. The Food Hygiene (England) Regulations 2006' provides for the execution and enforcement of the EC regulation in England.

[2] Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety

[3] Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs

The EC Regulation contains provisions on:

- **hygiene requirements for primary production;**
- **the need to operate procedures based on hazard analysis and critical control point (HACCP) principles to a level relavent to the activities of the business (applies to all but those involved only in primary production;**
- **registration and, in particular cases, approval of production, processing and distribution establishments;**
- **the hygienic layout, design, construction, siting and size of food premises;**
- **facilities in relation to the hygiene of personnel;**
- **ventilation, lighting, drainage and storage of cleaning materials;**
- **specific requirements for rooms where foodstuffs are prepared, treated or processed in relation to floors, walls, ceilings, windows, doors, surfaces, utensils, equipment and food washing facilities;**
- **requirements for movable and/or temporary premises;**
- **transport;**
- **articles, fittings and equipment with which food comes into contact;**
- **the handling and disposal of food waste;**
- **water supply;**
- **personal hygiene;**
- **the acceptance, storage, processing and distribution of raw materials, and intermediate and finished products;**
- **wrapping and packaging of foodstuffs;**
- **heat treatment of food to be sold in hermetically sealed containers;**
- **training – the food business operator must have an awareness of HACCP appropriate to the activities of the business; and**
- **food handlers should be supervised and instructed and/or trained in food hygiene matters commensurate with their work activity.**

EC Regulation 852/2004 allows the HACCP based procedures to be implemented with flexibility, so as to ensure that the requirements can be met by smaller businesses[4].The HACCP principles on which hygiene procedures should be based are:

- **identifying any hazards that must be prevented, eliminated or reduced to acceptable levels;**
- **identifying the critical control points at the step or steps at which control is essential to prevent or eliminate a hazard or to reduce it to acceptable levels;**
- **establishing critical limits at critical control points which separate acceptability from unacceptability for the prevention, elimination or reduction of identified hazards;**

[4] Guidance Document – Implementation of procedures based on the HACCP principles … Health and Consumer Protection, Directorate General, EU 2005.

- **establishing and implementing effective monitoring procedures at critical control points;**
- **establishing corrective actions when monitoring indicates that a critical control point is not under control;**
- **establishing procedures, to be carried out regularly, to verify that the measures outlined above are working effectively and establishing documents and records commensurate with the nature and size of the food business to demonstrate the effective application of the measures outlined above; and**
- **application of the measures outlined above.**

3.2.2 Hygiene requirements for products of animal origin

In addition to the above, further hygiene requirements for food of animal origin are contained in EC Regulation 853/2004 on specific hygiene rules for food of animal origin[5], which has direct application in Member States. Foods containing both products of plant origin and processed products of animal origin, and most retail operations are, however, outside the scope of the Regulation. But, it is the intention of future legislation that not all composite products will be excluded.

The Regulation is enforced in England by The Food Hygiene (England) Regulations 2006' and equivalent regulations in different part of the UK . General requirements in the EC Regulation, for all products of animal origin within its scope, include:

- **that premises should be approved, other than those carrying out only primary production, transport operations, the storage of products not requiring temperature control and defined retail or catering operations (i.e. business which supply the final consumer);**
- **that products which have been handled in approved premises should carry an identification mark;**
- **that imports from outside the Community come from authorised establishments and, in the case of live bivalve molluscs, echinoderms, tunicates and marine gastropods, from permitted production areas (there are special provisions for fishery products imported from a factory or freezer vessel flying the flag of a third country); and**
- **that when they are required, certificates or other documents accompany consignments of products of animal origin.**

[5] Regulation (EC) No 853/2004 of the European Parliament and of the Council of 29 April 2004 laying down specific hygiene rules for food of animal origin

3.2.2.1 Specific hygiene requirements for live bivalve molluscs

More detailed specific requirements for live bivalve molluscs (including live echinoderms, tunicates and marine gastropods, but not pectinidae harvested outside classified production areas ("wild caught scallops")) include:

- **that live bivalve molluscs may not be placed on the market for retail sale otherwise than via a dispatch centre, where an identification mark must be applied;**
- **that food business operators can only accept live bivalve molluscs if registration document requirements are complied with;**
- **that bivalve molluscs can only be harvested from designated areas, classified as class A, B or C depending on their degree of contamination;**
- **health standards for live bivalve molluscs, which must be met before live bivalve molluscs are placed on the market, as well as limits for several marine biotoxins;**
- **that products from class B and class C areas cannot be placed directly on the market – the former must first be purified (this does not apply to live echinoderms, tunicates and marine gastropods) or relayed and the latter must first be relayed over a long period; alternatively such products may be subjected to an approved form of heat treatment (see Section 5.4.3 for further details):**
  - **canning (sterilisation in hermetically sealed containers)**
  - **boiling or steaming under pressure to achieve a minimum temperature in the product of 90^{o}C for not less than 90 seconds or its equivalence**
  - **a prescribed pressure cooking/shelling/freezing process**
- **that harvesting techniques and further handling must not cause additional contamination or excessive damage;**
- **that structural and hygiene requirements for purification and dispatch centres are complied with;**
- **wrapping and packaging provisions;**
- **that the labelling must give the common and scientific species names, the date of packaging, the date of minimum durability or the statement "these animals must be alive when sold", and that the retailer must keep the label of outer, non-consumer packs for at least 60 days after splitting up; and**
- **that during storage and transport a temperature is maintained which does not adversely affect food safety or viability.**

Pectinidae (e.g. scallops) harvested outside classified production areas ("wild caught scallops") have their own separate requirements. They must comply with only the following requirements applicable to other live bivalve molluscs:

- **harvesting and handling requirements;**
- **health standards;**
- **the different requirements for the placing on the market of products from class A, B and C areas, where official data allow the classification of fishing grounds;**
- **the structural and hygiene requirements for dispatch centres when wild caught scallops are placed on the market via such establishments**
- **the registration document requirements; and**
- **for wrapped or packaged wild caught scallops, the labelling requirements.**

In addition, wild caught scallops may not be placed on the market otherwise than via a fish auction, a dispatch centre or a processing establishment and when operators handling wild caught scallops operate such establishments, they must inform the competent authority (i.e. in England, the Food Standards Agency). Enforcement has been delegated to local authorities.

3.2.2.2 Specific hygiene requirements for fishery products

The more detailed specific requirements for fishery products in EC Regulation 853/2004 apply in most cases also to bivalve molluscs, echinoderms, tunicates and marine gastropods when not placed on the market live. These products must, however, have been obtained in accordance with the hygiene rules applicable to their live forms.

In relation to fishery products and the application of EC Regulation 852/2004, primary production covers the farming, fishing and collection of live fishery products and, on board fishing vessels, also slaughter, bleeding, heading, gutting, removing fins, refrigeration and wrapping. Certain activities on fish farms and the transport of fishery products from the place of production to the first establishment of destination are also considered to be primary production.

The specific requirements for fishery products include the following:

- **structural, equipment and hygiene requirements for vessels (not applicable to bivalve molluscs, echinoderms, tunicates and marine gastropods when not placed on the market live);**
- **requirements during and after landing (not applicable to bivalve mollsucs, echinoderms, tunicates and marine gastropods when not placed on the market live);**
- **requirements for establishments, including vessels, handling/producing fresh fishery products, frozen products and mechanically separated fishery products (includes establishments at the retail level handling/producing fresh and mechanically separated fishery products);**
- **requirements, which apply also at the retail level, concerning parasites (including for fishery products to be consumed raw or**

almost raw and for marinated and/or salted fishery products if the processing is insufficient to destroy nematode larvae);

- **requirements, which apply also at the retail level, for operators cooking crustaceans and molluscs:**
  - **rapid cooling after cooking, to a temperature approaching that of melting ice if no other means of preservation is used**
  - **particular attention to hygiene during shelling or shucking**
  - **after shelling or shucking, cooked products to be frozen immediately or be chilled as soon as possible to a temperature approaching that of melting ice**
- **requirements, which apply also at the retail level, for health standards for fishery products, including for compliance with microbiological criteria (see later), for organoleptic properties, for histamine, for total volatile nitrogen and for parasites;**
- **requirements for wrapping and packaging;**
- **requirements for storage, including that:**
  - **frozen fishery products should be kept at –18^{o}C or below**
  - **requirements for transport, including that:**
  - **short, upward fluctuations to no higher than -15^{o}C are permissible during transport of frozen fishery products**
  - **melt water from ice must not remain in contact with chilled products.**

3.2.3 Microbiological criteria

Accompanying EC Regulations 852/2004 and 853/2004 is a Commission Regulation (EC) No. 2073/2005 on microbiological criteria for foodstuffs. This includes the following provisions:

- **testing should be carried out as appropriate when validating hygiene procedures and food safety criterion for the absence of Salmonella in cooked crustaceans and molluscan shellfish placed on the market and during their shelf-life;**
- **a food safety criterion for the absence of Salmonella in live bivalve molluscs and live echinoderms, tunicates and gastropods placed on the market and during their shelf-life;**
- **a food safety criterion for permitted levels, in live bivalve molluscs and live echinoderms, tunicates and gastropods, of E. coli as an indicator of faecal contamination;**
- **a food safety criterion for permitted levels, in "ready-to-eat foods able to support the growth of L. monocytogenes", of Listeria monocytogenes:**
  - **a criterion for products placed on the market during their shelf-life or, if this cannot be guaranteed, a zero criterion for products before they have left the immediate control of the producer**
  - **as necessary to ensure compliance with the criteria, producers of ready-to-eat foods able to support the growth of L. monocytogenes which may pose a L. monocytogenes risk for public health, should**

conduct studies to investigate compliance with the criteria throughout the shelf-life

- **when sampling is necessary, producers of ready-to-eat foods able to support the growth of L. monocytogenes, which may pose a L. monocytogenes risk for public health, should sample the processing areas and equipment for Listeria monocytogenes as part of their sampling scheme**

- **process hygiene criteria (applied at the end of the manufacturing process and, if exceeded, meaning that improvements in production hygiene must be carried out, but not necessarily that products cannot be marketed) for permitted levels in shelled and shucked products of cooked crustaceans and molluscan shellfish, of E. coli and coagulase-positive staphylococci.**

3.3 Labelling requirements

3.3.1 Food labelling regulation

The Food Labelling Regulations[6] stipulate general labelling requirements for food ready for sale to the final consumer or to a caterer. Labelling must include:

- **a date of minimum durability; and**
- **the required conditions of storage for that date to be achieved**.

However, these requirements do not apply to foods sold loose or pre-packed for direct sale by the retailer or caterer.

The date of minimum durability should take the form of a ‘use by’ date for highly perishable products that may present a risk to human health, or a ‘best before’ date for other products. Frozen products generally require ‘best before’ rather than ‘use by’ dates. Official guidance[7] recommends the ‘use by’ date for cooked products containing or comprising fish, whether or not they are intended to be eaten without further reheating. The ‘use by’ date specifies the day, up to midnight on which, the food may be used safely if it has been stored correctly. For further details see Section 5.8.

3.3.2 Fish labelling regulations

The Fish Labelling Regulations 2—3 apply at retail to the consumer. This requires shellfish (if raw or raw/cooked still with shell on) to be labelled with:

- Common name
- Production method
- Catch area

[6] The Food Labelling Regulations 1996, SI 1499 1996, as amended
[7] Use by date Guidance Notes. (Issued by the Food Standards Agency, February 2003)

Suppliers of shellfish (if raw or raw/cooked still with shell on) should include this information by labelling or trade documents to enable retailers to correctly label the products. The scientific name should also be included up to the point final sale to the consumer.

The regulations do not apply to caterers, so if it can be guaranteed that the shellfish supplied will be sold through a catering establishment then this information need not be supplied.

3.3.3. Allergen labelling

Crustaceans, but not molluscs, are subject to the allergen labelling rules, made at EU level, and implemented in England in the Food Labelling (Amendment) (No. 2) (England) Regulations 2004[8]. This means that when crustaceans or crustacean products are used as ingredients in pre-packed products, there must be a clear reference to their use either in the name or ingredients list of the product. This requirement over-rides any contrary labelling exemption which may otherwise apply to such a pre-packed product.

3.4 Traceability requirements and product/withdrawal/recall

The EC General Food Law Regulation includes a measure requiring that:

- **the traceability of food, feed, food-producing animals, and any other substance intended to be, or expected to be, incorporated into a food or feed be established at all stages of production, processing and distribution.**

This means in practice that:

- **food business operators must be able to identify those from whom they have been supplied with foods.**

The Regulation also includes a product withdrawal/recall requirement:

- **food business operators must withdraw from sale and recall if necessary, any food thought not to be in compliance with food safety requirements (see Section 3.1).**

[8] The Food Labelling (Amendment) (England) (No. 2) Regulations 2004, SI 2004 2824

4. Types of cooking processes and equipment

4.1 Cooking processes – theory and practice

The production of a safe and desirable product with shelf-life greater than that of the raw-material is an interaction between the following key factors:

- **heat applied;**
- **post cook handling;**
- **packaging; and**
- **storage temperature.**

If one or more of these parameters is compromised a poor quality or even unsafe product may result.

Cooking is a generic term, commonly used to describe the application of heat. This may be the main cook, or a subsequent pasteurisation stage. From a microbiological point of view, it is the maximum core temperature and the time maintained at this temperature that will control the amount and type of micro-organisms killed and hence impact on the safety and the shelf-life of the final product. The main cook is a compromise between making the food safe to eat without jeopardising the inherent qualities of the texture and appearance of the product.

Pasteurisation is the correct technical term for heat treatment which will reduce rather than eliminate bacteria. The DOH Cook-chill Guidelines recommend a core temperature of 70°c for 2 minutes. This combination will give a substantial reduction (6 log) in the pathogen *Listeria monocytogenes,* but will not kill bacterial spores or bacterial toxins; providing a shelf life of 5 days when stored at 8°C or below.

Cooking of un-purified live bivalves from grade B & C waters require a heat treatment of at least 90°C for 90 seconds or its equivalence in order to ensure small round viruses (SRV) are killed. If in doubt and to urge on the side of caution, it is recommended that all bivalves are cooked for least 90°C for 90 seconds or its equivalence.

Pasteurisation is usually associated with continuous cooking and aseptic packaging, or with cooking in sealed packages with vacuum or modified atmosphere. The relatively mild heat treatment results in minimal changes to the appearance, texture and flavour of the food but the products must be held chilled or frozen and have a limited storage life. Pasteurisation can be used as a secondary process for shellfish products that have already been cooked and shelled or shucked. It reduces the bacteria introduced during the handling of the cooked shellfish and produces convenient packs for distribution. Unfortunately, the conditions created by packing in a vacuum or modified atmosphere may allow Clostridium botulinum to grow, resulting in toxin production and serious food poisoning. Psychrotrophic (cold loving) strains of *C.botulinum* are able to grow and produce toxin at low temperatures, therefore controlled refrigeration becomes very important.

The Food Standards Agency have issued the following draft guidance[9]:

- **for products held below 5°C the maximum recommended shelf life is 10 days; and**
- **for products held between 5-8°C the maximum recommended shelf life is reduced to 5 days.**

To achieve a shelf live greater than 10 days for a product held at up to 8°C requires one or more of the following additional psychrotrophic Clostridium controls to be demonstrated; **if not challenge testing must be carried out:**

- **stronger heat treatment. A minimum of 90°C for 10 minutes (or equivalent), at the centre of the product;**
- **uniform pH of 5 or less;**
- **salt level of 3.5% (aqueous);**
- **water activity of 0.97 or lower; and**
- **combination of heat and other preservation factors shown to inhibit psychrotrophic *C. botulinum***

Other detailed guidance is available[10].

Other packaging and heat treatments include aseptic packaging. This involves an integrated and automated cooking then pack filling and sealing process, carried out within a sterile environment. The equipment is inherently specialised, complex and costly and is not suited to most shellfish cooking businesses.

Cooking in hermetically sealed packages can be more practical on a somewhat smaller scale and can offer significant advantages over separate cooking and packaging operations. The raw material, which may already have been prepared and incorporating added value ingredients such as a sauce, is placed in a heat stable, air and moisture impermeable container (a metal can, glass jar or nowadays a plastic pouch) and hermetically sealed. The packaged product is then heat treated.

Food sterilisation uses a stronger heat treatment 121°C for 3 minutes to effectively destroy all the micro-organisms present. Canning has traditionally been used to produce sterilised, ambient stable shellfish products. More recently, less severely processed cook-chill shellfish products in plastic vacuum packs have come on the market. In association with aseptic packaging or cooking in hermetically sealed containers, it results in products that are stable at ambient temperatures for long periods.[11] The strong heat treatment does, of course, significantly change the nature of the products.

[9] Guidance on the safety and shelf-life of vacuum and modified atmosphere packed chilled foods. January 2004 (draft)

[10] Food Pasturisation Treatments – Technical Manual No. 27, Campden & Chorleywood Food Research Association.

[11] Code of Practice for the Manufacture of Vacuum and Modified Atmosphere Packaged Chilled Food. May 1996, Campden and Chorleywood. Food Research Association.

4.2 Cooking equipment

Commercial shellfish cooking is normally done by boiling, steaming or pressure cooking in a retort. Equipment to do this is available in a wide range of capacities and degrees of automation and control. Some manufactures can supply specialised processing lines integrating the cooking, cooling and shelling or shucking processes for particular species of shellfish.

Boiling or steaming at atmospheric pressure provides a cooking temperature of about 100°c. Boiling can be a batch or continuous process. Steaming is usually a continuous process. Retorting applies steam at the higher temperatures achievable within a pressure vessel, and is a batch process. Depending on the pressure, the temperatures can be in excess of 120°c and so retorting can produce sterilised products.

Boiling is the simplest technique. It also provides some de-gritting during the cooking process, which is useful for species such as mussels and cockles, and results in a moist product. However, it also results in the leaching out of minerals, vitamins and protein into the cooking water which affects the nature of the product and creates an effluent disposal problem. Steaming at atmospheric pressure or in a retort minimises these effects. Steaming is also claimed by the manufacturers of specialist equipment to be more energy efficient. Retorting enables a shorter, higher temperature cook that can result in better quality products. It can also facilitate shelling or shucking e.g. by separating whelk caps from the flesh.

4.2.1 Batch boilers

These are typically open-topped boilers that can be heated directly or by steam (in a jacketed vessel). The batch of raw material may be placed in a wire basket, is lowered into the boiling water, cooked for the required period of time and then removed. The cycle is then repeated with a new batch of raw material.

Batch boilers are simple, adaptable and relatively inexpensive. In the smaller sizes they are particularly suited to the needs of small businesses. Larger and more sophisticated boilers can incorporate mechanical loading and unloading and automatic control of cooking temperature and time.

However, simple batch boilers can suffer from unequal distribution of temperature during the cooking process. The eating quality of some of the products may suffer from the relatively long cooking time required to ensure that the products at the core of the batch are adequately cooked.

4.2.2 Batch retorts

These are typically cylindrical pressure vessels with an opening cap at one or both ends. The raw material is loaded into the chamber which is then closed and pressurised with steam for the required period of time, after which the pressure is released and the product removed. A water spray cooling phase at the end of the cooking period can be incorporated within the chamber. If both end caps open, the

retort can create a hygienic through-flow process from the ‘dirty’ raw material handling area to the ‘clean’ cooked product handling area.

Retorts are adaptable but are more complex and have a higher capital cost than batch boilers and hence are more suited to a larger scale of operation. The larger and more sophisticated retorts commonly incorporate mechanical loading and unloading and automatic control and recording of cooking temperature, time and pressure.

4.2.3 Continuous cookers

These are typically a trough of boiling water or an enclosed tunnel filled with saturated steam, through which the shellfish are carried continuously on a conveyor from one end to the other. This creates a hygienic flow process from ‘dirty’ to ‘clean’ areas.

Continuous cookers are again more complex and expensive than batch boilers and more suited to a larger scale of operation. They integrate well into continuous flow production lines with automated cooling and shelling or shucking processes. They require relatively little labour for their operation and supervision. The cooking time is pre-determined by the conveyor speed and they commonly have automatic control of cooking temperature, which may stop the conveyor if the temperature falls below a pre-set critical value. Cooking then resumes once the problem has been resolved and the alarm system re-set.

5. Recommendations for good manufacturing practice

This section provides an overview of how to use this guidance, the responsibilities of each food business and provides practical GMP guidance on generic practices and each of the key stages of production.

5.1 Food business management

5.1.1. The application of this guide

It is recommended that all shellfish cooking businesses follow the practical guidance given in this document.

Although methods of operation vary widely throughout the industry, the same basic principles of good practice should be applied as appropriate to the particular circumstances of operation of each business.

It is in the interests of food safety and product quality, and hence for the long term benefit of the industry, that all businesses apply good manufacturing practice.

The practicalities of operation vary widely according to the types of products and processes and with the size of the business involved, and so it is recognised that appropriate means of applying this guidance will vary from business to business.

5.1.2 The responsibility to control hazards to food safety

Persons operating food businesses are responsible for the safety of their products.

They must consider the practical working of their business to identify any hazards to food safety and then introduce any measures necessary to control those hazards.

Thereafter they must check that the business is being carried out as it is supposed to be, that the control measures are effective and take any further corrective action necessary.

This may include taking samples for microbiological analysis to check on hygiene and product standards.

Records must be kept of all these activities.

The application of HACCP is recommended for shellfish cooking businesses.

The production of pre-cooked, ready to eat food presents a higher level of risk than in most fish processing operations and demands particular attention to hazard identification and control.

The operators of food businesses must look at the particular details of operation of their own business to identify any hazards to food safety. The hazards may include

microbiological, chemical or physical contamination and bacterial growth on the products.

They must then make any improvements to the facilities or the practices of the business necessary to control those hazards. Control measures include ensuring raw material suitability, thorough cooking, rapid cooling, hygienic packaging, chilling or freezing the product, establishing a safe 'use by' or 'sell by' date, regimes for cleaning and personal hygiene, and staff instruction and training.

Checks include supervision to ensure that the correct procedures are being followed, monitoring cooking temperature and time, monitoring cooling temperature, and microbiological testing of the products and the processing environment.

This must all be reviewed occasionally or if any changes are made to the operation of the business.

Records are necessary not only for efficient operation of the business but also must be available for inspection by the Food Authority and receiving food business operators on request. Records of measures put in place to control hazards must be kept for an appropriate period, commensurate with the nature and size of the business.

HACCP (Hazard Analysis and Critical Control Points) is a formal method of risk identification and control, operating to the principles of which, is a legal requirement. By definition, a HACCP analysis is unique to each business and has to be carried out by that business, although the guidance on good practice given in this document will assist in this. Further guidance on HACCP and an example of a simple hazard identification and control checklist for shellfish cooking are given in Appendix I.

5.1.3 Traceability and product recall (see Section 3.4)

Processors of live bivalve molluscs must retain the registration document accompanying each batch received, for at least 12 months or a longer period if required by the competent authority.

Beyond these basic needs, it is recommended that shellfish cooking businesses follow the more comprehensive traceability requirements for fish processors specified in the Tracefish standards.

If there is reason to believe that products are unsafe, they should immediately be withdrawn from the market and the local Environmental Health Officer informed. The FSA should also be informed which can be done using an online notification form[12]. Where the products have reached consumers, they should be informed and if necessary the products should be recalled.

There are commercial and food safety benefits in traceability, particularly for pre-cooked, ready to eat foods with known risks. Traceability helps provide assurance of standards in the supply chain and, in the event of a food safety problem, helps to

[12] Food Standards Agency - Incident report form

pinpoint the cause and enables corrective action to be taken with the minimum of disturbance and cost to trade. Without effective traceability, a problem may result in the entire business having to be closed down.

The Tracefish standards[13] are international agreements ratified by the European standards body (CEN). They specify the information to be recorded by each of the businesses in fish supply chains and a common means of identifying the units traded (EAN/UCC codes). The Tracefish scheme goes beyond the legal requirements as it includes information on production history and enables chain traceability. Although the scheme is for finfish supply chains, the specification for fish processors is equally relevant to shellfish cooking businesses.

If checks reveal that production controls have been ineffective and products may be unsafe, then the products should be withdrawn and the EHO/FSA informed. The advice of the EHO should be taken on any further action required.

5.1.4 Staff instruction and training

All staff involved in the production and handling of cooked shellfish products must be made aware of the correct procedures to be followed and of the particular needs for hygiene.

Staff should be instructed in their duties and working procedures, particularly in respect of the hazard control measures, and be adequately supervised.

Basic hygiene training is recommended for all these staff.

Staff instruction and supervision are essential parts of good practice.

Training to the level of a recognised basic food hygiene certificate is required. The particular need for high standards of hygiene when producing and handling cooked products should be emphasised.

5.1.5 Seeking further advice

Contact with the local Environmental Health Officer is recommended for those seeking further advice on hygiene and food safety.

Although responsible for enforcing food law, Environmental Health Officers would rather act as advisers than have to act as ‘policemen’ at a later date. Good relationships are valuable.

Further sources of information and advice are listed in Appendix II.

[13] CEN workshop Agreement (CWA), 14660, Traceability of fish products, Specification of information to be recorded in captured fish distribution chains

5.2 Premises and equipment

Premises and equipment must comply with the general hygiene requirements for fishery products establishments.

Particular care must be taken over the design and layout of shellfish cooking premises and equipment to minimise the risk of contamination after cooking.

Cooked products must be kept physically separate from raw materials and waste, etc:

- **it is strongly recommended that raw material and cooked product handling is carried out in different rooms, with the cooking equipment in-between, rather than in different areas of the same room;**
- **product storage should be in a separate room;**
- **floor drainage from raw material and waste areas should be away from the cooked product area;**
- **the transport paths of raw materials and waste and of the staff who handle them should not cross the cooked product area;**
- **the washing and changing facilities for staff who handle the cooked products should be adjacent to the cooked product area and separate to the changing facilities for staff who handle raw product; and**
- **packaging materials for cooked products should be similarly protected.**

Equipment should be purpose designed for food processing.

The use of integrated cooking, cooling and shucking or shelling equipment is recommended, where practicable, to ensure speedy operation and minimise the direct handling of the cooked products.

A particularly high standard of hygiene is required in the cooked product handling area. Achieving this is helped greatly by good simple design and layout.

If raw material and cooked product handling is done in the same room it is more difficult in practice to avoid cross contamination, particularly during cleaning operations. Using time separation of the handling of raw material and cooked product in the same area is not considered adequate.

Consideration should also be given to airflow within the premises to prevent airborne contamination of the cooked product area. Cooked product handling rooms can be operated at a slight overpressure to ensure that airflow is away from them. It is recommended that air into the cooked product handling rooms is filtered.

Continuous cookers, some retorts and some batch cookers can be positioned such that they convey the product through a wall separating raw material and cooked product handling areas.

5.3 Raw material supply and handling

5.3.1 Supply and storage

Obtain shellfish only from reputable suppliers who can provide assurance of origin and suitable conditions of harvesting, storage and transport.

Batches should be inspected on reception:

- **batches that are not in good condition should be rejected; and**
- **batches of live bivalve molluscs must each be accompanied by a registration document.**

Shellfish must be protected from contamination and stored in suitable temperature conditions:

- **they should be moved from the transport vehicle to protected storage with the minimum of delay. They must not be left lying around exposed to contamination and ambient temperature conditions;**
- **moist conditions and a storage temperature range of 2°c to 5°c are generally recommended for the storage of live shellfish; and**
- **dead shellfish must either be held in chilled storage at the temperature of melting ice or if frozen at a temperature of -18°c or less.**

Live shellfish must be handled with care to avoid stress and damage. They should not be thrown, dropped or subject to any other form of impact, crushing or shaking.

Ensuring the suitability of the raw material is an important control point, both for food safety and product quality.

The required storage conditions vary according to the type of raw material. Storage should be off the floor, well drained and adequately protected from contamination.

Live shellfish may have hard shells but they are sensitive to rough handling and temperature stress. They will die and then deteriorate rapidly if mistreated.

5.3.2 Preparation for cooking

Frozen shellfish should be thoroughly thawed.

Blocks of raw whole shrimp frozen at sea or on shore can be thawed in air or water. The water spray method is the fastest and most cost effective in terms of water use and effluent production.

Shellfish should be washed thoroughly using clean water to remove any physical contaminants.

Shellfish should be inspected and sorted to remove any not in good condition and any further extraneous and foreign material.

If there are significant size variations, the shellfish should be graded into batches of similar size for cooking.

Any further preparation, e.g. the de-bearding of mussels, that is appropriate prior to cooking should be done to minimise the need for handling the cooked products.

Lobsters and crabs should be humanely killed.

Thorough thawing is required as any partially frozen raw material may not reach the necessary temperature during cooking.

- Thoroughly cleaning and sorting the raw material minimises the contamination of the cooking process (the equipment and the water) and the need for handling after cooking.

- Cleaning and sorting can be manual or mechanical but with a final visual inspection.

- If shellfish of significantly different size are cooked together then some will be overcooked or some will be undercooked.

- Lobsters are effectively killed by immersion in boiling water although animal welfare organisations recommend drowning in fresh water or electrical stunning

- Crabs can be killed by drowning in fresh water or more rapidly by spiking the nerve centre or brain or electrical stunning. This prevents claw shedding during cooking.

5.4 Cooking

5.4.1 A controlled process

Cooking must be a controlled process to ensure that all parts of all the shellfish receive the required heat treatment.

A protocol should be established for the cooking process, detailing the type and size of the shellfish, the loading of the cooker and the temperature, time and pressure of cooking.

Records must be kept of checks on the temperature and time of cooking. Keeping a record of retort pressure is also recommended as an aid to process control.

Cooking is a critical control point for the safety of the products and is an important control point for their quality, and so it must be done according to a protocol and be controlled and monitored.

5.4.2. Cooking equipment

The cooking equipment must be capable of providing the required heat treatment at the required throughput of shellfish.

The use of cookers with automatic control of cooking time and temperature is recommended, wherever practicable, but it is recognised that this may not be practicable for small businesses carrying out basic cooking operations.

The use of automatically controlled cookers is strongly recommended for the approved heat treatment of live bivalve molluscs and for any cooking in sealed packages. They must be used for canning.

Cookers should be fitted with a thermometer displaying the operating temperature and, for retorts, a pressure gauge. Cookers with automatic controls can usefully incorporate automatic recording of the cooking conditions.

The use of continuous cookers and through-flow retorts which help separate raw material and cooked product areas is recommended, wherever practicable, but again it is recognised that this may not be practicable for small businesses.

Prior to commercial operation, the cooking equipment should be tested and the cooking protocol established, to ensure that the required heat treatment is achieved.

The equipment must be maintained and at regular intervals thermometers, pressure gauges and automatic controls should be checked for correct operation.

The choice of type of cooking equipment will depend on the types of shellfish to be processed, the types of products to be produced and the size of the business. Small businesses carrying out basic cooking operations, often for a range of shellfish, may find simple batch boilers adequate, inexpensive and flexible in use. Businesses with larger throughputs and more specialised businesses may find commercial benefit in more sophisticated cookers which may have product yield, quality and operating cost advantages as well as more assured control over the cooking process.

For a given throughput of shellfish, a more powerful or larger cooker is preferable to a smaller one that takes a relatively long time to come up to working temperature after loading, which necessitates a longer cooking time with adverse effects on product quality.

Steam cookers are dependant on their instrumentation for assurance of correct operation, although for simple boilers the visible signs of boiling may indicate that working temperature has been achieved. However, for some batch boilers, depending on their design and loading, this can be misleading as there may be boiling at the sides or on the surface but not in the centre or below. The thermometer should be located in the area that is the last to come up to operating temperature.

Depending on the complexity of the cooker and the degree of control required, its initial testing and the establishment of the cooking protocol can be simple or complex.

For basic cooking operations it may amount to simple checks with an electronic thermometer to ensure that all parts of the cooker reach boiling point for the required time. If the loading of the cooker is excessive, parts of the load will take a long time to come up to boiling point and this will necessitate a long cook, during which other parts of the load will be overcooked.

For the approved heat treatment, testing should include instrumented checks to ensure that the core of the shellfish actually reach the required temperature for the required time.

For instrumented and automatically controlled cookers, testing should include calibration of the instruments and the setting of the controls.

Maintenance and subsequent checks will similarly depend on the type of cooker. There are significant health and safety hazards in the operation of retorts at high temperature and pressure and hence a need for regular inspection and servicing.

5.4.3 Cooking temperatures, times and pressures

The required temperature and time depend on the type and size of the shellfish, the cooking method and the type of product produced.

Cooking must be sufficient to meet the statutory microbiological standards and to enable shelling or shucking but should not result in excessive toughening of the product.

Cooking time starts when the core of the product has reached the desired temperature. The time taken for the core of large chilled shellfish to reach cooking temperature can be substantial. This time is usually determined for each individual cooker by measuring the core temperature of the largest chilled product in different areas of the cooker. The time taken to reach cooking temperature is then incorporated into the cooking protocol.

For basic shellfish cooking operations a simple protocol based on boiling, steaming or retorting for a time that ensures full cooking at the core of the product should suffice and should meet the statutory microbiological standards.

The cooking protocol must allow for the time taken by the cooker to come up to working temperature after loading and provide sufficient cooking time at the working temperature.

Unpurified live bivalve molluscs from class B areas and un-relayed live bivalve molluscs from class C areas must be subjected to one of the approved heat treatments:

- **canning;**
- **boiling or retorting to achieve a minimum temperature in the product of 90°C for not less than 90 seconds or its equivalence; and**
- **retorting for 3 to 5 minutes at 120 to 160°C and 2 to 5kg/cm², followed by shelling or shucking and freezing to -20°C.**

The general minimum recommended cooking conditions are 70°c for 2 minutes or its equivalence in order to kill Salmonella and Listeria.

For cooking in sealed packages The Food Standards Agency have issued the following draft Guidance[14]:

- **for products held below 5°C the maximum recommended shelf life is 10 days; and**
- **for products held between 5-8°C the maximum recommended shelf life is reduced to 5 days.**

To achieve a shelf live greater than 10 days for a product held at 8°C or below requires one or more of the following additional psychrotrophic Clostridium controls to be demonstrated; if not challenge testing must be carried out:

- **stronger heat treatment. A minimum of 90°C for 10 minutes (or equivalent), at the centre of the product;**
- **uniform pH of 5 or less;**
- **salt level of 3.5% (aqueous);**
- **water activity of 0.97 or lower; and**
- **combination of heat and other preservation factors shown to inhibit psychrotrophic *C. botulinum***

For challenge testing specialist guidance should be sought.

In general, the larger the shellfish the longer the cooking time required for the heat to penetrate to its core.

The higher temperatures achieved within retorts result in significantly shorter cooking times than by boiling or steaming at atmospheric pressure.

For basic shellfish cooking operations, the practical requirements for sufficient cooking to enable shelling or shucking and for full cooking at the centre of the product, whilst avoiding toughening and yield loss through overcooking, dictate a cooking regime that should meet the statutory microbiological standards for cooked shellfish products at the end of manufacture (provided that the post-cook handling is hygienic).

The protocol for the cooking process should avoid overloading but inevitably batch cookers take a period of time to come up to full working temperature, and this has to be accounted for.

It is recommended that core cook temperature/ time profiles and core exit temperatures are carried out and monitored on a regular basis in order to demonstrate that the cooking process complies with the approved heat treatment.

By way of guidance for basic shellfish cooking operations, the following recommendations for cooking time in boilers have been published:

Species	Cooking time (minutes)	Source
Shrimp (ashore)	3	Torry [14]
Mussels	6	Torry [15]
Whelks	8-20 depending on size	Torry [15]
Brown crabs	20-30 depending on size	Torry [16]
Brown crabs	15-25 depending on size	Codex [17]
Lobsters	15-25 depending on size	Torry [18]
Lobsters	10 for a 500g lobster	Codex [19]

Some of the differences in these recommendations are accounted for by the different cookers and loadings they were based on. For example, the times for shrimp cooked at sea were based on relatively small batch boilers with a high loading and which therefore took a number minutes to return to the boil after loading. Whereas the time for shrimp cooked ashore was based on a much lower loading for which there was only brief drop in temperature after loading.

Similar times to these could be assumed for steaming at atmospheric pressure.

As a rough guide, retorting at about 120°C could be expected to reduce these times by about a third.

For cooking in sealed packages there is a complex relationship between the microbiological safety of a product and the temperature and time of cooking, the ability of the product to support bacterial growth, its storage life and the conditions of storage.

5.4.4 Cooking practices

The loading, temperature, pressure and time of cooking must be carried out according to the cooking protocol.

It is essential that the cooker is not overloaded and, with the exception of a retort, is up to temperature prior to loading.

[14] Handling and processing of shrimp. Torry Advisory Note No. 54
[15] Processing mussels, cockles and whelks, Torry Advisory Note No13
[16] Catching, handling and processing crabs, Torry Advisory Note No. 26
[17] Recommended International Code of Practice for Crabs, CAC/RCP 28-1983, Codex Alimentarius Commission
[18] Processing lobsters, Torry Advisory Note No. 6
[19] Recommended International Code of Practice for Lobsters, CAC/RCP 24-1979, Codex Alimentarius Commission

For non-automatic cookers an alarm timer should be used to time each cooking cycle.

Specifically for boiling:

- **the addition of about 3% of salt to the water is usually recommended to improve product flavour;**
- **the boiler must be full to the correct water level and fully boiling before the shellfish are loaded;**
- **for batch boilers it is recommended that the shellfish are loaded in wire mesh baskets rather than left loose in the boiler;**
- **the shellfish must be fully immersed in the water;**
- **it may be necessary to stir a simple batch boiler to ensure a uniform return to the boil; and**
- **the water should be replaced at regular intervals (or replenished continuously in continuous cookers) to prevent the accumulation of contaminants.**

A kitchen timer or similar device may suffice for the control of a non-automatic cooker.

Salt addition to the water for boiling should be measured and controlled.

Using baskets in batch boilers is preferable to ‘fishing’ for shellfish or parts of shellfish in the boiling water.

Some cold water may be added to a batch boiler at the end of the cooking cycle to prevent boiling over between cycles.

The accumulation of grit and protein, etc in boiler water will detract from the eating quality of the products. The required frequency of changing the water will depend on the nature of the shellfish and the loading of the boiler. For shrimp cooked ashore, Torry recommended regularly skimming the water and changing it several times a day. For lobsters, Codex recommend carrying out no more than 2 cooking cycles in the same water.

5.5 Cooked product handling

5.5.1 The essentials

Particularly high standards of hygiene are required for handling cooked products to avoid any contamination, particularly contamination by bacteria that may subsequently grow on the products.

Direct handling of the cooked products should be minimised because of the risk of contamination by human pathogens.

The sequence of initial cooling, washing, any further handling operations such as shelling or shucking, packaging and then chilling or freezing must be carried out as quickly as possible with the product temperature maintained between 0°C-3°C to minimise any bacterial growth.

Wherever practicable, this sequence should be planned and be carried out as a flow process without unprotected material accumulating at ambient conditions between stages.

The use of integrated cooking, cooling and shucking or shelling equipment is recommended, where practicable, to ensure speedy operation and minimise the direct handling of the cooked products.

Production planning and supervision should ensure the continuity of operation, even with batch processes, so that materials do not accumulate and are not left lying around at breaks or are not finally packaged and stored at the end of the day.

The use of purpose designed, mechanised shellfish processing lines has significant advantages but is not feasible for all species and may not be practicable for small businesses.

5.5.2 Initial cooling

The cooked products must be cooled to below 5°C as rapidly as possible.

Initial cooling by cold or refrigerated water is recommended, particularly for large shellfish, although small shellfish such as inshore shrimp can cool rapidly if spread out on racks in refrigerated air.

The water must be clean and should not be re-used for another batch of shellfish. It is recommended that the microbiological quality of the cooling water supply (or any ice used is periodically monitored).

For some shellfish the use of pumpable ice can be a very effective method of cooling them directly to storage temperature.

Rapid initial cooling is essential to avoid extended periods at the warm temperatures at which human pathogens grow rapidly. DOH guidelines recommend that the product is chilled to below 3°C within 2 hours to prevent growth of any surviving spores. It also has benefits for product quality and practical benefits for shelling and shucking.

The period of cooling must be sufficient for cooling to the core of the shellfish, and so depends on their size.

Immersion in a tank of cold water provides effective cooling. There should be a continuous feed of water or the water should be changed after each batch of shellfish. Water sprays can be effective but care needs to be taken with large shellfish to ensure that cooling is not just to the surface.

If the shellfish were cooked in a basket, it can be transferred directly to a cooling tank immediately after cooking.

A combination of initial water cooling followed by further refrigerated air cooling may be used but the shellfish must be spread out for air cooling to be effective.

The use of pumpable ice is the most rapid method of cooling but may result in salt uptake by the shellfish,

5.5.3 Handling operations

The cooked whole shellfish should be washed in clean water and, if necessary, be scrubbed to remove coagulated protein, etc.

The shucking or picking of molluscs and the peeling of shrimp are usually best done mechanically in purpose designed equipment.

Any inedible parts must be removed.

The extracted mollusc and shrimp meats should be washed in clean water to remove grit and any surface contamination.

The final product should be allowed to drain before packaging.

The final product should be inspected either before or at the point of packaging and any remaining sub-standard product or extraneous material, such as pieces of shell, finally removed.

The initial cooling process may provide adequate washing of the whole shellfish or it may need to be supplemented with water sprays and possibly some scrubbing or a mechanical process.

The efficiency, speed of operation and hygiene benefits of mechanised processing are usually preferable to manual processing for small shellfish such

as molluscs and shrimp. The purpose designed processing equipment commonly integrates several process stages including cooling, shucking, washing and draining (although not necessarily in that sequence).

If lobsters are prepared by splitting or peeling, those products should also be washed and drained.

The washing of meats should be a rapid process rather than a soaking.

Crab picking is usually done manually as it is difficult to mechanise without loss of yield and product quality, although equipment is available for recovering a lower grade of meat from some of the parts that cannot economically be picked by hand. Because of the soft nature of crab meat it is not usually washed after picking, but it needs to be picked with care to ensure the absence of shell or cartilage.

5.5.4 Packing and labelling

The packaging must provide adequate protection for the products in the expected circumstances of storage and distribution. It must be made of food grade materials.

Packaging materials must be clean when used and be stored in a clean and protected area away from processing areas. It is recommended that they are stored in a separate room.

Any shell used in the packaging or presentation of the product must have been treated as if it were part of the food.

Vacuum and MAP packaging can result in some extension of storage life at chill temperatures. Vacuum packaging can result in a considerable extension of frozen storage life.

Labelling must comply with food law. Specifically for food ready for sale to the final consumer or a caterer it must include:

- **a best before or use-by date is required; and**
- **the required conditions of storage.**

For cooked and chilled shellfish a use-by date is required.

For cooked and frozen shellfish a best before date is required.

It is recommended also that each trade unit produced is labelled with a unique identification code in accordance with the Tracefish specification.

There is a wide choice of suitable packaging materials and systems.

To minimise exposure of the packaging materials to contamination, only small stocks sufficient for a short period of operation should be held in the processing area.

Any shell used in the presentation of the product, e.g. for dressed crab, should have gone through the same cooking and handling processes as the meat, with the same rapidity and care, and be thoroughly cleaned and washed.

Vacuum and MAP packaging provide robust protection and convenience for distributors and consumers. The chilled storage life benefits are typically a few days but remain highly dependant on effective chilling. For frozen storage of sensitive materials such as crabmeat, vacuum packaging can up to double the storage life.

Labelling requirements are extensive for fishery products and may include the requirements to indicate origin and species name, see Section 3.3. The storage life information must in all cases be shown on the packaging, not merely in accompanying documentation. Guidance on establishing use-by and best before dates is given in Section 5.8. The conditions of storage will be either ‘refrigerated’ or ‘frozen’ as appropriate.

5.5.5 Chilling, freezing and storage

Depending on the type of product and packaging, it may be necessary to chill or freeze prior to packaging.

Chilling must rapidly chill the products to a temperature close to 0°C but should not freeze the products.

A chilled product storage temperature as close to 0°C as possible within the range of 0 to 3°C is recommended. For vacuum or modified atmosphere packed shellfish the temperature is critical to the safety of the product

Air blast chilling and refrigerated storage are recommended with the air temperature set just above 0°C to avoid partially freezing.

Freezing must rapidly freeze the products to a storage temperature of -18°C or less.

However, a freezing and storage temperature of -25°C or less is recommended, wherever practicable, as this will greatly extend product storage life.

Cryogenic and air blast freezing are recommended although plate freezing is suitable for some products.

Products may be lightly glazed with clean water after freezing.

A large box of loosely packed shellfish will take a long time to chill or freeze, particularly if it is an expanded polystyrene box, and so it is better to chill or freeze the individual shellfish prior to packaging. Loosely packed IQF products must, of course, be frozen prior to packaging. Blocks of meat and vacuum packed products can be effectively chilled or frozen in their packaging.

Simply placing ambient temperature products, particularly large shellfish, in a chill or cold store will not provide rapid chilling or freezing and will compromise product safety and quality. However, products previously cooled may be ready for chilled storage.

A frozen storage temperature of -25°C typically results in about double the storage life at -18°C.

Some products, particularly small individually quick frozen (IQF) shellfish, can benefit from light glazing to protect it from drying out and suffering from dehydration; although vacuum packaging reduces the need. Glazing must be accounted for in the labelling of the products.

5.6 Hygiene

A high standard of hygiene is required of premises, equipment and personnel, particularly in cooked product handling areas.

To achieve this, it is recommended that schedules are drawn up and implemented for:

- **maintaining premises and equipment in a good state of order;**
- **pest control;**
- **removing waste from food handling areas and its disposal from the premises;**
- **cleaning and disinfecting premises and equipment; and**
- **personal hygiene.**

The schedule should specify the procedures to be followed, including monitoring that they are carried out effectively, and who is responsible for carrying them out.

It is recommended that a person be designated to take overall control of the hygiene programme.

Hygiene is of crucial importance in cooked product handling areas and can only be assured by carrying out systematic procedures under firm management control. The hygiene controller should be a well trained person and preferably

should not be compromised by having direct production responsibilities, although it is recognised that this may not be feasible in small businesses.

5.6.1 Cleaning and disinfection

Premises and equipment should be thoroughly cleaned and disinfected as frequently as is necessary and including during extended work stoppages and breaks and at the end of the day. The effectiveness of cleaning should be checked before resuming work.

The general recommended sequence of cleaning and disinfection include:

- **tidying up the area and dismantling equipment as necessary for cleaning;**
- **rinsing or hosing down;**
- **physical cleaning, using a detergent;**
- **rinsing to remove the detergent;**
- **disinfection, generally using a chemical agent for the required time;**
- **rinsing to remove the disinfectant; and**
- **leaving equipment and utensils to drain and dry in air.**

Detergents and disinfectants must be suitable for food use and be used as instructed.

Swab samples must be taken from food contact surfaces for microbiological checks to confirm the effectiveness of cleansing and disinfection.

A ‘clean as you go’ policy is beneficial, rinsing down equipment and utensils to prevent the accumulation of waste and it drying on surfaces.

The required frequency of full cleaning and disinfection depends on the nature of the operations and the risks from contamination. Cooked crab picking is probably the highest risk and for this Codex recommends completely cleaning and disinfecting the area every 4 hours and cleaning and disinfecting working utensils and bowls, etc, every 2 hours.

Detergents and disinfectants need to be selected and used with care to avoid tainting the products to ensure the health and safety of staff. Hypochlorite disinfectants are suitable and chlorinating of the wash water can be beneficial.

Microbiological checks are dealt with in Section 5.7.

5.6.2 Personal hygiene

Staff in food areas must wear clean protective clothing including footwear and headgear that completely covers the hair. It is recommended that this clothing is not worn outside of the food area and that jewellery is not worn (there may be ethnic and medical exceptions). It is also recommended that the 'clean' cooked product handling area be treated as a separate food area and that, whenever practicable, protective clothing worn outside of the 'clean' area is not worn inside the 'clean' area. A colour coded system is recommended in order to demonstrate the effective operation of this. Light coloured protective clothing is preferable as is its state of cleanliness is readily apparent.

Staff handling or preparing food, particularly those handling cooked products, must wash their hands frequently:

- **at least each time entering the food area or resuming work;**
- **after using the toilet; and**
- **after handling or touching anything that may be contaminated.**

Staff must not be permitted to work in food areas if they are suffering from an illness that may contaminate food or from infected wounds or lesions. Minor cuts or abrasions must be covered by waterproof plasters. The use of distinctive coloured 'food grade' plasters is recommended. Persons suffering from an illness, particularly if associated with diarrhoea or vomiting, should report this to the management. Infectivity can remain for some time after the symptoms have passed. Further advice on this can be sought from the local Environmental Health Officer.

Smoking, spitting, eating and drinking in food areas and other unhygienic practices such as sneezing and coughing over the food must be prohibited.

These rules should also be applied as appropriate, to other persons, such as maintenance engineers, in food areas. Access to food areas, particularly cooked product handling areas, should be restricted.

5.7 Microbiological checks

Microbiological analysis is a highly specialised business that should be carried out by an accredited laboratory (CLAS / UKAS / NAMAS etc) using approved analytical methods. To ensure the validity of the results the instructions of the laboratory must be followed on sample gathering and storage.

The frequency of sampling required will depend very much on risk evaluation. Basic, short shelf life shellfish products, particularly if they are not shelled or

shucked, present a relatively low level of risk. Shelled or shucked products present a greater risk of contamination and a particular need for checks on the production hygiene indicators and on the effectiveness of cleaning and disinfection. Longer shelf life packaged and pasteurised or sterilised products may present a higher risk of pathogen growth and hence a need for rigorous control of pathogen levels at the end of manufacture, although the level of risk will also depend on the nature of the product including its pH and water activity. In general, a large business with a high throughput is expected to sample more frequently than a small business. A comprehensive HACCP scheme reduces the dependence on product testing.

The maximum permitted levels of *Listeria* differ according to whether or not the product will support its growth. Unless the nature of the product is substantially changed by modified pH, water activity or preservatives, etc, or by sterilisation in sealed containers, cooked shellfish products will support the growth of *Listeria,* although for basic short shelf life products this growth may not present a great risk.

The trends over time in the microbiological results should be monitored so that corrective action can be taken to halt any increasing trend before it becomes a problem (see Section 3.2.3).

5.8 Use-by and best-before dating

Confusion can arise between the use-by, sell-by, best-before and shelf life terms.

Sell-by date

Sell-by was replaced with the more specific term use-by in the 1980’s and no longer has a legal meaning.

Best-Before date

Most food such as frozen or canned shellfish that can safely be kept **for longer periods** carries a 'Best before' **date mark**. When that date runs out, it doesn't mean that the food may be dangerous**,** but it may no longer be at its best in terns of freshness or eating quality. The best before date is a guide for consumers to allow them to enjoy the product in its best possible condition. The period of time, which a product can be stored, under specified conditions, and remain in optimum condition and suitable for consumption is called the shelf life.

Best before dating is carried out by sensory evaluation over time to determine the point where the product is no longer considered acceptable. This evaluation may be carried out in house or by using specialist food services.

Some typical best before dates are given below.

Frozen cockle/whelk/mussel meats: 8/9 months

Jellied Mussels (jars): 2-4 months

Use-by date

The use-by date is the date up to and including which the food may be used safely (e.g. cooked or processed or consumed) if it has been stored correctly.

The Food Labelling Directive (2000/13/EEC) demands that cooked, ready to eat products such as cooked shellfish, which fit the following criteria, carry a use-by date:

- **at ambient or chill temperatures are capable of supporting the formation of toxins or multiplication of pathogens to a level which could lead to food poisoning if they are not stored correctly; and**
- **foods intended for consumption either without cooking or after treatment (such as reheating) unlikely to be sufficient to destroy food poisoning organisms, which may be present.**

The use-by date must be shown in a specific way**.**

It must consist of the words *"use by"* followed by

- **the date in terms of either**
  - **the day and the month (e.g. *use by* 5 March), or**
  - **the day, month and year (e.g. *use by* 5 March 2002)**

- **and any storage conditions which need to be observed (e.g. *keep refrigerated* or *if stored in a refrigerator).***

For example, *use by 5 March* means use by midnight on 5 March.

On packaging, the actual date and/or any storage conditions given as part of the date mark may appear separately from the words use by. However, these words must be followed by a reference to the place where the date and/or any storage information may appear. Official Guidance is available.

The use-by date is effectively the end point of the shelf life (time from production to safe consumption). The recommended shelf life pasteurised product.

Up to 5 days for standard or vacuum/map packaged products stored at up to 8°C.

Up to 10 days for vacuum/MAP products held below 5°C.

Over 10 days for products held at 8°C require one or more of the additional psychotropic Clostridium controls to be demonstrated; if not challenge, testing must be carried out (Section 5.6.3).

6. HACCP

Most businesses carrying out shellfish cooking operations are legally obligated to carry out hazard identification and control. High standards of hygiene are required for all food handling operations but particular care must be taken in the production and handling of cooked shellfish due to the inherent risks associated with the raw-material and the ready-to-eat nature of the products involved.

Regulation (EC) No 852/2004 allows HACCP principles to be implemented with flexibility for small businesses:

> "*The HACCP requirements should take account of the principles contained in the Codex Alimentarius. They should provide sufficient flexibility in all situations, including in small businesses. In particular, it is necessary to recognise that, in certain food businesses, it is not possible to identify critical control points, and that, in some cases, good hygienic practices can replace the monitoring of critical points. Similarly, the requirement of establishing 'critical limits' does not imply that it is necessary to fix a numerical limit in every case. In addition, the requirement of retaining documents needs to be flexible in order to avoid undue burdens for very small businesses."*

Assistance and guidance should be sought from the businesses Local EHO. A document explaining the flexibility and implementation of the HACCP requirements in small food businesses is available from the EC[4].

Hazard identification is achieved by the application of common sense principles to the particular circumstances of operation of the business concerned. It is achieved by following the shellfish through every step in the sequence of operation of the business, identifying any particular hazards that occur at each step. Practical control measures are then introduced to reduce the risk associated with each hazard. Where appropriate, checks and control measures are put in place.

The most commonly applied hazard identification method is called, Hazard Analysis and Critical Control Point, or HACCP. HACCP is an internationally recognised tool for achieving and maintaining all aspects of food safety. Producing an effective HACCP can appear daunting but in fact is relatively straightforward when a logical approach is used.

A basic overview of how to carry out HACCP is given in Appendix I. Generic hazards and control measures specific to most shellfish cooking operations are detailed in table 1. Businesses may use the control measures relevant to their own activities to assist in developing their own HACCP.

These examples provided are not a substitute for operators analysing their own business, which will have its own particular hazards, control measures and checks.

Good Manufacturing Practice - Shellfish Cooking

Process Step	CCP No.	Hazards	Control Measures	Critical Limit	Monitoring Procedures	Corrective Action	Records
Reception of live shellfish.	CCP 1	Microbial pathogens associated with dead shellfish	Inspection for dead and damaged shellfish.	No life signs	Inspection log	Disposal of dead shellfish. Reject batch if significant	Inspection log
		Excessive physical contamination mud etc	Visual check for physical contamination		Inspection log	Reject batch if significant Re training of buyers. Change suppliers	Inspection logs
		Chemical contamination from diesel/hydraulic oil	Visual & sensory check for contamination	Detectable	Inspection log	Reject batch	
		Bacterial / viral / parasitic or algal toxin contamination	Obtain molluscs only from reputable suppliers who can provide assurance of the source of the molluscs and of suitable conditions during harvesting, storage and transport. Accept molluscs only from category 'A' , 'B' or 'C' areas with the necessary registration documents.		Check suppliers documentation for each batch bacteriological tests, registration documents. etc	Reject batch	Supplier document ation

Process step	CCP No.	Hazards	Control Measures	Critical limit	Monitoring Procedures	Corrective action	Records
Handling of live shellfish within factory	CCP2	Physical contamination. Cleaning Chemical contamination Shell Damage leading to death and pathogen growth	Visual/sensory checks Effective cleaning schedule and trained cleaners. Staff training in shellfish handling & cleaning	Detectable	Inspection log cleaning schedules. Training records Spot checks	Staff training Reject batch Staff training Reject dead shellfish	Inspection logs and schedules
Washing & grading	CCP3	Physical contamination from insufficient washing Shell Damage leading to death and pathogen growth Contamination From Wash Water	Visual inspection Cleaning / maintenance of washing/grading equipment Use only clean water Periodic water testing	Potable water specifications	Review of inspection/ maintenance logs Water testing logs .	Re training of maintenance staff Reject dead shellfish Update maintenance practices	Inspection, maintenance and test certificates

Process step	CCP No.	Hazards	Control Measures	Critical limit	Monitoring Procedures	Corrective action	Records
Storage of live shellfish.	CCP4	Physical contamination Chemical contamination from cleaning Pathogen growth associated with dead shellfish resulting from damage / excessive holding time / incorrect conditions temperature, salinity oxygen, during immersed storage	Visual/sensory checks Effective cleaning schedule and trained cleaners Monitored storage parameters	Detectable Deviation from optimum conditions for each species	Manual or automatic monitoring and recording of storage parameters alarmed	Adjust to species optimum	Parameter logs
Killing (crab)	CCP5	Introduction of Physical /Chemical or Microbiological contamination	Keep spiking implements clean Use only potable water avoid recycling Periodic water testing	Potable water specifications	Cleaning log Water testing log	Staff training	Cleaning, testing and training log
Batch or continuous Cooking.	CCP6	Survival of vegetative pathogenic bacteria from failure to meet specified time/temperature requirements for molluscan shellfish from category 'B' and 'C'.	Correct cook time & temperature	Water temperature 100°C – 109°C (salt added) Steam temperature Cook time & conveyor speed Final temperature Bivalve molluscs minimum 90°C for 90 minutes (Cat B & C)	Continuous water temperature, cook time & conveyor speed monitoring Temperature probing of product from different areas of the cooking vessel	Rectify low temperature/ belt speed /cooking time Re cook	Parameter logs. Process deviations. Corrective actions and rechecks
Process step	CCP	Hazards	Control Measures	Critical Limit	Monitoring Procedures	Corrective	Records

	No.					action	
Transfer from cooker.	CCP7	Physical contamination Chemical contamination from cleaning agents Microbiological recontamination.	Scheduled cleaning	Cleaning schedules adhered to	Visual inspection ATP Hygiene checks	Re-clean & retrain	Cleaning records and ATP results
Cooling of cooked product.	CCP8	Microbiological/ chemical recontamination (from equipment, staff, environment, cooling water). Growth of spore forming pathogens from slow cooling	Scheduled cleaning Rapid chilling	Cleaning schedules adhered to Target <5°C in 3 hours Limit <5°C in 3 hours	Visual inspection ATP Hygiene checks Temperature probe warmest parts of product	Re-clean & retrain Check chillier >5°C for 4 hours dispose of product	Cleaning records and ATP results
Transfer to final sorting/ picking. See CCP7	CCP9	-	-	-	-	-	-
Picking/ meat extraction.	CCP10	Physical or cleaning chemical contamination from surfaces, equipment and direct from power washing Microbiological recontamination from utensils workers/ equipment. Bacterial growth or toxin formation due to elevated temperatures Physical contamination metal from deboning equipment (crab)	Use temperature range alarm and recorder. Scheduled cleaning / training Personal hygiene training Time & Temperature monitoring	Not detectable Not detectable Not detectable	Visual inspection ATP Hygiene checks Temperature probe warmest parts of product. Metal detect product	Re-clean & retrain Combined cooling and picking >5'C for 4 hours dispose of product	Cleaning records and ATP results Product time temperature profile
Process step	CCP	Hazards	Control Measures	Critical Limit	Monitoring Procedures	Corrective	Records

	No.					action	
Packaging.	CCP11	Physical Chemical Pathogens contamination associated with packaging	Scheduled cleaning Supplier specification Hygienic packaging storage	Cleaning schedules	Visual inspection ATP Hygiene checks		
Pasteurisation	CCP12	Survival of pathogens due to insufficient cooking time or temperature	Correct cook time & temperature	Minimum core temperature 60°C Minimum time 1 minute Steam temperature Cook time & conveyor speed	Continuous steam / water temperature, cook time & conveyor speed monitoring Temperature probing of product from different areas of the cooking vessel	Rectify low temperature, belt speed, cooking time Re cook	Parameter logs. Process deviations. Corrective actions and rechecks
Post pasteurisation cooling	CCP13	Recontamination through failed packaging	inspection	Burst packaging	Inspection log	Re package & re pasteurise Dispose of product	Inspection log
Storage & Dispatch .	CCP15	Chemical /physical packaging contamination C botulinum pathogen growth	Protect from bird/ animals Ensure dispatch vehicles are clean. Visual inspection on loading Chilling	Temperature <3°C	Loading log Manual/automatic temperature recording	Hold & rectify or disposal	Loading log

Appendix I – Guidance on HACCP Procedures

This overview was adapted from Codex Alimentarius Guidance developed by the Food and Agriculture Organisation (FAO)[20].

After familiarising oneself with the basic principles here it is worth collecting as much guidance, advice and assistance as possible before starting HACCP for a specific business. Detailed guidance on the specific HACCP stages, generic examples and blank HACCP forms are available [21] and Seafish also carry out HACCP training.

A typical HACCP can be summarised by the following steps:

1. Establishing the Team and Scope

The first step is to assemble the HACCP team, which will work through the remaining steps to develop the HACCP. The end result is only as good as the team members involved. Where possible team should be multi-disciplinary, with the specific knowledge of the product, process and the potential hazards involved. Where expertise is not available on site, expert advice should be obtained a from other sources such as Seafish, an Environmental Health Officer or HACCP consultants.

The scope of the HACCP plan should be identified, for example, if the operation has multiple processes such as both crab and whelk cooking, one HACCP plan should be done for each process.

2. Describe the Product

Draw up a full description of the product, including relevant information, which will impact on the product safety; such as composition, physical and chemical structure, Water Activity, pH, packaging type and durability and also storage conditions.

Thought should also be given to the intended end use. If the product is ready to eat or has a specific consumer profile such as the very young, old or immunocompromised it deserves special care.

[20] Food Quality and Safety Systems – A Traiing Manual on Food Hygiene and the Hazard Analysis and Critical Control point (HACCP) System – Section 3 – THE HAZARD ANALYSIS AND CRITICAL CONROLPOINT (HACCP) SYSTEM

[21] HACCP A Practical Guide (Third edition) Campden & Chorleywood Food Research Association

3. Prepare a Flow Diagram

Start with a blank sheet of paper and work through the business from start to finish, following the flow from raw material reception, to product dispatch and identify and list each process or step.

Observe the process, what actually happens?

4. Identify the Hazards/Analyse the Risk/Consider Control Measures

For each step of the operation and the action immediately prior to and following it, list all the physical, chemical, and microbiological hazards to food safety that are actually present. A Guide to the types of hazards, which may be encountered, is given in Appendix II.

Conduct a hazard analysis to identify which hazards are critical to the safety of the final product.

List the control measures associated with each hazard.

By way of example, particular hazards at mollusc reception could include:

a) lack of information on the source of the molluscs, hence on their level of microbiological contamination
b) leaving the molluscs lying around outside the premises, exposed to further contamination and to temperature stress after delivery.

Appropriate control measures for those hazards include:

a) insistence on the requirement for a registration document to identify the source of every batch of molluscs
b) moving the molluscs directly from the transport vehicle into a protected storage or preparation area.

5. Determine the Critical Control Points (CCPs)

A critical control point is like a checkpoint; applied to each step where a hazard exists that is critical to the final safety of the product. A decision tree like the one shown in Figure 1 can be used to assist in the decision-making process.

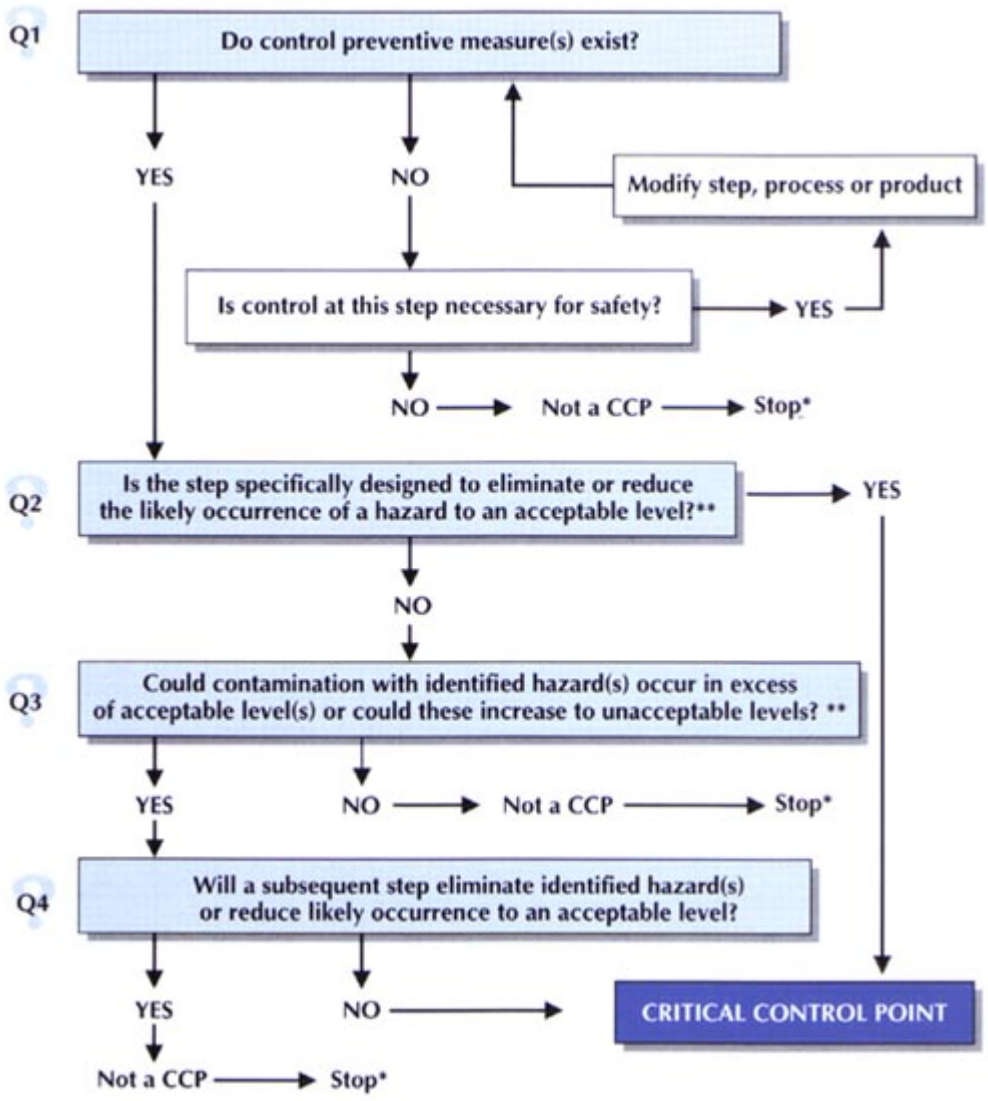

Figure 1 - CCP Decision Tree

6. Establish Critical Limit(s)

Establish measurable critical limits which must be met to ensure that the critical control is working. This may be temperature, P.H., water activity, available chlorine, sensory parameters or microbiological testing.

By way of example, particular hazards during processing could include:

a) Incomplete cook due to insufficient time or temperature.
b) Physical, chemical or microbiological recontamination of the cooked shellfish during cooling or meat extraction.

Measurable critical limits for those hazards include:

a) Minimum cook time of 90seconds, with a minimum temperature of 90°C (Cat B and C bivalve molluscs).
b) Contaminants or pathogens present.

7. Critical Control Point Monitoring and Action System

Establish a system to monitor and record the critical limits by scheduled testing or observation. Establish the corrective action to be taken when monitoring indicates that a particular CCP is not under control.

Appropriate checks on those control measures include:

a) The requirement to keep records of all cooking times and temperatures.
b) Records of cleaning logs, and microbiological testing.

8. Documentation, Verification and Record Keeping

Establish procedures to confirm that the HACCP system is working effectively. Verification and auditing methods, procedures and tests, including random sampling and analysis, can be used to determine if the HACCP system is working. The frequency of verification should be sufficient.

Efficient and accurate record keeping is essential to the application of an HACCP system. HACCP procedures should be documented. Documentation and record keeping should be appropriate to the nature and size of the operation.

A tabular format is the most common way to present an overview of the HACCP study. An example of which is Table 1. In a complex study the tabular format may be to limiting in terms of the amount of space available. Alternatively, each process step of can have its own A4 sheet .

Appendix II – Hazard Guide

Potential Hazards

Examples of potential biological, chemical and physical hazards are given in the accompanying boxes. These lists can be used for assistance in the identification of potential hazards.

Biological hazards

Food borne biological hazards include microbiological organisms such as bacteria, viruses, fungi and parasites. These organisms are commonly associated with humans and with raw products entering the food establishment. Many of-these micro organisms occur naturally in the environment where foods are grown. Most are killed or inactivated by cooking, and numbers can be minimized by adequate control of handling and storage practices (hygiene, temperature and time).

Examples of Biological Hazards

Bacteria (spore-forming)

Clostridium botulinum
Clostridium perfringens
Bacillus cereus

Bacteria (non-spore-forming)

Brucella abortis
Brucella suis
Campylobacter spp.
Pathogenic *Escherichia coli* (*E. coli* 0157:1-17, EHEC, EIEC, ETEC, EPEC)
Listeria monocytogenes
Salmonella spp. (*S. typhimurium, S. enteriditis*)
Shigella (*S. dysenteriae*)
Staphylococcus aureus
Streptococcus pyogenes
Vibrio cholerae
Vibrio parahaemolyitcus
Vibrio vulnificus
Yersinia enterocolitica

Viruses

Hepatitis A and E
Norwalk (Norovirus) virus group
Rotavirus

Protozoa and parasites

Cryptosporidium parvum
Diphyllobothrium latum
Entamoeba histolytica
Giardia lamblia
Ascaris lumbricoides
Taenia solium
Taenia saginata
Trichinella spiralis

The majority of reported food borne disease outbreaks and cases are caused by pathogenic bacteria. A certain level of these micro-organisms can be expected with some raw foods. Improper storage or handling of these foods can contribute to a significant increase in the level of these micro-organisms. Cooked foods often provide fertile media for rapid growth of micro-organisms if they are not properly handled and stored.

Viruses can be foodborne/water-borne or transmitted to food by human, animal or other contact. Unlike bacteria, viruses are unable to reproduce outside a living cell. They cannot therefore replicate in food, and can only be carried by it.

Parasites are most often animal host-specific and can include humans in their life cycles. Parasitic infections are commonly associated with undercooked meat products or contaminated ready-to-eat food. Parasites in products that are intended to be eaten raw, marinated or partially cooked can be killed by effective freezing techniques.

Fungi include moulds and yeasts. Fungi can be beneficial, as they can be used in the production of certain foods (e.g. cheese). However, some fungi produce toxic substances (mycotoxins) which are toxic for humans and animals.

Chemical hazards

Chemical contaminants in food may be naturally occurring or may be added during the processing of food. Harmful chemicals at high levels have been associated with acute cases of foodborne illnesses and can be responsible for chronic illness at lower levels.

Examples of Chemical Hazards

Naturally occurring chemicals

Allergens
Mycotoxins (e.g. aflatoxin)
Scombrotoxin (histamine)
Ciguatoxin
Mushroom toxins
Shellfish toxins
- Paralytic shellfish poisoning (PSP)
- Diarrhoeic shellfish poisoning (DSP)
- Neurotoxic shellfish poisoning (NSP)
- Amnesic shellfish poisoning (ASP)
- Pyrrolizidine alkaloids
- Phytohaemagglutinin

Added chemicals

Polychlorinated biphenyls (PCBs)
Agricultural chemicals
- Pesticides
- Fertilizers
- Antibiotics
- Growth hormones

Prohibited substances
- Direct
- Indirect

Toxic elements and compounds
- Lead
- Zinc
- Cadmium
- Mercury
- Arsenic
- Cyanide

Food additives
Vitamins and minerals
Contaminants
- Lubricants
- Cleaners
- Sanitizers
- Coatings
- Paints
- Refrigerants
- Water or steam treatment chemicals
- Pest control chemicals

From packaging materials

Plasticizers Vinyl chloride Printing/coding inks Adhesives Lead Tin

Physical Hazards

Illness and injury can result from hard foreign objects in food. These physical hazards can result from contamination and/or poor practices at many points in the food chain from harvest to consumer, including those within the food establishment.

Examples of Physical Hazards

Material	Injury potential	Sources
Glass	Cuts, bleeding; may require surgery to find or remove	Bottles, jars, light fixtures, utensils, gauge covers, etc.
Wood	Cuts, infection, choking; may require surgery to remove	Field sources, pallets, boxes, building materials
Stones	Choking, broken teeth	Fields, buildings
Metal	Cuts, infection; may require surgery to remove	Machinery, fields, wire, employees
Insulation	Choking; long-term if asbestos	Building materials
Bone	Choking	Improper processing
Plastic	Choking, cuts, infection; may require surgery to remove	Packaging, pallets, equipment
Personal effects	Choking, cuts, broken teeth; may require surgery to remove	Employees

Texts with more specific information on particular food products and food processes are of course available, depending on the product being considered. However, the best places to obtain access to these texts would be universities and research institutions.

Appendix III – Further Sources of Information and Advice

Advice on shellfish cooking matters can be obtained from the Local Environmental Health Officer. Environmental Health Officers are employed by Local Government Authorities who are the Food Authorities, and they can be located in the local telephone directory, probably listed under the Council's 'Environmental Services'.

Technical advice can be obtained from The Sea Fish Industry Authority:

Sea Fish Industry Authority
Seafish Technology
Seafish House
St. Andrew's Dock
HULL
HU3 4QE

Tel: 01482 327837
Fax: 01482 223310

Seafish Technical Information Sheets and guidance Documents:

- Guidance on Procedures to Minimise Risks to Food safety in Bivalve Mollusc Purification. 1st Edition, March 1999.

- Guidelines for the Facilities and Equipment Required for Handling Bivalve Molluscs from Harvesting through to Distribution to Retail Outlets. April 1997.

- Basic Guidance on Good Hygiene Practice for the Inshore Shrimp Industry.

Information on the provision of training courses can be obtained from the local EHO and from The Sea Fish Industry Authority which operates a number of area based Group Training Associations to deliver training locally:

The Shellfish Association of Great Britain can give technical advice on shellfish matters to its members:

The Shellfish Association of Great Britain
Fishmonger's Hall
London Bridge
LONDON
EC4R 9EL

Tel: 020 7283 8305 Fax: 020 7929 1389