

Major incidents of foodborne illness

Aberdeen – Typhoid

1964 – Associated with cans of corned beef cooled in sewerage polluted water

Stanley Royd – Salmonella

1984 – Involving cross-contamination of cooling roast beef from raw chicken resulting in 450 cases and 19 deaths

Cumbria - *Salmonella* Ealing

1985 - Dried baby milk (Farley Health Products) resulting in 60 cases and 1 death. Caused by pinhole in silo allowing moisture to provide suitable multiplication conditions. Factory value reduced from £40 million to £18 million

Wishaw – *E. coli* O157

1996 – Cooked cold meats and cooked steak/gravy (John Barr).
Mainly cross-contamination, resulting in 500+ cases and 21 deaths.
(At least 3 major outbreaks and sporadic cases)

Birmingham – *Clostridium botulinum*

1989 – Hazelnut yogurt resulting in 27 cases and 1 death.
Caused by failure to undertake a risk assessment when producing new product.
(Sweetener instead of sugar (a_w) and hazelnut
> pH than fruit - failure to increase processing temperature).

France – *Listeria monocytogenes*

1992 – Pork tongue in aspic resulting in 279 cases, 63 deaths and 22 abortions

USA – Salmonella

Pasteurised milk resulting in 18,000 cases and 2 deaths

Lawsuits in USA resulting from *E. coli* O157 outbreaks

June 2000 – Iwan's Deli and catering of Orland Park
1,200 ill (potato salad) - \$3,000,000

May 1998 – Odwalla Inc
5 children (apple juice) - \$1,200,000

February 1998 – Jack in the Box restaurant chain
4 customers died, many more ill
Accepted \$58,500,000 from 9 beef suppliers (hamburgers)

February 2001 – Taco hamburgers served with school lunch
11 children, 3 developed kidney problems (one serious).
Court awarded \$4,750,000

Definitions

A case of food poisoning	A person with symptoms usually diarrhoea and/or vomiting, who has become ill as a result of eating contaminated food and who has provided a specimen from which a food poisoning organism, toxin or poison has been isolated or is part of a confirmed food poisoning outbreak.
An outbreak of food poisoning	An incident in which two or more people, thought to have a common exposure, experience a similar illness.
Carrier/s	A person who harbours, and may transmit, pathogenic organisms without showing signs of illness.
Causative agent	The bacteria, toxin or poison that contaminates the food and causes the illness.
Contamination	The presence or introduction of a hazard. (EC Regulation No. 852/2004)
Convalescent carrier	Recovered from illness but is still excreting the organism.
Cross-contamination	The transfer of bacteria from contaminated food (usually raw) to ready-to-eat foods by direct contact, drip or indirect contact using a vehicle such as the hands or a cloth.
Danger zone of bacteriological growth	The temperature range within which the multiplication of most pathogenic bacteria is possible i.e. 5°C to 63°C. Most rapid growth takes place between 20°C and 50°C.
Food hygiene	All measures and conditions necessary to control hazards and to ensure fitness for human consumption of a foodstuff taking into account its intended use. (EC Regulation No. 852/2004)

Definitions

Food hygiene (*cont*)

- Preventing multiplication of bacteria
- Destroying organisms
- Destroying/removing unfit/unsafe/contaminated food.

Food poisoning

An acute illness, usually with symptoms of diarrhoea and/or vomiting, nausea and abdominal pain, caused by the consumption of contaminated or poisonous food (a multiplication of bacteria usually occurs within the food).

Food vehicle

The food consumed that contained the causative agent.

Healthy carrier

Never shown symptoms but is excreting organisms.

Incubation (onset) period

Time between consuming the contaminated food and showing the first signs of illness.

Pathogen

Disease-producing organism.

Risk groups

Those people who are likely to suffer the most severe consequences, or death, from foodborne illness including the elderly, ill people (immunocompromised), the very young and pregnant women.

Safe food

Food which is free of contaminants and will not cause illness or harm.

Source(causative agent)

The point from which the causative agent first entered the food chain or what brought the causative agent into the food premises.

Spores

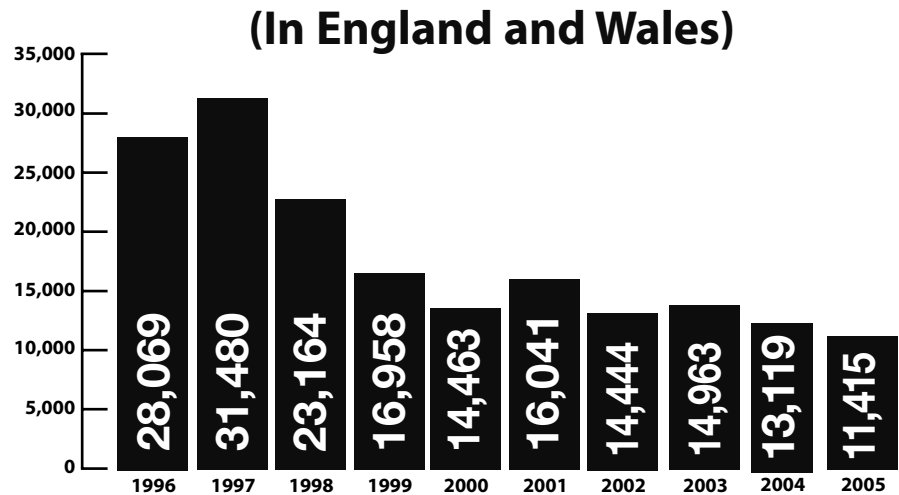
A resistant resting phase of certain bacteria, protecting them against adverse conditions, such as high temperature. They can survive for many years in this state.

Toxins

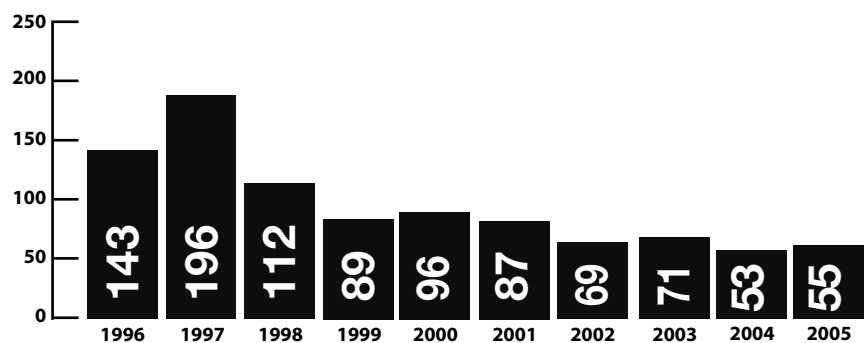
Poisons produced by pathogens.

Current food poisoning trends

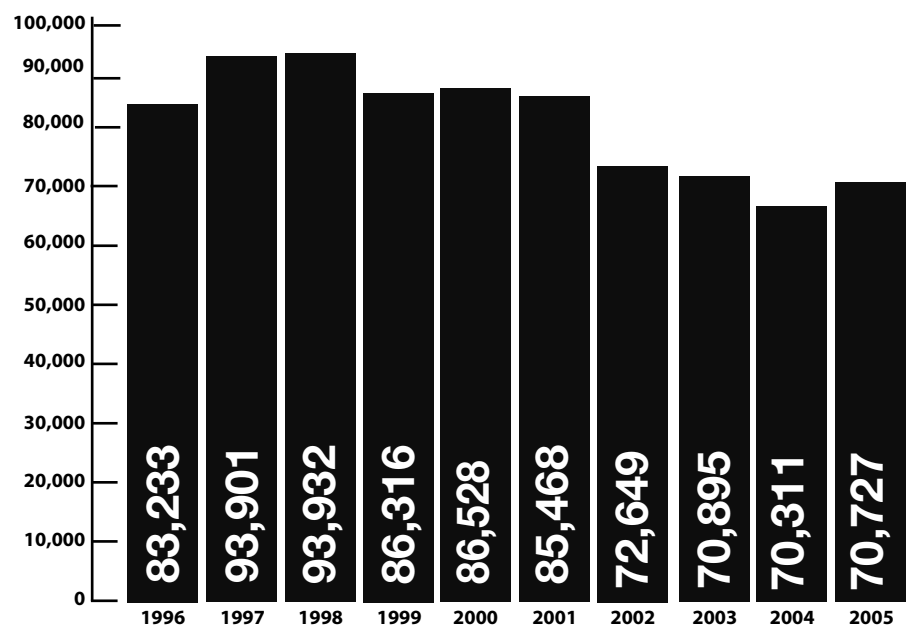
Salmonella Isolates from humans (1996 - 2005)



Outbreaks of foodborne infectious intestinal disease (excluding private residences) (1996 - 2005)



Reported cases of food poisoning (1996 - 2005)



Advanced food safety

Target population

- **Middle and upper management**
- **Senior staff responsible for food safety**
- **Food hygiene trainers**
- **Food course designers**

Aim

To improve the management and food safety skills of candidates

Objectives

To provide candidates with sufficient knowledge to enable them to:

- Improve the standards and safety of their operation
- Reduce the risk of food poisoning and food complaints
- Identify hazards **and instigate suitable** controls, monitoring and corrective action
- Interpret the requirements of food legislation
- Successfully complete the Advanced **food safety** examination

To be interesting, informative and enjoyable

Notes



Safe food

Food which is free of contaminants and will not cause harm, **injury** or illness.

Ask the class for their definitions of each of the above, prior to giving the handout or providing the answers.

Food hygiene

The measures and conditions necessary to control hazards and to ensure fitness for human consumption of a foodstuff taking into account its intended use.

(EC Regulation No.852/2004) (It involves preventing objectionable matter getting into food).

It includes:

- **Rejecting contaminated, or poisonous food or food from suspect sources**
- **Protecting food from contamination, including harmful micro-organisms, poisons, allergens and foreign bodies**
- **Preventing multiplication of bacteria to a level which would result in illness of consumers or the early spoilage of food**
- **Destroying micro-organisms in the food or food environment**
- **Discarding/removing unsafe/unfit or contaminated food**

Contamination

The presence or introduction of a hazard.
(EC Regulation No. 852/2004)

Cross-contamination

The transfer of bacteria from contaminated food (usually raw) to ready-to-eat foods by direct contact, drip or indirect contact using a vehicle such as hands or a cloth.

Pathogen

Disease-producing organism.

Notes



Food poisoning definitions



Food poisoning

An acute illness, of sudden onset caused by the recent consumption of contaminated or poisonous food (Usually with symptoms of diarrhoea and/or vomiting)

A case of food poisoning

"A person with symptoms, usually diarrhoea and/or vomiting, who has become ill as a result of eating contaminated food and who has provided a positive specimen or is part of a confirmed food poisoning outbreak"

Outbreak of food poisoning

Two or more people with a common exposure experience a similar illness

General outbreak

Two or more cases in different households

Family outbreak

Two or more cases in the same household

Sporadic case

- **Isolated cases with no connection with other cases**
- **Majority of cases - sporadic**
- **(May be part of an undetected outbreak relating to retailing or manufacture)**

Carriers

Carriers are people who:

- **Excrete food poisoning organisms or carry them on their bodies**
- **Show no symptoms**

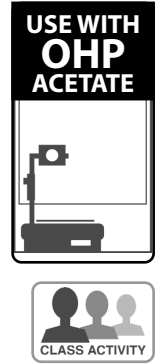
Two types:

Convalescent carrier

Recovered from illness but is still excreting organisms

Healthy carrier

Never shown symptoms but is excreting organisms



Class exercise

Split the class into two with a competition to determine which group can suggest most of the following:

The benefits of GOOD hygiene

A good reputation, satisfied customers **and** increased productivity (Brand protection)

Compliance **with food safety legislation**

Good working conditions.

Reduced risk of food poisoning

Less food wastage and increased shelf-life **of food**

Higher staff morale, **reduced staff turnover**

Higher profits

The costs of POOR hygiene

Food poisoning **outbreaks (deaths, suffering, bad reputation)**

Food contamination and customer complaints

Brand damage/loss of business

Closure **of premises/prohibition of processes**

Fines **from court action**

Civil action **from ill or annoyed customers**

Pest infestations and food loss

Waste food due to spoilage

Loss of production (**whilst cleaning/checking**)

Decontamination (time to clean and remove contamination)

High staff turnover because of poor conditions

Lower profits

Incidence of food poisoning

The annual incidence of food poisoning in England and Wales is unknown and records of confirmed cases of food poisoning are unavailable.

Several million people each year suffer from gastrointestinal infections i.e. diarrhoea and vomiting and many of these will be foodborne illness. Actual number of cases of foodborne illness estimated to be around 900,000 (2005)

Risk groups - elderly, very young, pregnant women, ill people and immunocompromised

Graph salmonella

Considered by many to be one of the best indicators of food poisoning trends but there are many things other than standards of food safety that affect trends.

(Estimated there are 3 times as many cases compared to the number of isolates recorded and around 90% of isolates are a result of foodborne infection).

Graph general outbreaks

Identifies outbreaks from commercial food businesses not from private residences.

Reported cases of food poisoning

- Food poisoning (for notification purposes) "Any disease of an infectious or toxic nature caused by or thought to be caused by the consumption of food or water". These reports include illness resulting from viruses (<10% foodborne) and Campylobacter (>70% estimated to be foodborne).
- Many of these cases are unconfirmed i.e. no specimen provided.
- They include many cases of diarrhoea and vomiting, which are not foodborne. (Especially viral - rotavirus and norovirus, but also campylobacter).
- These statistics should not be used to indicate trends of actual food poisoning and they should never be used to indicate trends of food safety standards in commercial premises.



Module 2

Microbiology

Aims

To provide a detailed understanding of micro-organisms, their effect on the food industry and how they can be effectively controlled

Key Points

- Food poisoning bacteria are common in all food businesses
- Bacteria need food, people and equipment to move around the kitchen
- Require food, moisture, warmth, time, suitable pH and atmosphere to multiply
- Most pathogenic bacteria prefer 20-50°C
- Can double in number in 10 minutes, the bacterial growth curve indicates the various phases involved
- Temperatures above 75°C used to destroy
- Some toxins and spores can survive boiling for several hours
- Most food poisoning bacteria do not grow <5°C
- High acids, salt and sugar stop multiplication of bacteria
- There are various methods of identification of specific bacteria

Video/DVD

Visual Aids

- Agar plates/photographs

Handouts

- Explanatory notes (HO6)
- Water activity (HO7)
- Spores (HO9)
- Toxins (HO10)
- Examination questions (HO11)

Group exercise

Individuals to complete "optimum factors affecting bacterial multiplication" (HO8)

Module 2



Explanatory notes

Bacterial growth

Pass through a number of phases
Lag - no multiplication (bacteria producing necessary enzymes)

The lag phase may be considered as the recovery period for bacteria subjected to unfavourable conditions, for example: too hot, cold, dry

Logarithmic - rapid multiplication

Stationary - numbers remain constant, i.e. number produced is equal to number dying
(Factors involved - food, competition and waste)

Decline - numbers decrease, i.e. numbers dying exceed numbers produced

Growth ranges of specific bacteria

Psychrophiles

Below 20°C (spoilage-refrigerators)

Mesophiles

20-50°C (pathogens)

Thermophiles

Above 45°C (canning industry-spoilage)

Psychrotrophs

Below 20°C but prefer above 20°C

Binary fission

Reproduction by splitting into two
Speed varies with presence or absence of other requirements (food, moisture, warmth)
In optimum conditions it can be as quickly as every 10 minutes (1000 to 1000,000 in 1 hour 40 minutes) generally accepted as every 20 minutes

Mould

Chlorophyll-free fungi
Produce thread-like filaments (hyphae)
Form branched network of mycelium
Mould may be various colours including:
Black, white, green and pink
Optimum growth temperature 20-30°C
Can grow as low as -10°C
High humidities and fluctuating temperatures assist growth
Affects most foods
Normally mouldy food is "unfit for human consumption"
Stock rotation and "best-before" dates important
Some moulds such as *Aspergillus flavus* can produce mycotoxins
Moulds are usually aerobic

Explanatory notes

Obligate aerobe

Grows only in the presence of oxygen e.g. moulds

Facultative anaerobe

Grows either with or without oxygen
e.g. *Salmonella spp* and *Staphylococci spp*

Obligate anaerobe

Grows only in the absence of oxygen
e.g. *Clostridium perfringens* and *Clostridium botulinum*

pH (acid/alkaline balance)

Most bacteria prefer around 7 (neutral)
Below 4.5 most do not multiply
Some bacteria can survive pH below 4.5 for some time,
(e.g. *E. coli* O157)
Staphylococcus aureus can survive relatively high salt levels

Protozoa

Single-celled organisms which form the basis of the food chain.
Some are harmful (pathogenic) e.g. *cryptosporidium*

Viruses

Multiply in living cells
Cannot multiply in food
May survive several days outside living cell
Mainly airborne and person to person spread
(faecal oral route)
Only small numbers required (10-100 particles)
Onset period 15-60 hours (dose dependent)
Norovirus or Norwalk-like virus (NLV) (up to 10% may be foodborne)
Some diarrhoea
Vomiting (often projectile)
Abdominal pain
Fever
Nausea
Fatalities rare
Symptoms relatively mild
Rotavirus (most common, but unlikely to be foodborne)

Water activity/ available water

Water needed to transport nutrients and waste
Pure water a_w 1.00
Bacteria's preferred range 0.99-0.95
Some foods don't have enough "available water" for growth
Some bacteria can survive dehydration as spores

Yeasts

Microscopic fungi
Reproduce by budding
Most are aerobic (obligate and facultative)
Majority prefer acid foods (pH 4-4.5)
Reasonable level of moisture required
Many grow in high concentrations of sugar and salt
Growth range 0°C to 47°C (Optimum 25°C to 30°C)
Many used in food manufacture
Some cause food spoilage

Water activity

Freely available water in the food

If salt/sugar is added the water binds tightly to it so the amount of freely available water is reduced, hence the a_w is reduced (the addition of salt/sugar increases the osmotic pressure)

Staphylococcus aureus can survive relatively high salt levels

An alternative way of reducing the a_w is to remove the water by dehydration

Most bacteria require $a_w > 0.95$

pH

Most bacteria prefer pH around 7 (neutral)

When foods have a lower pH the yeasts and moulds are problematic

The limit of growth for *Clostridium botulinum* type E is 4.5, this is relevant in canning

Some strains of salmonella and *Staphylococcus aureus* may be capable of growth at pH as low as 3.8 (Salmonella has been involved in food poisoning outbreak with apple juice)

E. coli is acid tolerant and consequently has been the cause of foodborne outbreaks due to consuming acidic foods such as apple juice and cider

Note the alkaline end of the pH scale is used for cleaning and disinfection e.g. caustic soda

Alkalis are unpalatable

Optimum and limiting factors affecting the multiplication of important UK foodborne pathogens

Temperature	
Minimum temperature	(Except <i>Listeria</i> and <i>Yersinia</i> 0°C - but very slow)
Maximum temperature	
Optimum temperature	
Scientific danger zone	
Legal danger zone	
NB Vegetative forms of pathogenic bacteria will be destroyed at, for example, temperatures of 55°C for 2 hours	
pH value	
Minimum pH	(<i>Staphylococcus aureus</i> / <i>Salmonella</i>)
Optimum pH	
A _w	
Minimum	(<i>Staphylococcus aureus</i> / <i>Salmonella</i>)

NB Moulds grow at lower pH and a_w values

No reports of mycotoxin production below an a_w value of 0.80

Optimum and limiting factors affecting the multiplication of important UK foodborne pathogens

Temperature

Minimum temperature	3°C/4°C	(<i>E. coli</i> O157 and <i>Clostridium botulinum</i>)
Maximum temperature	52°C (Usually 50°C)	<i>Clostridium perfringens</i>
Optimum temperature	20°C to 47°C	20°C <i>Clostridium botulinum</i> 47°C <i>Clostridium perfringens</i>
Scientific danger zone	3°C to 52°C	
Legal danger zone	8°C to 63°C	

pH value

Minimum pH	3.8	(<i>Staphylococcus aureus</i> / <i>Salmonella</i>)
Optimum pH	Around 7 (neutral)	

A_w

Minimum	0.83	(<i>Staphylococcus aureus</i> / <i>Salmonella</i>)
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NB Moulds grow at lower pH and a_w values

No reports of mycotoxin production below an a_w value of 0.80

Although low pH prevents the multiplication of pathogens they may remain viable for some time and if present in large numbers have been known to cause food poisoning, for example, salmonella in apple juice

Spores

Spore formation

Some bacteria can form spores, which can survive unfavourable conditions such as:

- High temperature
- Dehydration
- Disinfectants

- Cooking provides a heat shock which may induce germination of spores during cooling
- Spores are modified bacteria with a protective layer or “shell”
- Can survive for many years
- Do not require food or water to survive
- Some can survive boiling for up to 5 hours
- During canning a core temperature of 121°C for 3 minutes is necessary to reduce the chance of survival of *Clostridium botulinum* spores to 1 in 10¹² in low-acid foods such as vegetables
- When conditions become favourable they germinate
- Toxins can be released during sporulation, e.g. *Clostridium perfringens* and *Bacillus cereus* (emetic) and germination in intestine e.g. *Bacillus cereus* (diarrhoeal)
- If favourable conditions persist multiplication of vegetative bacteria begins

Toxins

Toxin production

- Toxins are poisonous chemicals produced by certain bacteria as waste
- Only a few types of bacteria produce waste poisonous to humans
- These are known as pathogens

Neurotoxins

Affect the nervous system e.g. *Clostridium botulinum*

Examples of symptoms:

- Blurred and double vision
- Nerve paralysis
- Collapse

Exotoxins

- Produced in food (or in the intestine in case of *Clostridium perfringens*) during multiplication. (see: Microbiological Food Poisoning by Adrian Eley, Chapman and Hall, Page 49)
- Many are heat resistant e.g. *Staphylococcus aureus* and *Bacillus cereus*. If cooking destroys bacteria, exotoxins may remain
- Usually results in a short incubation period with vomiting

Endotoxins

- Usually produced in intestines of person consuming e.g. *Salmonella*
- Toxin forms part of bacterial cell wall
- Released on death of bacteria or during sporulation
- Usually longer onset period than exotoxins
- Diarrhoea normally one of main symptoms

Enterotoxins

- Exotoxins which affect gastrointestinal tract

Examination question

Subject Microbiology1



1. Write notes on the following:

- a) Spores**
- b) Toxins**
- c) The requirements for bacterial growth**
- d) The bacterial growth curve**
- e) Spoilage organisms**

Bacteria - size, shape and structure



To understand the problems caused by some bacteria it is necessary to understand basic bacteriology

Bacteria:

Single celled organisms

Found everywhere (**ubiquitous**) including **on/in raw food, people, soil, air, water**

A small number cause disease - **pathogens**

Most harmless

Some essential

Some spoil food (spoilage bacteria)

Break down decaying matter - some help digestion

Some beneficial to food industry e.g. cheese and yoghurt manufacture

Size

Microscopic **0.001 to 0.003 mm**

Colonies are visible following Lab incubation

The effects of large numbers of spoilage bacteria can be detected on meat, for example, when there has been a breakdown in controls i.e. slime and odour

Shape

Various shapes:

Cocci; **round** (*Staphylococcus aureus*)

Rods; **sausage shaped**

Spirochaetes; **spiral** (*Leptospira*)

Vibrios; **comma shaped** (*Cholera*)

Structure

Cell wall - **A rigid structure that provides shape**

Cytoplasm - **The "body" of the bacterium**

Cell Membrane - **Controls passage of waste and nutrients**

Nuclear material - **The "brain" of the bacterium**

Flagella - **Allow the bacteria to move in liquids**

Capsule - **Found on "slime" bacteria**

Fimbriae - **May aid adhesion**

Requirements for bacterial multiplication

Food (nutrients)

Protein, fats, vitamins, minerals carbon, sugar

High protein food such as meat, fish and dairy produce

Moisture (water activity/available water)

Needed to transport nutrients and waste

Pure water a_w 1.00

Bacteria's preferred range 0.99 - 0.95

Some foods don't have enough "available water" for growth

Some bacteria can survive dehydration as spores

Staphylococcus aureus can survive relatively high salt levels

Warmth

Although the Danger Zone is quoted as 5°C- 63°C the range for most rapid multiplication of pathogens is usually 20°C-50°C (37°C body temp)

Classification of bacteria based on temperature

Psychrophiles (below 20°C)

- Include bacteria, which cause spoilage in refrigerator e.g. *Pseudomonas* (a slime bacteria)
- Important pathogens include *Listeria* and *Clostridium botulinum* type E

Mesophiles (20°C to 50°C)

Include most of the common pathogens that cause food poisoning

Thermophiles (>45°C)

Important in the canning industry and can cause blown cans

Psychrotrophes

Capable of multiplying below 20°C but prefer above 20°C

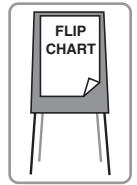
Time

Reproduction by binary fission (splitting into two)

The time taken for a complete cell cycle

(effectively the number of bacteria doubles) is called the generation time (tg)

Speed varies with presence or absence of other requirements





If optimum conditions it can be every 10 minutes
1,000-1,000,000 in 1 hr 40 mins (worst case scenario)

Where $t_g = 10$ minutes 1 pathogen will become
approximately 17 million in just 4 hours.

Unfortunately pathogens do not affect the smell,
taste or texture of food (unlike spoilage bacteria)

Vegetative state when growing and multiplying

Examples:

Salmonella

at 37°C $t_g = 20$ minutes

at 10°C $t_g = 10$ hours

E coli O157/Clostridium perfringens

at 45°C $t_g = 10$ minutes

Listeria monocytogenes

at 4°C $t_g = 30$ hours

lag phase 2 days in milk



Food types

High-risk foods (a_w 0.95 - 0.99)

- **Are usually identified as** food vehicles in food poisoning **outbreaks**
- Ready-to-eat **foods which support the rapid multiplication of food poisoning bacteria**
- **Intended for consumption without treatment, such as cooking, which would remove or destroy these bacteria**
- Usually protein (**NB cooked rice-carbohydrate**)
- **Require** refrigerated storage
- **Keep separate from raw foods**

Examples:

- **Cooked meat and cooked poultry**
- **Cooked meat products, patés, liquid gravy, stew meat pies etc. Large cans of pasteurized ham**
- **Dairy produce, milk(esp. raw milk), cream, custards, ice-cream, dairy based desserts, ripened soft and moulded cheese**
- **Eggs and egg products, mousse, hollandaise sauce, mayonnaise**
- **Cooked fish/shellfish and raw bivalves, such as oysters**
- **Cook-chill meals**
- **Baby foods**

NB Frozen high-risk foods have the available moisture removed and are safe whilst frozen

Raw foods (intended for cooking/processing)

- **Often contaminated with large numbers of food poisoning bacteria**
- **Risk of food poisoning if consumed without thorough cooking, heat treatment, fermentation, acidification, washing (risk from *E. coli* O157), curing etc.**
- **Keep separate from ready-to-eat foods, even if frozen(risk is probably low regarding packaged frozen raw food)**



Low-risk foods

- Preserved foods e.g. jams, marzipan, honey, chocolate filling, marmalade (a_w 0.75-0.80)
- Dried acid foods such as fruit
- Flour, cereals, pulses, fruit cake, sweetened condensed milk (a_w 0.80-0.87)
- Biscuits, rusks, breadcrumb (a_w 0.30)
- Fermented products e.g. Salami and mature cheese (a_w 0.87- 0.91)
- Canned foods whilst in unopened can
- Dried fruits, toffees and caramels (a_w 0.6-0.65)
- Dry pasta, noodles, spices (a_w 0.50)
- Ambient **stable** foods rarely implicated in food poisoning
- Once powders such as gravy or custard are reconstituted they become high-risk

Ready-to-eat raw foods

- Raw foods such as lettuce or fruit **may be contaminated with** low-dose pathogens **such as *E. coli* O157** and **must always** be washed before eating (NB cut melons have been implicated in outbreaks of salmonella). Lettuce, raspberries and apple juice have been implicated in foodborne disease

Effect of temperature on bacteria

100°C	Temperature at which water boils
82°C	Disinfection using hot water Legal requirement in Scotland for reheating
75°C	Recommended minimum core cooking temperature
63°C	Legal requirement to store hot food above this
20-50°C	Food poisoning bacteria grow most rapidly High-risk food too long at this temp. is probably the commonest cause of food poisoning
5-20°C	Most food poisoning bacteria grow slowly Listeria, spoilage bacteria and moulds grow more rapidly Food more likely to be spoilt rather than unsafe
5°C	Temperature at which it is recommended that high-risk foods be stored at or below
1-4°C	Recommended air temperature for general refrigerator
0°C	Temperature at which water freezes
-18°C	Frozen food storage . No bacterial growth

To convert °F to °C deduct 32 and multiply by 5/9

To convert °C to °F multiply by 9/5 and add 32

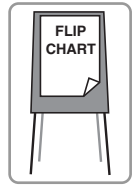
- **Each bacterial species has an optimum temperature at which cell growth is most rapid**
- **The growth rate falls abruptly at both the upper and the lower limits of their temperature range**
- **The maximum temperature for growth is usually only a few degrees higher than the optimal temperature**

Use a probe thermometer to demonstrate temperature e.g. cup of tea, hot food or refrigerator.

Notes



With temperatures. Class to confirm significance



Bacterial growth curve

- When conditions are right bacteria begin to multiply
- The increase in numbers is not uniform
- It passes through a number of phases

Lag

- No multiplication, **bacteria are producing necessary enzymes**
- **Lag phase may be considered as recovery period for bacteria subjected to unfavourable conditions, for example:**
 - Too: hot, cold, dry
 - No oxygen

Logarithmic

Rapid multiplication (**growth**)

Stationary

- Number remains constant
- Number produced equals number dying
- **Food has decreased**
- **Competition for space and food has increased**
- **Toxic waste products have increased killing some bacteria**

Decline

- Number decreases
- **Number dying exceeds number produced**

Competition

- **Micro-organisms compete for space and food**
- **Food poisoning bacteria tend to be less competitive than natural flora. NB some doctors do not like prescribing antibiotics for salmonella food poisoning - they prefer to rely on competition from natural bacteria in the intestines. Antibiotics tend to kill the protective gut bacteria, exposing attachment sites on the gut wall for invasive pathogens such as salmonella**
- **Could result in the person becoming a salmonella carrier**



Oxygen requirements of bacteria

Notes



Obligate aerobe

- Grows only in the presence of oxygen
- Most moulds and some yeasts

Facultative anaerobe

- Prefers aerobic conditions but may grow slowly if oxygen absent
- Most food poisoning bacteria are facultative anaerobes, e.g. salmonella, as they may need to multiply in the intestines of their victims to cause illness

Obligate anaerobe

- Grows only in the absence of oxygen
- *Clostridium perfringens*
- *Clostridium botulinum*

Micro-aerophilic

- Prefer to grow in atmosphere of around 5% oxygen
- *Campylobacter*

Water activity

Freely available water in the food

- If salt/sugar is added the water binds tightly to it so the amount of freely available water is reduced, hence the a_w is reduced (the addition of salt/sugar increases the osmotic pressure) *Staphylococcus aureus* can survive relatively high salt levels
- An alternative way of reducing the a_w is to remove the water by dehydration
- Most bacteria require $a_w > 0.95$

pH

- Most bacteria prefer pH around 7 (neutral)
- When foods have a lower pH the yeasts and moulds are problematic
- The limit of growth for *Clostridium botulinum* type E is 4.5, this is relevant in canning
- Some strains of salmonella and *Staphylococcus aureus* may be capable of growth at pH as low as 3.8 (Salmonella has been involved in food poisoning outbreak with apple juice)
- *E. coli* is acid tolerant and consequently has been the cause of foodborne outbreaks due to consuming acidic foods such as apple juice and cider
- Note the alkaline end of the pH scale is used for cleaning and disinfection e.g. caustic soda
- Alkalis are unpalatable

Notes



(Individual exercise)

Destruction of bacteria



Heat

Pasteurization (destroys pathogens)

Sterilization (destroys all bacteria, spores and toxins)

Canning (commercially sterile)

Effective cooking (centre temperature at least 75°C)

N.B. Time/temperature is important e.g. 63°C for 30 minutes.

Chemicals

Salt, sugar, nitrates/nitrites **and bleach**

Irradiation

Very little food other than spices, in UK, subject to irradiation

However, as it is difficult to detect food which has been irradiated, it is possible that several imported foods may have been irradiated e.g. strawberries

U/V light

Used to destroy bacteria in water **used for the purification of** shellfish. **Can be used to** destroy bacteria in brine **used for food production. Also used to** destroy micro-organisms in the atmosphere. **Not suitable for surfaces.**

Spores

Spore formation

Some bacteria form spores when conditions are unfavourable i.e.

- High temperature (**not when increase is quick**)
- Disinfectants
- Dehydration

- **They are modified bacteria with a protective layer or “shell”**

- **Can survive for many years**

- **Do not require food or water to survive**

- **Some can survive boiling for up to 5 hours**

- **Canning 121°C core temperature for 3 minutes**

- **When conditions become favourable they germinate**

- **Toxins can be released on formation and germination**

- **If favourable conditions persist multiplication of vegetative bacteria begins**



Toxins

Toxin production

Toxins are poisons

Toxins are chemicals produced by certain bacteria as waste

Only a few types of bacteria produce waste poisonous to humans. These are known as pathogens.

Exotoxins

Usually produced in food during multiplication, many are heat resistant e.g.

Staphylococcus aureus

Bacillus cereus

Even if cooking destroys bacteria, exotoxins may remain

They result in a short incubation/onset period with vomiting

Endotoxins

Usually produced in the intestines of person consuming

Toxin forms part of bacterial cell wall

Released on death of bacteria or when spores are formed

Usually longer onset period

Diarrhoea normally one of main symptoms

e.g. Salmonella

Neurotoxins

Toxins that affect the nervous system

e.g. *Clostridium botulinum*

Examples of symptoms:

- Blurred and double vision
- Nerve paralysis
- Collapse

Enterotoxins

Exotoxins that affect the gastrointestinal tract



Identification of bacteria

Macroscopic examination

- Culture media (specific additives)
- Shape, size, colour and consistency of colony

Microscopic examination

- Add "bacteria solution" onto growth media using a wire loop
- Selective enrichment enables specific bacteria to be identified
- Various stains assist identification
- High powered microscope usually required

The Gram stain

- Heat fix bacteria onto a slide and flood with iodine or crystal violet (blue) then rinse off with alcohol and safranin
- Gram positive: blue dye retained
- Gram negative: blue dye rinsed away

Biochemical reaction

- Based on the presence/absence of enzymes
- Response to certain chemicals, sugar, etc.

Serological typing

- Based on antigen-antibody reaction (the immune response)
- Distinguishes sub-types of same species
- 2000 different serotypes of salmonella
- Most common is *Salmonella enteritidis*

Phage typing

- Enables differentiation of same serotype
- Some viruses are able to infect and kill bacteria (bacteriophages)
- They are very selective and can distinguish between bacteria with the same serotype
- Most common is *S. Enteritidis* PT4

Immunoassay

The use of monoclonal antibodies e.g.
ELISA (Enzyme Linked Immunosorbant Assay)

Ask the delegates to write down the five most important things they have learnt



Module 3

Food contamination and control

Aims

- To provide an understanding of microbiological, chemical and physical contamination of food
- To outline the importance of controlling contamination to prevent food poisoning

Key points

- Sources of microbiological contamination include people, raw foods, animals and pests
- Causes of contamination
- Vehicles include hands, equipment and cloths
- Routes taken by contaminants to reach high-risk foods
- Cross-contamination
- Disrupt route by design, practice, disinfection and cleaning
- Physical hazards(foreign body) from packaging, equipment, structure, people, pests and customers
- Chemical hazards can occur during growth, processing, preparation, transport or sale
- Allergenic hazards

Video/DVD

Food Aliens

Visual aids

Examples of food complaints

Handouts

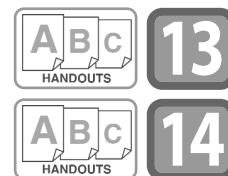
Allergenic hazards (HO13)

Examination questions (HO14)

Group exercises (optional) (HO12)

- Split the class into groups; ask them to design policies concerning the following areas:
 - Visitors, maintenance, deboxing, glass, first aid, cleaning, staff, pest control
- Physical contaminants, sources, examples and controls

Module 3



Physical and chemical hazards and controls (GROUP EXERCISE)

Source	Hazards	Controls
1. Raw materials		
2. Building		
3. Equipment		
4. Notice boards		
5. Packaging materials, inc. food containers		
6. Maintenance		
7. Food handlers and visitors		
8. Cleaning activities		

Physical and chemical hazards and controls (GROUP EXERCISE)

Source	Hazards	Controls
9. Pests		
10. Pesticides		
11. Industrial chemicals		
12. Sabotage		
13. Food containers (jars and bottles used for filling e.g. jam)		

Physical contaminants and controls

Source	Hazards	Controls
Raw ingredients	Natural poisons Stones/bones/dirt Glass Pests/pest debris Wood Cigarette ends Metal - nails/wire/nuts Plastic	Approved suppliers Product specification/routine checking Cleaning/washing/inspection Optical systems Air/liquid separation Illuminated inspection belts/spotters Sieving/filtration Metal detection/x-ray/magnets
Building	Flaking paint/rust/nails Condensation Glass - light-fittings/windows Insulation Wood	Maintenance programme Replace worn and damaged surfaces Effective ventilation/cover food/enclosed systems
Equipment	Bolts/nuts/screws Grease/oil Glass Wood	Metal detection/self-locking Staff training (not above open food) Use perspex/glass policy/breakage Wood policy
Notice boards	Drawing pins	Not to be used. Perspex covered notice boards
Packaging materials	Staples String Wood (pallets) Nb containers Plastic Glass	Specify packaging e.g. tape, not staples Strict instructions on un-packaging/de-boxing Remove secondary packaging before entering high-risk areas. Clean on arrival Separate de-boxing areas Strict rejection policies if contaminated
Maintenance operatives	Swarf Screws/nuts/bolts Wire Fibres/cloth	Training of maintenance operatives Cleaning and inspection after maintenance Metal detection Avoid maintenance during food production/remove food and food equipment from food areas
Food handlers and visitors	Jewellery Buttons Pen tops/cigarette ends Dressings	High standards of personal hygiene Staff training Strict rules enforced Visitors to wear protective clothing No eating/smoking
Cleaning activities	Plastic slivers Chemicals	Regular checking/replacement of suspect equipment Use of correct equipment/chemicals (not phenols) Training of cleaners No inappropriate methods e.g. high pressure spraying near open food
Pests	Bodies Droppings Webbing Larvae/eggs Feathers	Effective pest control Prevent entry Correct storage and rotation Training of operatives to spot and report signs Reject potentially contaminated food Physical control preferable Correct siting of electric fly killers

Physical contaminants and controls

Source	Hazards	Controls
Pesticides	Spraying on food/ equipment Contaminated raw materials	Control systems/approved contractors Operator/staff training Cleaner training Approved suppliers
Industrial chemicals	Contaminated raw materials Freezer breakdown Veterinary drugs/fertilisers Environmental contamination e.g. dioxins	Approved suppliers Segregation/leaks Staff training (leaking refrigerants) Note distribution/delivery vehicles
Sabotage	Needles Razor blades Toothpicks Glass	Tamper evident packaging Vigilance Thorough investigation of complaints
Food containers (jars and bottles used for filling, e.g. jam)	Glass shards Careful handling/distribution/unloading Staff training, effective supervision Inversion and cleaning (compressed air/water jets) Protect after cleaning prior to filling Effective procedures for dealing with breakage	Approved supplier/correct glass
	Chemical contamination	Effective/cleaning/rinsing/emptying

Allergenic hazards

Allergens cause the body's immune system to react, often within minutes but sometimes within hours. In serious cases a person may have a life-threatening anaphylactic shock.

*Foods which commonly contain allergens include:

- Peanuts – also called groundnuts, are found in many foods, including sauces, e.g. satay, cakes and desserts, Indonesian, Thai, Indian, Bangladeshi dishes and peanut flour and groundnut oil.
- Nuts – these include walnuts, hazelnuts, Brazil nuts, cashew, pecan, pistachio, macadamia, Queensland nuts and almonds. Found in sauces, e.g. pesto, desserts, salad dressings, crackers, bread, ice cream, oils, praline, frangipane and marzipan.
- Milk – including lactose, in liquid or in powder form, in yoghurt, cream, cheese, butter, whey, casein and other milk products. Ready-made or glazed dishes may contain milk powder.
- Eggs – found in mayonnaise, cakes, mousses, pasta, sauces and quiche. Sometimes used to bind meat in burgers, or to provide a glaze.
- Fish – e.g. anchovies used in salad dressings, sauces, e.g. worcestershire sauce, relishes and on pizzas.
- Shellfish – including prawns, scampi, mussels, lobster and crab. Shrimp paste and oyster sauce are found in Chinese and Thai dishes.
- Soya – may be found as tofu, bean curd, flour, and textured soya protein also found in ice cream, sauces, desserts, meat products and vegetarian products, e.g. veggie burgers.
- Cereals containing gluten – coeliacs need to avoid wheat, rye and barley, oats, spelt and kamut and foods made from these. Bread, pasta, cakes, pastry, and meat products may contain wheat flour. Soups and sauces, dusted, battered or bread crumbed foods may contain flour.
- Sesame seeds – used in bread and breadsticks. Sesame paste (tahini) in Greek or Turkish dishes, including hummus and gomashio. Sesame seed oil used in cooking or salad dressings.
- Mustard, celery and celeriac

All staff should be aware of the action to take in the event of a customer having an anaphylaxis (severe allergic reaction). Symptoms include:

- | | |
|--|--|
| • Generalised flushing of the skin | • Nettle rash |
| • Swelling of the throat and mouth | • Difficulty in swallowing or speaking |
| • Severe asthma | • Abdominal pain, nausea and/or vomiting |
| • Sudden feeling of weakness
(fall in blood pressure) | • Collapse and unconsciousness |

www.anaphylaxis.org.uk www.allergyaction.org.uk

Food businesses must implement an allergen control system based on HACCP. This will involve clear labelling, satisfactory packaging and segregated storage, preparation and serving. All equipment must be thoroughly cleaned and hands should be washed before preparing or handling food for an allergen-sensitive customer. Menu descriptions must be clear and clear instructions must be given from the person taking the order to the person preparing the food.

Customers having an anaphylaxis must not be moved and an ambulance with a paramedic should be requested immediately.

*Courtesy of the Food Standards Agency (Safer food better business)

Examination questions

Subject: Physical contamination

1. List the 5 major sources of foreign object contamination with an example for each
2. List one method of significantly reducing the risk of contamination for each of the above major sources
3. List one detection method which could be used for each of the above
4. What are the three main dangers from physical contamination?

Subject: Food contamination

1. Cross-contamination is a major problem in the food industry, explain why
2. In a butcher's premises dealing with both raw and cooked meats what specific precautions should be taken to prevent cross-contamination?
3. What are the major problems associated with self-service high-risk foods at a wedding buffet in a village hall?
4. If you had only one refrigerator where would you store the following open foods in relationship with one another?
a) Raw meat b) Cress
c) Cooked meat d) Cream gateaux

Subject: Contamination

1. Define cross-contamination
2. Explain the food safety hazards associated with the sale of cooked and raw meats
3. Explain how these hazards can be controlled

Types of contamination (hazards)

Contamination

The presence or introduction of a hazard.
(EC Regulation No. 852/2004)

Introduce concept of food safety hazards

Hazard

Something which may cause harm to the consumer, e.g. pathogens in food. (Present in raw materials or introduced at sometime from delivery through to service)

Microbiological hazards

- **Food poisoning bacteria**
- Spoilage bacteria
- **Moulds and yeasts**
- **Viruses**

Physical hazards (foreign bodies)

- **Cuts/choking/broken teeth**
- Raw materials
- **Packaging**
- **Structure/equipment**
- **Personnel**
- **Pests**

Chemical hazards

- **Can be acute/chronic/carcinogenic**
- **Industrial chemicals PCBs (polychlorinated biphenols)**
- **Pesticides (growing crops and pest control)**
- **Veterinary residues**
- **Metals (cooking utensils/lead pipes/open cans in fridge)**
- **Cleaning materials**
 - **Use and storage**
 - **CIP (caustic soda)**
- **Waste chemicals (dioxins - incinerators)**
- **Excess additives (nitrates/nitrites)**
- **Packaging materials (plasticisers)**
- **Effects depend on:**
- **Chemical/type and/or concentration**



Sources, vehicles and routes of bacterial contamination

To control hazards we need to know where they come from (sources) and how they get into food or food premises (routes)

Class discussion - Which foodborne pathogens are most likely to originate from the following sources:

Sources

- **People (staff and customers):** Hands, nose (sneezing), mouth, bowel, skin, boils, cuts(septic), spots and sewage
- **Raw food:** Vegetables, milk and eggs, meat (red and white), shellfish, water
- **Environment:** Soil, dust & refuse/waste food
- **Pests:** Insects (feet, vomit, faeces), rodents (feet, urine, faeces, mouth), animals (pets) and birds

Vehicles

- Hands
- Hand-contact surfaces
- Food-contact surfaces
- Cloths, utensils and equipment

Routes

A route is the path taken by food poisoning bacteria to get from the source to the high-risk food. This may be direct (including drip) or indirect via a vehicle.

Cleaning, disinfection and good hygiene practice are essential to remove routes.

Remove source, and/or avoid vehicle and/or provide a barrier to the route e.g. cleaning and disinfection

Cross-contamination

Discuss the transfer of bacteria from contaminated foods (usually raw) to ready-to-eat foods by:

Direct contact: Raw → ready-to-eat food

Indirect: Raw → surface → ready-to-eat food

Indirect contact via:

- Hands
- Cloths
- Equipment
- Work surfaces

Class discussion-What practical controls may be implemented in a food business to minimize the risk of cross-contamination?



Control of bacterial hazards

Remove sources

- Purchase food from reputable suppliers
 - Check delivery vehicles
 - Inspect food on arrival
 - Immediate storage
- Integrated pest management
- High standards of personal hygiene (exclusion)
- **Visitors policy**

Preventing contamination

- Effective instruction, supervision and training
- Good design of premises and equipment
- Good hygiene practices **and high standards of personal hygiene**
- Protect food
- Minimise handling **of food**
- Segregate high-risk **and ready-to-eat food** from raw food (colour coding)
- Effective cooling and thawing systems
- Segregate fit and unfit
- Cleaning schedules/systematic cleaning
- Satisfactory waste management

Preventing multiplication

- **Store food out of the danger zone below 5°C or above 63°C**
- **Fermentation e.g. salami, yogurt and cheese**
- **Preservatives, e.g. salt and sugar or acid**
- **Keep dry foods free from moisture**

Destroying bacteria

- Thorough cooking (**75°C**)
- Processing (**pasteurization, sterilization, UHT, canning (121°C for 3 mins)**)
- Disinfection
- Preservation

Controls involve:

- **Removing sources**
- **Preventing contamination of food (break the route)**
- **Preventing multiplication of bacteria**
- **Destroying bacteria**
- **Destroying unfit, suspect or contaminated food**



Contamination in retail premises

Group exercise - list the practices that may lead to the microbiological contamination of surfaces and high-risk food from staff and customers in a delicatessen

Customers

- Shopping bags
- Pets

Staff

- Blowing into bags
- Licking fingers

Customers and staff

- Coughing
- Sneezing
- Spitting
- Handling
- Smoking
- Cuts and sores
- Clothing
- Hair

Notes



Physical hazards

Hazards

- Broken teeth
 - Cuts in mouth
 - Choking
- (However, all physical contaminants must be controlled to comply with legislation)

Raw materials

Pebbles, snails, stalks, leaves, wood, glass, insects, rodents,
bone cartilage and hide

Control

Approved suppliers/specifications

Keep sources of contamination out of food rooms

Packaging material

- (Also containers and returnable containers, e.g. milk bottles)
- Staples, cardboard, string, fibres, cloth, glass, rubber, plastic, wood and polythene

Control

- Care **when** deboxing
- Detection **systems** (metal/magnet/x-ray)
- **Care with waste disposal**

Structure/equipment/notice boards/cleaning

Wood, nuts and bolts, plaster, paint flakes, grease/oil, glass, drawing pins, cloths and bristles

Control

- Care with maintenance and cleaning activities
- **Good design**
- **Use non-corroding materials**
- **Avoid temporary repairs**
- **Glass policy (diffusers, no glass in food areas)**
- **Care with use and storage of cleaning chemicals**



Physical hazards

Personnel/visitors

Jewellery, fingernails, buttons, combs, pen tops, sweet papers, cigarette ends and hair.

Maintenance operatives/pest control

contractor/cleaning contractor

NB Sabotage - disgruntled employee

Control

Good personal hygiene/**training**

Pests/pesticides

Rodents, droppings, hair, bait, insects, eggs, larvae and **nymphal** moults

Control

Integrated pest management

General detection methods

Sieves and filters, illuminated inspection belts, spotters, metal detectors, magnets, x-ray equipment (**detection below 1mm depending on product speed**), optical, colour sorters, air/liquid separators. **Training of maintenance operatives.**

Effectiveness of machines depends on

- **Specification**
- **Maintenance**
- **Settings**
- **Age and use**
- **Testing frequency and parameters**
- **Staff training/supervision**

Metal detectors

- **Food passed through magnetic field - metal distorts field - alarm - food rejected (compressed air)**
- **Rejected food in secure container - retested**
- **Reason for rejection fully investigated**
- **Effectiveness - checked e.g. hourly with test packs**
- **Limitations - ferrous/non ferrous, stainless steel, aluminium foil**
- **Size and position of contaminant**



Chemical hazards

Sources:

Pesticides

- On the farm
- In the food premises

Industrial chemicals

- Environmental contamination
- Freezer breakdown (ammonia)
- Mercury
- Fertilizers (nitrates)
- Veterinary drugs

Cleaning activities

- CIP
- Storage in food containers
- Spraying near food
- Storage with food

Packaging

- Leaching

Group exercise - Groups to list

Group to list physical and chemical hazards and controls. (Tutor may wish to discuss which are critical, i.e. likelihood and severity. Could also discuss monitoring systems and corrective action.



Allergenic hazards

Food allergies are an increasing problem for the food industry including caterers. Food allergens cause the body's immune system to react, often within minutes but sometimes within hours. In serious cases a person may have an anaphylactic shock which is life-threatening. Even minute amounts of the allergen can result in serious problems. Peanut and other nut allergies are often severe.

Symptoms usually include some of the following:

- **generalised flushing of the skin**
- **nettle rash**
- **swelling of the throat and mouth**
- **difficulty in swallowing or speaking**
- **severe asthma**
- **abdominal pain, nausea and/or vomiting**
- **sudden feeling of weakness (fall in blood pressure)**
- **collapse and unconsciousness**

www.anaphylaxis.org.uk

www.allergyaction.org.uk

Food intolerances are usually less severe and do not involve the immune system. They may be due to a lack of enzymes or a response to an irritant.

***Foods which commonly contain allergens include:**

Peanuts – also called groundnuts, are found in many foods, including sauces, e.g. satay, cakes and desserts, Indonesian, Thai, Indian, Bangladeshi dishes and peanut flour and groundnut oil.

Nuts – these include walnuts, hazelnuts, Brazil nuts, cashew, pecan, pistachio, macadamia, Queensland nuts and almonds. Found in sauces, e.g. pesto, desserts, salad dressings, crackers, bread, ice cream, oils, praline, frangipane and marzipan.

Milk – including lactose, in liquid or in powder form, in yoghurt, cream, cheese, butter, whey, casein and other milk products. Ready-made or glazed dishes may contain milk powder.

Eggs- found in mayonnaise, cakes, mousses, pasta, sauces and quiche. Sometimes used to bind meat in burgers, or to provide a glaze.

*** Courtesy of the Food Standards Agency (Safer food better business)**





Fish – e.g. anchovies used in salad dressings, sauces e.g. Worcestershire sauce, relishes and on pizzas.

Shellfish – including prawns, scampi, mussels lobster and crab. Shrimp paste and oyster sauce are found in Chinese and Thai dishes.

Soya – may be found as tofu, bean curd, flour, and textured soya protein also found in ice cream, sauces, desserts, meat products and vegetarian products, e.g. veggie burgers.

Cereals containing gluten – coeliacs need to avoid wheat, rye and barley, oats, spelt and kamut and foods made from these. Bread, pasta, cakes, pastry, and meat products may contain wheat flour. Soups and sauces, dusted, battered or bread crumbed foods may contain flour.

Sesame seeds – used in bread and breadsticks. Sesame paste (tahini) in Greek or Turkish dishes, including hummus and gomashio. Sesame seed oil used in cooking or salad dressings.

Mustard, celery and celeriac

Some fruits such as strawberries and kiwi fruit, or salad items, and lupin flour can cause problems, in addition to colourants, artificial flavourings and preservatives all pose a risk to allergy sufferers.

Manufacturers must exercise particular care during food production to ensure allergens do not contaminate other products, for example, dust from nuts does not end up contaminating a product that does not normally contain nuts. Cleaning to remove all traces of contamination can be quite difficult and therefore many factories use completely separate production lines or even different factories. Dust can be spread through ventilation systems or involve cross-contamination from cloths, cleaning equipment or personnel.

Food businesses should implement an allergen control system based on HACCP and prerequisite programmes to reduce risk from allergens. This will involve using reputable suppliers with all ingredients and foods clearly labelled. Satisfactory packaging and segregated storage. Using specific equipment for preparation, cooking etc. segregated displays, separate serving utensils/cloths and



clear labelling. **Ingredient information must be available for all products and staff should know how to check this. In the event of a product becoming contaminated with an allergen it must be discarded or dealt with as a contaminated product.**

If there is any risk of a product containing an allergen, it must be clearly labelled. Requirements for labelling allergens are defined in the Food Labelling (Amendment) (England) (No. 2) Regulations 2004.

www.europe.eu.int/comm/food/food/labellingnutrition/

In catering, effective communication and knowledge of all ingredients are essential to reduce the risk from allergens. Don't guess. Clear menu descriptions identifying potential allergenic ingredients should be provided e.g. cooked in ground nut oil. Always update the menu when ingredients or recipes are changed. Staff must be instructed and trained about allergens and the implementation of effective control measures, especially preventing contamination, effective cleaning and handwashing. Regular audits and effective supervision are important to ensure control measures are working.

When a customer confirms they are allergic to a particular food, the person taking the order must provide accurate information to the person preparing the food. It is not just the menu item that may contain the allergen, it could be sauce used to make a garnish, it may be the oil used to cook the food or the allergen may be introduced because of a failure to effectively wash the hands or clean preparation equipment. Allergens won't be destroyed by cooking.

All staff should be aware of the action to take in the event of a customer having an anaphylaxis (severe allergic reaction). The customer may have a pre-loaded adrenaline injection kit which they use as soon as a serious reaction is suspected.

The customer should not be moved and an ambulance with a paramedic should be called using the emergency number. You should explain that the customer could have anaphylaxis (pronounced 'anna-fill-axis').

Legislation

The General Food Regulations 2004

Offence to sell food which does not comply with food safety requirements i.e. food which is unfit or so contaminated that it would not be reasonable to expect it to be used for human consumption in that state

It is also an offence to sell food which is not of the nature, substance or quality demanded by the purchaser

Ask the delegates to list the five most important things they have learnt.

Notes



Module 4

Food poisoning

Aims

To provide an understanding of the causes and effects of food poisoning

To clarify the specific and generic controls required in order to prevent an outbreak of food poisoning

Key points

- Bacteria are the most common cause of food poisoning (infectious or toxic)
- An understanding of the sources, food vehicles, incubation periods, symptoms and controls of common food poisoning organisms
- Chemicals, metals, poisonous plants and fish can cause serious problems in the food industry
- Spores and some toxins are heat resistant
- The role of management and EHPs in outbreak investigation

Video/DVD

Visual aids

Handouts

- Characteristics of food poisoning organisms (HO15)
- Major food poisoning outbreaks (HO16)
- Case studies (HO17)
- Role of supervisor (HO19)
- Role of EHP (HO20)
- Newspaper/journal articles (HO21)
- Examination questions (HO22)

Group exercise

Split class into groups. Give each group a food poisoning outbreak scenario and ask them to form conclusions and recommendations as to the causative organism and the ways the problem could have been prevented; the case studies could be utilised for this purpose

Top ten causes of food poisoning outbreaks (HO18)

Module 4



Important (UK) foodborne pathogens, sources, vehicles, growth characteristics, onset periods, duration, symptoms and control measures

Pathogen	Source	Food vehicle	Growth temperature range (°C) (optimum)	Growth pH (range) (optimum)	Incubation/onset period (duration)	Typical symptoms	Infective dose	Oxygen requirements	*Additional specific controls
<i>Bacillus cereus</i> Toxin in food (Tf) Toxin in intestine (Ti)	Soil, vegetation, dust and a variety of cereals, especially rice, dried foods and spices. Intestinal tract of humans.	Meats, vegetable dishes, milk, cream pastries, soups and puddings, fried, boiled or cooked rice, cornflour, vanilla slices, custards and other starchy foods e.g. potatoes and pasta	5 to 48 (28 to 35)	4.4 to 9.3 (7)	(Tf) 1 to 6 hrs (12 to 24 hrs) (Ti) 6 to 24 hrs (1 to 2 days)	V, A, N, D (some) A, D (watery), V (some) F	Medium	Facultative anaerobe Spore former	<ul style="list-style-type: none"> Thorough cooking, hot-hold (>63°C) or rapid cooling Storing at correct temperatures Avoid rewarming Avoid cross-contamination
<i>Clostridium botulinum</i> Toxin in food (Tf)	Soil, vegetables, intestinal tracts of fish and mammals	Low-acid processed foods, bottled vegetables, garlic oil, mascarpone cheese, dried milk, meats, smoked/fermented fish and other marine products (especially in vacuum packs)	3 to 50 (20 to 30) (type E)	4.6 to 9.0 (7)	2 hrs to 8 days usually 12 to 36 hrs (several months)	Difficulties in swallowing, talking and breathing, vertigo, double-vision and paralysis of cranial nerves.	Very low (toxin) (fatalities common)	Anaerobic Spore former	<ul style="list-style-type: none"> Strict control over processing low-acid canned foods (pH >4.5) Use of nitrates Discard blown cans or those with holes or defective seams Thorough cooking Strict control over smoking and handling of smoked fish (store in freezer) Care in gutting and preparing raw fish Strict attention to the shelf life of vacuum packed food (refrigerate) Avoid cross-contamination Temperature control
<i>Clostridium perfringens</i> Toxin in intestine (Ti)	Soil, sediment (widespread), intestinal tracts of humans and animals/sewage, raw meat, dust and insects	Beef (especially rolled joints), turkey, pork, chicken, cooked minced meat and other meat dishes, gravy, soups, stews and sauces	10 to 52 (43 to 47)	5.0 to 8.9 (7)	8 to 22 hrs usually 8 to 12 hrs (12 to 48 hrs)	A, D, V (rare)	Usually high	Anaerobic Spore former	<ul style="list-style-type: none"> Eat immediately after cooking, store above 63°C or rapid cooling and refrigeration within 1.5 hours of reaching 63°C. Strict temp control. Joints should not exceed a size of 2.25kg Thorough reheating of foods Separate raw/high-risk foods Double-wash vegetables
<i>Salmonella</i> spp. Infection	Water, sewage, soil, birds, insects, carriers, intestinal tracts of animals, especially poultry and swine, raw meat, eggs, milk, melons, terrapins, rodents and reptiles	Beef, turkey, pork, poultry, eggs and egg products (especially raw or lightly cooked), cheese, salads, shellfish, raw milk, melons, almonds, dried coconut, baked goods, dressings (especially mayonnaise), bean sprouts and chocolate	7 to 47 (37)	3.8 to 9.0 (7)	6 to 72 hrs usually 12 to 36 hrs Up to 10 days in low dose outbreaks (1 to 7 days)	A, D, V, F, N, headache	Medium (low in milk and high fat foods such as chocolate)	Facultative anaerobe	<ul style="list-style-type: none"> Sterilization and strict control of animal foodstuff Slaughterhouse hygiene Safe sewage disposal and chlorination of water Screening of carriers or suspects Avoid products made with raw eggs and not fully cooked. Use pasteurized egg. Separation of raw/high-risk food Thorough thawing and cooking of frozen poultry Avoid raw milk, use heat treated Temperature control Vaccination of poultry Acidification and reduction of aw

Key: V=vomiting A=abdominal pain D=diarrhoea F=fever N=nausea M=malaise * Controls in addition to effective prerequisite programmes and HACCP

Important (UK) foodborne pathogens, sources, vehicles, growth characteristics, onset periods, duration, symptoms and control measures

Pathogen	Source	Food vehicle	Growth temperature range (°C) (optimum)	Growth pH (range) (optimum)	Incubation/onset period (duration)	Typical symptoms	Infective dose	Oxygen requirements	*Additional specific controls
<i>Staphylococcus aureus</i> <i>Toxin in food (Ti)</i>	Hands, throats and noses of humans, boils and cuts; raw milk from cows or goats with mastitis and skin and hides of animals	Ham, turkey, chicken, pork, roast beef, egg products, salads (e.g. egg, chicken, potato, macaroni), bakery products, cream-filled pastries, luncheon meats, milk, dairy products, lasagne and fermented sausage	7 to 48 10 to 45 (for toxin production) (37)	3.8 to 10.0 (7)	1 to 7 hrs usually 2 to 4 hrs (6 to 24 hrs)	A, V (mainly), D (some), N collapse and subnormal temperatures	Medium	Facultative anaerobe	<ul style="list-style-type: none"> Avoid handling food, use utensils Good personal hygiene, especially regarding handwashing Exclude handlers with respiratory infections involving coughing or sneezing Cover cuts with waterproof dressings Exclude persons with boils or septic cuts Avoid the use of raw milk Refrigeration of high-risk food Rapid cooling, precool salad ingredients
<i>Vibrio parahaemolyticus</i> <i>Infection</i>	Estuarine and marine waters and seafoods	Raw, improperly cooked or cooked recontaminated fish or shellfish	5 to 43 (30 to 37) (8 mins at 35°C)	4.5 to 11.0 (8)	2 to 96 hrs usually 12 to 18 hrs (1 to 7 days)	D (blood/mucus), N, A, F V (some)	Medium	Facultative anaerobic	<ul style="list-style-type: none"> Cook fish well Take care to avoid cross-contamination between raw and cooked shellfish and fish Avoid raw shellfish Refrigerated storage
<i>Yersinia enterocolitica</i> <i>Infection</i>	Soil, water, intestinal tracts of various animals (pigs, birds, dogs and cats), milk and raw pork	Meat and meat products (particularly pork), turkey, vegetables, salads, milk and milk products, shellfish (especially oysters)	0 to 44 (28 to 30)	4.2 to 10.00 (7)	1 to 5 days usually 24 to 36 hrs (1 to 7 days)	A, D, V (rare), F headache	Unknown	Facultative anaerobe	<ul style="list-style-type: none"> Thorough cooking Care with shelf-life of foods stored under refrigeration (psychrotrophic) Prevent cross-contamination
<i>Bacillary dysentery</i> <i>Shigella sonnei</i> <i>Shigella flexneri</i>	Infected person/carriers - sewage/manure, water	Contaminated foods, water, milk, salads, parsley, fruits, sandwich fillings, bakery products, e.g. cream filled pastries and shellfish Faecal/oral route	N/A	N/A	1 - 7 days usually 4 days (2 - 16 days)	F, A, N, V, D (may contain blood/mucus)	Very low	N/A	<ul style="list-style-type: none"> Exclusion of ill food handlers, or if close contact of case Ensure safe water supplies Satisfactory disposal of sewage Heat treatment of milk Approved suppliers Washing/blanching of fruits and salads
<i>Campylobacter jejuni</i>	Soil, sewage, poultry, water, animals, raw meat and raw milk, Cats, dogs, rodents and some wild birds (ducks, geese and seagulls)	Raw milk, handling raw or eating undercooked chicken, other meats, meat products, water, bottled milk pecked by birds	28 to 46 (37 to 43)	4.9 to 9.5 (7)	1 to 11 days usually 2 to 5 days (1 to 7 days)	Headache, F, D (often bloodstained) A (colicky), N V (rare)	Low	Obligate microaerophilic	<ul style="list-style-type: none"> Reduce contamination levels of raw meat/poultry (slaughterhouse hygiene) Hygiene of harvesters Washing hands after handling raw poultry/meat Keep animals/pets out of food rooms/businesses Avoid cross-contamination Chlorination of water (care with irrigation) Heat treatment of milk Thorough cooking

Key: V=vomiting A=abdominal pain D=diarrhoea F=fever N=nausea M=malaise
*** Controls in addition to effective prerequisite programmes and HACCP**

Important (UK) foodborne pathogens, sources, vehicles, growth characteristics, onset periods, duration, symptoms and control measures

Pathogen	Source	Food vehicle	Growth temperature range (°C) (optimum)	Growth pH (range) (optimum)	Incubation/ onset period (duration)	Typical symptoms	Infective dose	Oxygen requirements	*Additional specific controls
<i>Escherichia coli</i> O157	Intestinal tracts of humans and animals, sewage, animal carcasses and water	Raw or rare meats and poultry, raw milk and milk products, unprocessed cheese, salads, fruit, undercooked burgers/mince, cooked meats, buffets, fruit juice and seafoods.	3 to 46 (37)	4.4 to 9.5 (7)	1 to 8 days usually 3 to 4 days (2 weeks or longer)	D (watery/bloody) A, N Up to 30% develop haemolytic uraemic syndrome	Very low (fatalities especially young and elderly)	Facultative anaerobe	<ul style="list-style-type: none"> Reduce contamination levels of raw meat especially at slaughterhouses Effective separation of raw meat and ready-to-eat food (avoid cross-contamination) Thorough cooking of meat especially burgers and mince Double-washing salad vegetables and ready-to-eat fruit Heat treatment of milk/apple juice Hygiene of harvesters
<i>Hepatitis A</i> (viral)	Carriers, faeces, blood, urine and water	Water, shellfish, milk, icing/pastry glazes, fruit, salad, vegetables and fruit juices Faecal/oral route	N/A	N/A	15 - 50 days (1 week or longer)	F, M, N, A Jaundice		N/A	<ul style="list-style-type: none"> Exclusion of ill food handlers Ensure safe water supplies Satisfactory disposal of sewage Heat treatment of milk Approved suppliers Washing/blanching of fruits and salads
<i>Listeria monocytogenes</i>	Soil, sewage/effluent, water, vegetation and other environmental sources, carriers, birds and mammals	Raw milk, soft cheese, coleslaw, ice cream, raw vegetables, raw and cooked meat, raw and undercooked poultry, raw and smoked fish, pâté, jellied pork tongue, fermented sausages, salads and cook-chill products.	-1.5 to 42 (30 to 37)	4.4 to 9.5 (7)	1 day to 3 months (48 to 72 hrs)	Flu-like symptoms N, V, M, F, D, septicaemia, meningitis and abortion in pregnant women	Probably low for immuno-compromised	Anaerobic (microaerophilic)	<ul style="list-style-type: none"> Strict stock rotation of refrigerated food and use within date code Pregnant women to avoid risk foods, especially soft cheese and pâté Thorough reheating of cook-chill foods Avoid cross-contamination, especially in factories Washing of ready-to-eat salads etc. Safe sewage disposal/care with irrigation Use of clean vehicles/crates for transport of raw vegetables
<i>Norovirus</i>	Infected person, environmental contamination (airborne spread) sewage/water	Ice, desserts, cold meats, salads, some fruit, shellfish. Faecal/oral route	N/A	N/A	10 - 50 hrs 12 - 60 hrs	V (often projectile) D (some) A, F, N	Very low	N/A	<ul style="list-style-type: none"> Exclusion of ill food handlers Approved suppliers Washing/blanching of fruits and salads Environmental decontamination of public areas
<i>Typhoid</i> (<i>Salmonella Typhi</i>) ** <i>Paratyphoid</i> - <i>salmonella paratyphi</i>	Carriers, sewage/manure, water	Water, milk, cooked meat, dairy products, coconut, salad dressings, salads, some fruit and vegetables (manure) Faecal/oral route	N/A	N/A	3 days to 1 month usually 8 to 14 days (Paratyphoid usually shorter) (1 to 8 weeks)	F, N, M, headache. Rose spots on trunk. Slow pulse. Anorexia, Spleen enlargement. Constipation or sometimes D (severe)	Low (some fatalities)	N/A	<ul style="list-style-type: none"> Exclusion of ill food handlers Ensure safe water supplies Satisfactory disposal of sewage Heat treatment of milk Approved suppliers Exclude carriers Washing/blanching of fruits and salads Hygiene of harvesters

**** Paratyphoid is less severe and symptoms may be similar to salmonella food poisoning.**

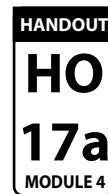
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Some major food poisoning outbreaks involving Salmonella

<u>Year</u>	<u>Country</u>	<u>Vehicle</u>	<u>Serovar</u>	<u>Cases</u>
1953	Sweden	Pork	typhimurium PT8	8845
1964	Scotland	Canned corn beef	typhi PT34	507
1967	USA	Ice cream	typhimurium PT2a braenderup	~1790
1968	Scotland	Raw pork	typhimurium PT32	472
1973	Canada/USA	Chocolate	eastbourne	217
1974	Trinidad	Milk powder	derby	~3000
1976	Australia	Raw milk	typhimurium PT9	~3400
1976	Spain	Egg salad	typhimurium	>500
1976	USA	Cheddar cheese	heidelberg	702
1977	Sweden	Mustard dressing	enteritidis PT4	2865
1981	Scotland	Raw milk	typhimurium PT204	654
1982	England/Wales	Chocolate	napoli	245
1982	Norway	Black pepper	oranienberg	126
1984	Canada	Cheddar cheese	typhimurium PT10	2700
1984	England/Wales	Ham	virchow	274
1984	France/England	Pate	goldcoast	756
1984	Airline	Aspic glaze	enteritidis PT4	766
1985	USA	Pasteurised milk	typhimurium	16284
1987	China	Egg drink	typhimurium	1113
1987	Norway	Chocolate	typhimurium	361
1988	Japan	Cooked eggs	Salmonella spp.	10476
1989	England	Cold meat	typhimurium PT12	538
1989	England	Roast pork	typhimurium PT193	206
1989	USA	Cantaloupe	chester	295
1989	USA	Mozzarella cheese	javiana, oranienberg	164
1990	USA	Bread pudding	enteritidis	~1100
1990	USA	Turkey meat	agona	851
1991	Germany	Fruit soup	enteritidis	600
1991	US/Canada	Cantaloupe	poona	>400
1991	USA	Mexican fajitas	heidelberg	673
1993	France	Mayonnaise	enteritidis	751
1993	Germany	Potato chips	saintpaul, javiana rubislaw	>1000
1994	Finland/Sweden	Alfalfa sprouts	bovismorbificans	482
1994	USA	Ice cream	enteritidis	200000
1996	Australia	Peanut butter	mbandaka	>200
1997	Australia	Pork rolls	typhimurium PT1	>770
1998	USA	Toasted oat cereal	agona	209

Source: Encyclopedia of Food Microbiology (2000), Vol. 3, p. 1936

Case study A - Food poisoning outbreak



60 people out of 200 who attended a local authority function on 11th November 2000 became ill with symptoms of stomach pains and nausea. The main symptom was vomiting.

The buffet meal included ham quiche, sausage rolls, egg mayonnaise, risotto, ham and chicken sandwiches, chicken drumsticks, mixed sea food pizza, prawn and mushroom vol-au-vents, fruit trifle and fresh cream.

The buffet had been prepared on Friday 10th November by local councillors and their wives in their homes and transported at 10.00am on the 11th November in unrefrigerated vehicles to the Civic Centre.

The buffet was left unrefrigerated in a room until required for consumption at 19.30.

The first person became ill at 21.00 hours and most people became ill between 21.00 and 23.00 hours. All of the people had eaten the risotto.

- 1) Please suggest the possible pathogen, food vehicle, and causes of the outbreak.**
- 2) Can you identify the hazards and controls that should be taken to prevent further outbreaks of this type?**

Case study A - Conclusions

Investigation findings

Bacillus cereus was isolated from the faecal specimens of those people who had been ill and also from the remains of the risotto. The risotto was therefore the vehicle and the rice the original source of the bacteria.

The rice had been cooked at 12.00 noon Friday 10th November. After cooking it had been left to cool at room temperature overnight. It was then transported unrefrigerated. It was reheated by microwave oven just prior to service.

Explanation

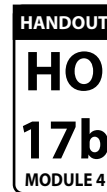
The rice contained spores of *Bacillus cereus*. Normal cooking is incapable of destroying spores, in fact the heat activates the spores so that on long slow cooling they germinate and produce large numbers of vegetative bacteria. The bacteria multiply and produce toxins (this is the main hazard). These toxins are heat resistant and would not have been destroyed by normal cooking methods including the use of the microwave.

Controls

The main control is to serve the rice immediately after cooking or keep the rice above 63°C prior to serving or to cool the rice rapidly, for example with cold running water. The rice should then be refrigerated at below 5°C.

The rice should then be reheated thoroughly and only allowed to be at room temperature for a short period of time (maximum 30 minutes), during further preparation or waiting to be served.

Case study B - Food poisoning outbreak



Fifty people out of the 120 who attended a meal at the Sura Hotel experienced vomiting, nausea and abdominal pain. The meal was served between 19.30 and 21.00 on Friday 10th January. The first person developed symptoms at 22.00 on the 10th and the last person was ill at 03.00 on Saturday 11th January.

The meal included egg mayonnaise, steak Dianne, new potatoes, peas and carrots followed by Black Forest gateaux and ice cream.

The egg mayonnaise was made at 11.00am on the 10th January. The sauce for the steak was made just prior to service. The vegetables and steak were cooked at 18.30 and the gateaux and ice cream were purchased from a national manufacturer.

- 1) Please suggest the possible pathogen, food vehicle, and causes of the outbreak.
- 2) Can you identify the hazards and controls that should be taken to prevent further outbreaks of this type?

Case study B - Conclusions

Investigation findings

Staphylococcus aureus was isolated from the nasal swab of a food handler who prepared the mayonnaise. After preparation the low-acid mayonnaise had been left in the kitchen at 26°C for around 8 hours. The same strain of *Staphylococcus aureus* was isolated from the mayonnaise and toxin isolated from vomit specimens of ill persons.

Explanation

The source of the pathogen was the nose of the food handler and the vehicle the mayonnaise. The cause of the outbreak was contamination of the mayonnaise by the food handler and the storage of the mayonnaise for 8 hours at 26°C, which allowed the production of exotoxin. (Contamination and toxin production are the hazards).

Controls

The controls involve the training, instruction and close supervision of staff to ensure they always wash their hands after sneezing or touching their nose. The other important control would be to purchase the mayonnaise or if home-made to prepare it immediately prior to consumption or to store under refrigeration as soon as it has been made.

Case study C - Food poisoning outbreak

On Wednesday 6th March, 200 children at Smith Street School became ill after eating a dinner consisting of potatoes, peas, carrots, chicken and gravy.

The first child developed symptoms of diarrhoea, abdominal pain and nausea at 23.00 on Wednesday and the last child was ill at 08.00 on Thursday.

The chicken was delivered on Tuesday the 5th March. It was cooked well in 4 stainless steel boilers (95°C). The chicken remained in the boilers overnight.

On Wednesday, at 11.00am the chickens were removed and sliced. The gravy powder was made just before service on Wednesday 6th March.

- 1) Please suggest the possible pathogen, food vehicle, and causes of the outbreak.
- 2) Can you identify the hazards and controls that should be taken to prevent further outbreaks of this type?

Case study C - Conclusions

Investigation findings

A retained sample of the chicken and gravy contained high levels of *Clostridium perfringens*, which was also isolated from the majority of ill children.

The source and vehicle was the chicken.

Explanation

The cause of the outbreak was the long, slow cooling of the chicken after boiling. The spores of *Clostridium perfringens* would have been activated by the cooking and germinated to produce vegetative bacteria. The long, slow cooling would have resulted in rapid multiplication, especially around 45°C when it would take only 10 minutes to double the numbers present.

After consumption, sporulation within the stomach and intestine would have released enterotoxin in sufficient amount to cause food poisoning.

Controls

The chickens should have been removed from the boiler, separated and cooled as quickly as possible after the temperature had reached 63°C. The critical temperature range for *Clostridium perfringens* is between 30°C and 50°C.

After cooling for around 1.5 hours, the chickens should have been placed in a suitable refrigerator, i.e. one with adequate capacity and not used for raw food.

Top ten contributory factors of food poisoning (the top ten hazards)

Contributory factors of food poisoning (hazard)	Controls
Preparation too far in advance and storage at ambient temperature (multiplication)	
Inadequate cooling (multiplication)	
Inadequate reheating (survival)	
Contaminated processed/canned Food (inherent contamination)	
Undercooking (survival)	
Inadequate thawing (survival during cooking)	
Cross-contamination (contamination)	
Raw food consumed (inherent contamination)	
Improper warm holding (multiplication)	
Infected food handlers (contamination)	

Top ten contributory factors of food poisoning (the top ten hazards)

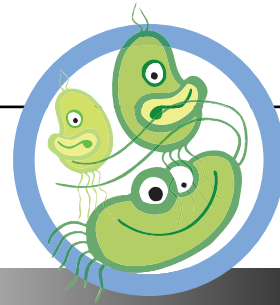
Contributory factors of food poisoning (hazard)	Controls
Preparation too far in advance and storage at ambient temperature (multiplication)	<ul style="list-style-type: none"> • Food Stored below 5°C or above 63°C • Prepare minimum amount of food • Time at ambient during preparation minimised
Inadequate cooling (multiplication)	<ul style="list-style-type: none"> • Food cooled from 60°C to 10°C within 1.5 hours - Blast chilling • Food cooled from 60 to 21°C in 2 hours • Food cooled from 21°C to 7°C in 4 hours • After cooling - food stored in a refrigerator below 5°C • Weight/thickness of joints of meat controlled
Inadequate reheating (survival)	<ul style="list-style-type: none"> • Reheat greater than 75°C at the coolest point (82°C in Scotland)
Contaminated processed/canned food (inherent contamination)	<ul style="list-style-type: none"> • Purchase all food from approved suppliers • Do not use damaged/old cans/damaged packaging • Inspect food prior to use
Undercooking (survival)	<ul style="list-style-type: none"> • Centre temperature at least 75°C • Frozen poultry/joints thawed prior to cooking
Inadequate thawing (survival during cooking)	<ul style="list-style-type: none"> • Ensure poultry/joints completely thawed (thawing cabinet) • Avoid cross-contamination • Knowledge of time to thaw specific weights at specific temperature
Cross-contamination (contamination)	<ul style="list-style-type: none"> • Raw and high-risk food to be segregated at all stages from delivery to service • Separate food contact surfaces/equipment (colour coding) • Effective cleaning and disinfection • High standards of personal hygiene/staff training • Effective pest control
Raw food consumed (inherent contamination)	<ul style="list-style-type: none"> • Hazardous raw food not to be consumed • Only use reputable suppliers • Suspect food not to be used (staff training)
Improper warm holding (multiplication)	<ul style="list-style-type: none"> • All food maintained above 63°C • Prepare minimum amount of food
Infected food handlers (contamination)	<ul style="list-style-type: none"> • Pre-employment medical questionnaire/screening • Screening of ill staff • High standards of personal hygiene • Appropriate facilities provided • Staff training, especially reporting of illness and hand washing

Role of the supervisor in the event of allegations of food poisoning

- Advise manager if he is aware of a food poisoning problem, suspending sales of suspect food – remove and isolate.
- Exclude staff with food poisoning symptoms or suspected of suffering from food poisoning. If necessary, arrange for specimens to be provided.
- Ascertain whether any staff have been ill (boils etc.), which food(s) were implicated, any other complaints received, the food history from delivery to service.
- Obtain products for sampling.
- Obtain and check any relevant monitoring records, especially temperature control, stock and staff sickness records.
- Thoroughly clean and sanitise all relevant work surfaces and equipment before serving any more food.
- Arrange for re-stock.
- Be available to answer questions during any subsequent investigation.

The role of the EHP in the investigation of food poisoning

Preliminaries	<p>Evaluation of information to determine if food poisoning is likely.</p> <p>Deciding on resources required to investigate. Consider where resources should be deployed. Obtaining forms, sterile sampling jars and equipment.</p>
Case finding	<p>Locating suspect cases and carriers to interview. Recording detailed case histories, including food consumption over last 3 days, symptoms and onset time. Obtain faecal specimens and food samples if available.</p>
Site investigation	<p>Terminate food production, trace, detain or seize suspect food.</p> <p>Interview staff involved in food preparation and conduct a thorough inspection of premises to ascertain cause of outbreak.</p> <p>Obtain relevant records, for example, ill staff, temperature control. Obtain samples, swabs of surfaces and specimens. Provide advice, for example, on cleaning and disinfection, restocking. Consider formal closure of business.</p>
Review	<p>Assemble all relevant data to determine if outbreak is foodborne or, for example, person to person. Is the outbreak under control, can sale of food restart? Decide if the business should be prosecuted for the sale of unfit food. What further investigation is required?</p>
Source tracing	
Report writing	



The salmonella wedding reception

In August 2000, 80 out of 147 guests at a wedding reception in Wakefield became ill following the consumption of roast pork. The causative agent was *Salmonella* Enteritidis phage type 4. The causes included cross-contamination, preparing the food in a kitchen which was too small, poor hygiene practices (no handwashing facilities and failure to disinfect equipment used for raw and then cooked food) and a failure to implement a food safety management system for outside catering. (The wedding was held on one of the hottest days of the year.) Each partner was fined £9,500 including costs, for selling unfit food and failing to undertake a hazard analysis.

Botulism outbreaks and fish

In 2003, four people in Norway suffered from botulism after consuming homemade rak fish, a semi-fermented fish treated with salt and sugar, and stored at 5-8°C in a pressurised container for several weeks before being consumed raw. (Temperature >8°C and for salt concentration <5% of the weight of fish enable the *Cl. botulinum* to germinate and produce toxin.)

Symptoms appeared the day after the meal and included vomiting, abdominal pain, dryness of the mouth, difficulties in swallowing, general lethargy and low energy. Botulism antitoxin was administered and all patients recovered.

October 2003, three members of the same family in Germany suffered from botulism following the

consumption of sea bream caught from the river Elbe. The fish was gutted, salted in brine, pressed and dried in the open air for several days and consumed raw.

Typical incubation periods for botulism are 12-36 hours but can vary between 6 hours and 8 days. The most common symptoms are dry mouth, double vision, constipation, speech difficulties and progressive paralysis including respiratory weakness. At onset, vomiting and diarrhoea may occur. Respiratory problems may require ventilation.

Salmonella and lettuce

368 cases of *Salmonella* Newport infection were confirmed in England and Northern Ireland between 9 September 2004 and 7 October 2004. Fast food premises and take-away restaurants were implicated and the probable food vehicle was lettuce. Most cases occurred in Lincolnshire.

Staphylococcus aureus and an ice cream machine

In October 2004 at a fast food outlet in Ohio USA, 120 cases of *Staphylococcus* food poisoning appear to have arisen because of consumption of ice cream, shakes and sundaes contaminated by *Staphylococcus* growing in an ice cream machine because of a mechanical malfunction.

Salmonella and Spanish sausage

In February 2004 the Food Standards Agency issued a food alert

when *Salmonella* Typhimurium was found in the Spanish made Sabarí Embutidos- chorizo during routine sampling of ready-to-eat dried cured meats by EHOs from Broxtowe and Lambeth District Council. Further samples by EHOs from Rushmore District Council found unsatisfactory levels of E-coli and the presence of *Salmonella* Emsbuettel.

4 raw eggs and a wedding

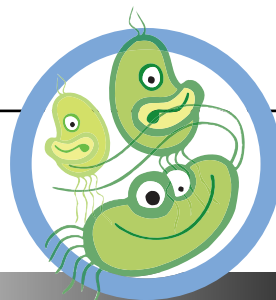
In December 2003, following 15 cases of food poisoning, a Nottingham catering company was fined £4700 for failure to comply with food safety requirements, failure to identify points critical to food safety and failure to register with the local authority. The suspect food vehicle was chocolate cheesecake, which tested positive for salmonella, the same type as that found in the faecal specimens submitted by the ill people.

Botulism and home bottled garlic in oil

In September 1999, three members of the same family suffered from botulism following consumption of a meal including garlic in olive oil salad dressing. Garlic cloves from the oil tested positive for botulism toxin type A.

Symptoms included nausea, abdominal pain, vomiting, blurred/double vision, dysphagia (difficulty in swallowing), dysphonia (difficulty in speaking), dyspnea (difficulty in breathing), muscle weakness, dizziness, paralysis and ptosis (drooping of the upper eyelid).

The incubation periods were 2 to 3 days. The cloves from the oil were



chopped up and added to the salad. The salad dressing was prepared by boiling the jars for 25 minutes and then storing at ambient temperatures. The pH of the dressing was 6.4. Other similar outbreaks have been recorded. Advice for safe preparation includes increasing heating time to destroy spores, inhibiting toxin production by reducing the pH <4.5 (phosphoric or citric acid) and storing under refrigeration. Foods associated with botulism include home-canned foods, commercially processed foods (tuna, smoked fish, mushrooms, soup, garlic in oil & cheese sauce) sautéed onions and leftover baked potatoes.

Non-foodborne salmonella

There have been several recorded incidents of salmonella infection as a result of contact with pets, including frogs and turtles. Two such very unfortunate incidents involved the deaths of babies in contact with lizards. One four-month-old baby died after contracting *Salmonella* Poona from a pet lizard. Two months earlier a three-week-old baby died of meningitis after being infected with salmonella from a water dragon lizard.

Dangerous duck egg

A lady from Rotherham who consumed a fried duck egg contaminated with *Salmonella* Typhimurium died in hospital on 7 May.

Spanish eggs and salmonella

In 2004 the Health Protection

Agency raised concern about the high incidence of *Salmonella* Enteritidis arising from consumption of raw or lightly cooked products made with Spanish eggs. It is estimated that there were over 2000 cases in 2003/4. Surveys indicated that 5.6% of Spanish eggs were contaminated with salmonella compared with 1.1% of non-lion quality UK eggs. (None of the 12000 lion quality contained salmonella.) Representations were made to the EC and the Spanish Food Standards Agency.

International outbreak of *Salmonella* Oranienburg

From October 2001 to January 2002 a significant increase in notified cases of persons suffering from *Salmonella* Oranienburg was noticed in Germany, Denmark, Sweden, Belgium and several other countries. The suspect food vehicle was chocolate produced and sold in Germany and exported abroad. 373 notifications of *S. Oranienburg* were reported in Germany.

A case was defined as a person with a stool specimen positive for *S. Oranienburg*, who had been reported to the health department between 15 October and 6 December 2001 and who had suffered from at least one of the following: diarrhoea, abdominal pain, nausea, vomiting and/or fever. Each case was matched with two persons from a case control study group.

Criteria for control group:

- Same age as the case
- No gastrointestinal symptoms since 1 October 2001
- No travel history abroad during

the incubation period of the matched case.

Controls were selected by adding '2' to the cases telephone number.

A questionnaire was issued to obtain data on symptoms, travel history and consumption of suspect or other chocolate products and some other foods.

Leftovers from chocolate consumed by the cases tested positive for *S. Oranienburg* on 18 December and this resulted in a recall of all chocolate implicated. Only two reported cases occurred after the product recall.

Molecular sub-typing confirmed that chocolate was the food vehicle and the electronic exchange of PFGE (pulsed field gel electrophoresis) patterns accelerated confirmation that cases were occurring in other countries probably due to the same vehicle. *S. Oranienburg* was isolated from the German bars of chocolate exported to Sweden, Canada, Finland and Croatia.

Salmonella infections after consumption of contaminated chocolate are periodically notified. The low moisture and high sugar content of chocolate increase the thermal resistance of bacteria and the high fat content protects the salmonella against the stomach acid and accounts for the low infective dose of salmonella in chocolate.

In an unrelated incident *S. Oranienburg* was isolated from cocoa powder in Melbourne Australia. (The suspect source of *Salmonella* on chocolate is usually the cocoa beans/powder not milk or food handlers.)

Examination questions

Subject Food poisoning

- 1. Describe a typical outbreak of staphylococcus food poisoning**
- 2. Which chemicals most commonly cause food poisoning?
Describe the typical symptoms of one of them**
- 3. What control measures would you introduce to avoid an outbreak of salmonella food poisoning?**
- 4. What action should a food handler undertake should he/she believe they are suffering from food poisoning?**
- 5. Write short notes on:
 Bacillus cereus
 Staphylococcus aureus
 and describe the symptoms they cause**
- 6. Describe the main factors involved in the growth and toxin production of the following bacteria:
 Clostridium botulinum
 Salmonella
 Clostridium perfringens
Select any two of these bacteria and provide an example of how each of them could cause food poisoning as a result of poor food handling practices.**
- 7. You are the manager of a hotel and have been notified that a number of people have been taken ill with diarrhoea and vomiting after attending a function at the hotel the previous evening. Describe your role as manager in investigating this complaint.**

Food poisoning

The young, elderly, sick, immunocompromised and pregnant women are most vulnerable (risk groups).

Causes

- Bacteria **or their** toxins (**major cause**)
- Chemicals
- Metals
- Poisonous plants
- Poisonous fish/shellfish
- Moulds (mycotoxins)

NB Viral gastroenteritis is dealt with as a foodborne disease.

Definitions:

Bacterial food poisoning

An acute disturbance of the gastrointestinal tract resulting in abdominal pain with or without diarrhoea and vomiting due to the consumption of food contaminated by food poisoning bacteria or their toxins

Causative agent

The bacteria, toxin or poison that contaminates the food and causes **the** illness

Incubation (onset) period

Time between consuming the contaminated food and showing the first signs of illness

Food vehicle

The food consumed that contained the causative agent

Source

The point from which the causative agent first entered the food chain (also the vehicle that brought the causative agent into the food premises)



Salmonella and controls

(Infectious)

Sources

Raw poultry, eggs, milk and meat; people, animals, rodents, insects

Common food vehicles

Cooked poultry **and** meat, raw milk, egg products **lightly or not cooked e.g. mousse, mayonnaise, home-made ice-cream**

Incubation period

- **6-72 hours (usual: 12-36),**
- **Duration 1-7 Days**

Symptoms

- **Abdominal pain, diarrhoea, vomiting, fever, occasional deaths**

Specific characteristics

- **Usually millions required, occasional outbreak - low dose in high fat foods e.g. milk/chocolate**
- **Facultative anaerobe**
- **Commonest *S. Enteritidis/S. Typhimurium***
- **Gram -ve, rod shaped**
- **Salmonella infects gut wall and produces an endotoxin**
- **Peaks in summer months**
- **Growth range 7°C to 47°C optimum 37°C**
- **2500+ serotypes**

Control factors

- **Animals: heat treated feed**
- **Avoid overcrowding, segregate ill, in houses/transport**
- **Hygienic slaughter**
- **Food: avoid raw milk and raw egg products (pasteurized), thorough thawing and cooking of frozen poultry**
- **People: good personal hygiene of food handlers, especially handwashing (training)**
- **Exclude ill, detection of carriers**
- **Premises: good design/product flow**
- **Segregation**
- **Integrated pest management**



Clostridium perfringens and controls

(Infectious)

Sources

Humans, animals, faeces, sewage, soil, dust, insects, raw meat, raw poultry

Common food vehicles

Stews, casseroles, rolled joints, meat pies

Incubation period

- 8-22 hours (usually 8-12)
- Duration 12-48 hours

Symptoms

- Abdominal pain
- Diarrhoea
- Vomiting rare

Specific characteristics

- Gram +ve
- Millions usually required to cause illness
- Spore former
- Anaerobic
- Grows between 10°C and 52°C (Usually 50°C in most foods)
- Optimum 43°C-47°C (tg* 46°C is 10 minutes)

Control factors

- Separation/segregation **avoid contamination**
- Pre-prepared vegetables
- **Simmering (avoidance of cool spots)**
- Rapid cooling **to prevent multiplication of vegetative cells - from spores**
- Refrigerated storage (<5°C)
- Good personal hygiene
- Joint size (maximum 2.25kg)
- Cleaning and disinfection

* tg = generation time



Staphylococcus aureus and controls

(Toxic)



Sources

- Humans: nose, mouth, skin, spots, boils
- Raw milk

Common food vehicles

- Milk and dairy products
- Desserts, custards
- Cooked meats, poultry, prawns

Incubation period

- 1-7 hours exotoxin in food
- Duration 6-24 hours

Symptoms

- Abdominal pain, vomiting, prostration
- Diarrhoea not common

Specific characteristics

- Gram +ve coccus
- Requires millions, under reported; aerobic or anaerobic
- Growth range 7°C to 48°C (10°C to 45°C for toxin production)
- Optimum 37°C
- tg 10°C is 30 hours
- Salt tolerant
- Heat resistant exotoxins (30 mins boil)
- 40%+ carriers - skin, nose, throat

Control factors

- Personal hygiene, hand washing, etc.
- Reduce handling
- Exclusion - colds, **flu**, boils, septic cuts
- Avoid raw milk
- Refrigeration of high-risk food
- Waterproof dressings

Bacillus cereus and controls

(Toxic)



Sources

- Cereals (especially rice)
- Spices
- Cornflour
- **Sprouting seeds, esp** bean sprouts
- Soil
- Dust

Common food vehicles

- Reheated rice, cornflour products
- Food containing spices

Incubation period

- **Type 1:** **1-6 hours** (**exotoxin in food**)
 duration 12-24 hours
- **Type 2:** **6-24 hours** (**enterotoxin in intestine**)
 duration 1 to 2 days

Symptoms

Type 1: abdominal pain, nausea, vomiting and some diarrhoea

Type 2: abdominal pain, nausea, diarrhoea and some vomiting

Specific characteristics

- **Gram +ve rod**
- **Millions required, facultative anaerobe, spore former, heat resistant toxin**
- **Range 5°C to 48°C optimum 28-35°C**

Control factors

- Cook and serve
- Hot hold above 63°C
- Cool rapidly
- Refrigerated storage
- Thorough reheating
- Avoid cross-contamination
- Cleaning and disinfection

Clostridium botulinum and controls (Toxic)

Sources

- Fish intestines, soil, vegetables, **marine mud**

Common food vehicles

- Low-acid processed food; canned and smoked fish, bottled vegetables and honey (infant botulism, **spores may germinate and colonise the intestine and produce toxin**)
- **Hazelnut puree (in yoghurt) unlikely to be common**

Incubation period

- **Usually 12-36 hours (2 hours to 8 days)**
- **Duration - recovery may take months**

Symptoms

- **Difficulties swallowing, slow recovery, blurred and double vision, muscle paralysis, diarrhoea then constipation**
- **Deaths common**

Specific characteristics

- **Exotoxin**
- **Gram +ve, 7 types of toxin**
- **Type E - psychrophile**
- **Very toxic**
- **Obligate anaerobe**
- **Multiplies between 3°C and 50°C**
- **Spore former, if spores consumed - unable to germinate, therefore harmless (except infant botulism)**
- **Heat sensitive exotoxin**
- **pH 4.5 limit of growth**

Control factors

- Time/temperature control (vacuum packs especially smoked fish)
- Discard blown cans
- Preservatives (nitrates)
- Thorough cooking destroys toxin
- Good manufacturing practice in canning (**121°C for 3 min, botulinum cook**), bottling and smoking
- Prevent cross-contamination
- Care in gutting and preparing raw fish
- Prevent post-process contamination



Vibrio parahaemolyticus and controls

(Infectious)

Sources

- Faeces
- Sewage

Common food vehicle

Seafood, especially prawns

Incubation period

- 2-96 hours (usually 12 to 18 hours)
- Duration 1-7 days

Symptoms

- Diarrhoea
- Vomiting
- Fever
- Abdominal pain
- Dehydration

Specific characteristics

- Gram -ve
- Requires millions; facultative anaerobe
- More prevalent where the sea is warm
- Growth 5°C to 43°C
- Optimum 30°C to 37°C tg = 10 mins

Control factors

- Do not consume raw shellfish
- Cook well
- Avoid cross-contamination



Yersina enterocolitica

(Infectious)

Sources

- Milk
- Raw pork/meat/poultry
- Shellfish/fish

Common food vehicle

Meat, poultry, raw milk, fish, shellfish especially oysters and salads and dairy products

Incubation period

- 1-5 days usually 24-36 hours
- Duration 1-7 days

Symptoms

- Abdominal pain, fever and diarrhoea
- Nausea and vomiting less common
- Most patients recover completely

Specific characteristics

- Growth 0°C to 44°C (optimum 28°C to 30°C)
- Not common in UK

Control factors

- Good hygiene practice
- Avoid raw fish and milk
- Thorough cooking
- Avoid cross-contamination
- Time/temperature control
- Effective stock rotation especially under refrigeration

The Case Studies may be used as individual exercises, group exercises or as part of a class discussion.



Common food vehicles involved in food poisoning and foodborne disease outbreaks (high-risk foods)

Notes



- Poultry (**undercooked**)
- Cooked red meats and meat products
- Desserts
- Shellfish (**usually raw**) **usually viral** and fish (**scombrototoxin**)
- Salads, vegetables and fruit (usually viral/**low dose organisms**). **Not usually considered high-risk but increasingly identified as the vehicle for low dose organisms**
- Egg products and **occasionally** eggs
- Milk (**usually raw**) and milk products

Ten main contributory factors of food poisoning (Symptoms of management failures)

- Preparation too far in advance and storage at ambient temperature (multiplication)
- Inadequate cooling (multiplication)
- Inadequate reheating (survival)
- Contaminated processed/canned food (contamination)
- Undercooking (survival)
- Inadequate thawing (survival in cooking)
- Cross-contamination (contamination)
- Raw food consumed (contamination)
- Improper warm holding (multiplication)
- Infected food handlers (contamination)

Notes



Management failures

- No risk assessment on menu change
- No contingency planning
- Poor communication between management and front line staff
- Management disincentives
- Cost cutting on equipment etc.
- Failure to recognise hazards
- Failure to learn from earlier errors
- Poor design
- Unrealistic demands on junior management or untrained staff
- Absence of routine planning and consistent procedures

Notes



Preventing food poisoning

Break the food poisoning chain

Food poisoning rarely occurs because of a single isolated mistake.

Controls involve:

- Effective management
- Implementation of HACCP
- Obtaining food from reputable/approved suppliers
- Preventing contamination
- Preventing multiplication
- Thorough cooking/processing
- Avoiding the consumption of raw foods likely to be contaminated with food poisoning organisms e.g. raw milk, bivalves and raw egg products

Preventing contamination

- Effective instruction, supervision and training (competency) of all persons who can influence food safety
- High standard of personal hygiene, especially handwashing and waterproof dressings
- Exclusion of symptomatic food handlers/visitors (carriers/boils/septic cuts)
- Avoid handling food
- Protect/cover food
- Good design of premises
- Prevent practices which result in contamination
- Well designed equipment properly used
- Separation of raw and ready-to-eat products from delivery to service
- Effective cleaning and disinfection (NB redistribution and contamination)
- Integrated pest management
- Effective waste management

Preventing multiplication

- Store food out of the danger zone below 5°C (legal <8°C) or above 63°C
- Minimise time at ambient, e.g. unloading and preparation





Cool rapidly

Fermentation e.g. salami, yogurt and cheese

Preservatives, e.g. salt and sugar or acid

Keep dry foods free from moisture

Heat processing/cooking

**Meat etc. (centre temperature 75°C or equivalent)
complete thawing**

Stews etc. (usually around 100°C)

Reheat to a minimum 75°C (82°C in Scotland)

**Pasteurization, sterilization, canning (121°C for 3
minutes)**

Destroying unfit, suspect or contaminated food

Non-bacterial food poisoning

- Chemicals
- Metals
- Plants
- Fish/ shellfish
- Moulds

Mould (mycotoxins)

Aflatoxin

- Some moulds such as *Aspergillus flavus* can produce mycotoxins, especially on cereals and nuts. High levels have been found in “cloudy” apple juice
- Causes organ failure and cancer

Patulin

- Produced by mould on apples
- Causes liver cancer

Ochratoxin

Produced by mould on cereals



Chemicals

Incorrect additive

- E.g. alcohol strengthening
The addition of methyl alcohol, not ethyl alcohol, as was intended, caused 15 deaths in 1986
- Onset time 10-60 minutes
- Symptoms: vomiting, abdominal pain, occasional diarrhoea
- Severity depends on type of chemical and its concentration

NB Also chronic symptoms

2003 FSA alert Methanol contamination of Vodka and Whisky

Excess of additive

- E.g. excess nitrites added to bacon or ham
3 people ill 1997 (200 times permitted level)
- May be fatal in infants
- Excessive monosodium glutamate

Cleaning chemicals

- E.g. caustic soda left in pipes following cleaning
- Dishwasher liquid poured into jug prior to use, left unattended, resident in residential home added it to lime juice, drank it and died
- Phenol in mains water 1984 many ill

Commercial greed

E.g. oil containing toxins (allegedly industrial waste oil) added to cooking oil 20,000 ill with 350 deaths in Spain in 1981/2

Pesticides and insecticides

- E.g. residues on fruit and vegetables. Outbreaks in USA from watermelons and UK cucumbers

Packaging

Migration of plasticiser into food - increased problem when microwaving foods covered in cling film

NB 2003 Concern with imported Brazilian and Portuguese chicken containing excessive amounts of nitrofurans (antibiotic)

Also concern with imports of honey and prawns containing chloramphenicols (antibiotic)



Poisoning from metals

Several metals are toxic

If ingested in sufficient quantity can give rise to food poisoning

Symptoms include:

- **Mainly vomiting and abdominal pain**
- **Develop within 1 hour**
- **Diarrhoea is possible**

Acid fruits should not be stored or cooked in equipment containing any of the following metals:

- Antimony
- Cadmium
- Copper
- Lead
- Tin
- Iron
- Zinc
- Aluminium

In addition the following metals have caused problems in food:

- Mercury
- Chromium

In 2003 the FSA issued a warning that fish such as merlin, swordfish and tuna contained unacceptable levels of mercury and consumption should be minimised, especially by pregnant women.

Food, especially acid food, should not be stored in open cans as acid dissolves tin, iron and lead solder

New internal coatings and can construction make this less likely



Poisonous plants

Rarely the cause of food poisoning

Toadstools

Poisonous and hallucinogenic

Death cap

Mistaken for edible mushrooms

Deadly nightshade (Belladonna)

1983 several people ill after drinking
contaminated tea (imported from Germany)

Rhubarb leaves

Oxalic acid sometimes concentrated in wine making

Red kidney beans

- Consumption of raw or undercooked red kidney beans
- Short onset period (1-6 hours)

Symptoms include:

- Vomiting followed by diarrhoea
- Caused by haemagglutinins

Almonds

Contain cyanide

Potatoes

- Damaged, rotten, green or sprouting
- Contain toxic glycoalkaloids (solanine) which affect the nervous system
- Peeling assists removal
- An outbreak occurred when 78 school children were taken ill, 7-19 hours after a meal; 17 hospitalised, 3 seriously ill



Poisoning from fish/shellfish

Scombrototoxin

- In certain scombroid fish e.g. mackerel, tuna, pilchards and sardines
- Spoilage bacteria change histidine (amino acid) into histamine (found in nettles)
- Reaction results in toxin formation. Symptoms include: burning sensation in mouth, rash, swelling of mouth and gums, headache and nausea, diarrhoea and vomiting
- Incubation/onset period: 15 minutes - 3 hours

Paralytic shellfish poisoning (PSP)

- Consumption of mussels or other bivalves
- Caused by neurotoxin

Symptoms include:

- Almost immediate numbness of mouth spreading to neck, arms and legs
- Death from respiratory paralysis can follow within 12 hours

Diarrhetic shellfish poisoning (DSP)

- Shellfish consume toxin-producing dinoflagellates
- Toxin accumulates in gut of shellfish (2002 cockle harvesting in Thames suspended because of concerns of DSP)

Fugu (puffer) fish

- Gonads and intestines poisonous
- Japan (only prepared by licensed persons)
- Care in gutting fish • Death likely

Ciguatera

- 300 species of Pacific and Caribbean fish
- From toxin-producing dinoflagellates consumed by fish
- Carnivorous fish eat herbivorous fish - cumulative effect
- Onset period usually 1-6 hours
- Toxin heat resistant

Symptoms include:

- Disturbed vision, respiratory paralysis, numbness or burning in the mouth, abdominal pain, diarrhoea and vomiting
- Occasional deaths

Red whelk poisoning



Outbreak investigation

Aims

- To limit the spread of infection
- To prevent recurrence

Objectives

- Identify the outbreak location
- Identify the food vehicle
- Prevent further sales of implicated food(s)
- Identify the causative agent involved
- Trace carriers, especially food handlers
- Trace the source of the causative agent
- Determine the main faults
- Make recommendations to prevent recurrence
- Provide data for use in surveillance

Food Poisoning Outbreak Control Team

- Team is established in the event of a serious or large outbreak
- Consists of several experts:
EHP, CCDC and a representative of the Health Protection Agency

Environmental Health Practitioner

- An organisational, investigative and enforcement role
- Skills in inspecting premises and interviewing people

Consultant in Communicable Disease Control (CCDC)

Public health doctors employed by the Health Authority/Local Authority who are medical experts and also have an advisory role

Health Protection Agency (HPA)

- Staff have considerable laboratory expertise in the control of infectious disease
- Receives samples and swabs organised by the EHOs
- Determine the type of organism present in the food, faeces, and water or on the swab

Since April 2003 most public health laboratories now combined with NHS laboratories based in hospitals.



Role of management

- Advise **relevant** staff **of problem**
- Suspending sales **of suspected food**, its removal and isolation
- Exclude staff **with food poisoning symptoms or suspected of suffering from food poisoning. Ensure specimens are provided for doctor**
- Specimens
- **Ascertain whether any** staff **have been ill (boils etc.)**
- **Identify which** foods **are** implicated
- **Have any other** complaints **been received**
- **Ascertain the** food history **from delivery to service**
- Sampling
- **Obtain and check any relevant** monitoring records
- **After clearance from EHP or manager thoroughly** clean and disinfect **all relevant work surfaces and equipment before serving any more food**
- Arrange for re-stock
- **Be available to** answer questions **during any subsequent investigation**



Role of EHP

Six key stages of investigation

1 Preliminaries

- Reviewing notification
- Formulating hypothesis
- Determination of case definition
- Population at risk
- Resources required
- Defining responsibilities
- Setting up communication channels
- Briefing inspectors

2 Case finding

- Searching for cases, carriers and contacts
- Recording detailed case histories of sufferers
- Food consumption details
- Symptoms and onset times
- Occupational details etc
- Obtaining specimens
- Assembling data
- Formulation of hypothesis re: outbreak location
- Obtain details of food preparation etc
- Questionnaires for all attending suspected function
- Accuracy of details essential

3 Site investigation

- Secure assistance of manager(s)
- Collect menus, details of food and suppliers
- Identify all food production staff and their functions
- Obtain staff records and sickness returns
- Identify food production areas
- Obtain samples of food and waste if possible
- Seize or detain suspected food
- Postponing cleaning and disinfection
- Terminating or modifying food production
- Collecting food or other samples and swabbing surfaces
- Inspecting and recording site conditions
- Interviewing managers and staff
- Arranging collection of specimens from staff

Notes





4 Intermediate review

Assemble all available data

Assess control measures needed

Formulate hypothesis as to:

Suspect food vehicle

Causal factors

Source

Review investigation, determine if outbreak is foodborne

Is a due diligence defence likely to succeed?

If prosecution is likely:

Statements obtained in accordance with "PACE"

Determine what further evidence is needed

Prepare an interim report

Issue public warning if necessary

5 Source tracing

Sample ingredients used

Assess possibility of organisms surviving processing

Analysis of sample specimen and swab results

Trace production chain

Investigate primary sources

6 Consolidation

Collation of data and testing hypothesis

Further detailed examination of critical factors

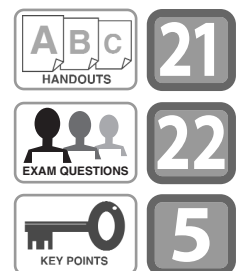
Discussion of draft report

Agreement on final hypothesis

Formulating remedial and control measures

Publishing final report

Ask the delegates to list the five most important things they have learnt.



Module 5

Foodborne disease

Aim

To provide an understanding of the causes of foodborne diseases

To outline the characteristics of common foodborne disease causing organisms

Key points

Only a small number of organisms are required to cause a problem (low infective dose)

Multiplication in food is not essential

Airborne and person to person spread is common

Pets, farm animals and birds are a common source of foodborne disease organisms

Campylobacter is the most common cause of diarrhoea in the UK

Listeria can multiply significantly in a refrigerator

The Pennington report recommendations

Video/DVD

E coli O157 The Facts

Visual Aids

Handouts

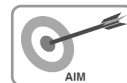
Case histories (HO23)

Examination questions (HO24)

Group exercise

Split the class into groups and ask them to discuss the methods of control possible in order to reduce the risks of outbreaks from the major foodborne diseases. Each group should elect a spokesperson to advise the rest of the class of their findings which should then be open for class discussion

Module 5



Case histories

Hepatitis A

A lady who drank a glass of ice water was one of the 30 diners who developed Hepatitis A after visiting the Hoggsbreath Bar. The virus resulted in nausea, fever, stomach cramps, malaise and jaundice.

On March 10th the manager of the Hoggsbreath sent home a cook who was not feeling well. After examination by a doctor who advised the cook had a respiratory infection, she was allowed to return to work. A week later the cook developed jaundice and laboratory diagnosis confirmed Hepatitis A.

Hepatitis A has an incubation period of up to 7 weeks and hundreds of people were exposed to the risk.

Protective immune globulin injection given within two weeks of exposure can offer some protection.

The lady was off work for six weeks and joined a class-action lawsuit against the Hoggsbreath. The owner's wife also developed Hepatitis A. The cook left Hoggsbreath to work for another restaurant, which has not been identified.

The cause of this outbreak was probably the failure of the cook to wash her hands correctly after using the toilet. Even a microscopic amount of faecal material will contain sufficient viral particles to contaminate food and equipment throughout the kitchen.

In the USA ill or infected food handlers are considered to be involved in a much greater percentage of foodborne outbreaks than in the UK. In some states one out of every three outbreaks is attributable to ill or infected food handlers (mainly viral).

Dysentery



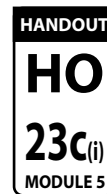
In 1998 a food handler employed at Ciatti's Restaurant infected a seafood salad with Shigella bacteria. 30 people became ill, including a lawyer and his wife who received \$140,000 in compensation.

Also in 1998 hundreds of consumers became ill with dysentery following the consumption of parsley. The parsley was contaminated with Shigella at a farm in Mexico and allegedly was not removed by the washing procedure adopted by the restaurants.

Listeria

In 1998 hotdogs and luncheon meat from a factory in the USA resulted in 80 ill people and 21 deaths.

Case history involving *E. coli* O157



John Barr and Sons, Wishaw, Scotland

John Barr and Sons was a large, popular butchers and bakers shop in Wishaw, Scotland. The business operated as a local retail outlet but, unknown to the food authority, also provided a large amount of wholesale meat .

Prior to 1996 John Barr had been voted Butcher of the Year and it appeared on the surface, that the premises were clean and well organised.

From November until December 1996 John Barr was alleged to have poisoned over 500 people by supplying them with cooked meat contaminated with *E. coli* O157. The incident involved three documented outbreaks and a large number of sporadic cases which were traced back to John Barr. In addition to a large number of people suffering an extremely serious and unpleasant illness, a total of 21 deaths were alleged to have resulted amongst those consuming contaminated cooked meat purchased from Barrs or shops supplied by Barrs.

Outbreak 1

The lunch at Wishaw Old Parish Church on Sunday 17th

At noon on Saturday 16th November a John Barr employee delivered two 15lbs bags of cooked stew and pastry tops to the Wishaw Church kitchen

The meat was unrefrigerated overnight. Surplus gravy was drained off and not served with the meal. When tested a week later the gravy was found to contain *E. coli* O157. Swabs taken from surfaces in John Barr's shop on 23rd November revealed the same strain of *E. coli* O157.

It is thought that either the stew was not cooked at sufficient temperature for sufficient time to destroy *E. coli* O157 at John Barrs or that the stew and/or bags became contaminated after cooking. It is likely that the *E. coli* O157 multiplied after cooking and overnight, and survived the reheating in the church ovens.

Outbreak 2

Bankview Nursing Home, Kilsyth

Sandwiches consumed on 23/24th November and prepared with cold, cooked meat purchased from a Scotmid shop in Haggs at around 11 a.m. on Saturday 23rd November. The meat included smoked ham, chopped pork, meat loaf, brisket and chicken roll. John Barr supplied cooked meat to the Scotmid shop but not any of the meat used to prepare the sandwiches.

Five elderly residents died between 6th December 1996 and 11th April 1997.

It is thought the original contaminated cooked meat was supplied to Scotmid by John Barr and that cross-contamination occurred, either by the slicing machine or a tray on which several cooked meats were placed.

Outbreak 3

Birthday party at the Cascade Public House

It is thought that cooked meat supplied by John Barr was responsible for the outbreak, involving twenty five people. As it was an eighteenth birthday party, very few elderly and young persons were involved and there were no deaths.

In addition to these three outbreaks, there were a large number of sporadic cases and eight deaths involving elderly people who had consumed products supplied by John Barr (either directly or indirectly from premises supplied by John Barr).

Examination questions

Subject Foodborne disease



1. Fully describe the following:

- a) Differences between food poisoning and foodborne diseases**
- b) "Fitness to work" Code recommendations regarding typhoid or *E. coli* O157**
- c) Viral gastroenteritis**

2. Campylobacter is the most common cause of gastroenteritis

- a) Discuss the sources and vehicles associated with this infection**
- b) What control measures can be taken to reduce the number of cases?**

3. *E. coli* O157 has caused several major outbreaks of food poisoning over the last 10 years.

- a) State the three main sources of *E. coli* O157**
- b) Describe the characteristics, symptoms and incubation period for *E. coli* O157**
- c) Name four foods that have been associated with outbreaks of *E. coli* O157**
- d) Discuss in detail four distinct control measures which should be used to prevent an outbreak of *E. coli* O157**

Campylobacter

C. jejuni (approx. 90%) *C. coli* (approx. 10%)

The most frequently reported reason for acute bacterial diarrhoea



Sources/vehicles

- Animals and birds are main source of organism
- Cross-contamination from raw poultry common
- **Common in gut of poultry.** Undercooked poultry or meat **most likely food vehicles**
- Magpies to milk common
- Raw milk
- Untreated natural water

Incubation period

- 1-11 days (usually 2-5 days)
- Usual duration 1 to 7 days

Symptoms

- Colicky abdominal pain
- Diarrhoea (often bloodstained)
- Vomiting rare
- Fever
- Headache
- Nausea

Specific characteristics

- Gram -ve
- Reduced oxygen required for growth
- No long-term carriers
- Multiplies quickly between 37°C and 43°C but not below 28°C, maximum 46°C
- Easily killed by cooking
- Around 500 organisms required to cause illness

Control factors

- Better hygiene in slaughterhouses
- Heat treatment of milk
- Thorough cooking
- Better hygiene awareness of consumers
- Pet hygiene
- **Avoid** cross-contamination from farm to table
- Chlorination of water

E. coli O157 (VTEC)

Sources

- Intestines of animals (including cattle and sheep) and man. Person to person **likely**
- **Manured vegetables/fruit crops**
- Water (drinking/bathing) **and raw milk**

Common vehicles

- Cooked meat (**cross**-contamination)
- Undercooked mince/burgers (**mainly** beef and lamb)
- **5.9 % of raw lamb sampled was contaminated**
- Raw milk, cheese made from unpasteurized milk
- Apple juice
- Salad vegetables **contaminated with manure**

Incubation period

- **1-8 days (usually around 3-4 days)**
- **Duration - around two weeks (unless complications)**

Symptoms

- **Varies from watery diarrhoea, nausea abdominal pain to bright red, bloody diarrhoea and severe abdominal cramps, 30% develop HUS (Haemolytic Uraemic Syndrome)**
- **Often fatal, severe cases shorten life expectancy due to organ damage especially serious in the old and young**

Specific characteristics

- **Gram -ve rod**
- **Low infective dose <100 bacteria**
- **Facultative anaerobe, acid tolerant**
- **Destroyed by thorough cooking**
- **Around 1000 cases per year in England and Wales more common in Scotland**
- **Not easily diagnosed**

Control factors

- Prevent cross-contamination
- Thorough cooking (esp. mince/burgers)
- **Clean** salad vegetables, **strawberries etc.**
- High standards of personal hygiene
- Strict segregation of raw and high-risk foods
- Avoid untreated milk and apple juice
- Training of food handlers
- Increase consumer awareness
- Use of effective hazard analysis



Pennington report recommendations



- **An education awareness programme for farm workers**
- **Consistent and rigorous enforcement of hygiene standards at slaughterhouses including cleaner animals HACCP and staff training**
- **Accelerated implementation of HACCP including documentation, licensing of butchers and training**
- **Physical separation of raw meat and unwrapped cooked meat/meat products and other ready to eat foods**
- **Improved food hygiene training for all food handlers**
- **Supervisory staff and one-person operations to be trained to at least Intermediate level**
- **Further targeted and prioritised research**
- **Food hygiene training to be provided within the primary and secondary school curriculum**
- **More resources to address enforcement and education/awareness issues especially relating to the dangers of cross-contamination and eating undercooked products**
- **Improved surveillance, research and control of outbreaks, including full written reports and consideration of their publication**

Norovirus

- 0.03 times the size of bacteria
- **Requires "electron microscope" (often undetected)**
- Multiply in living cells
- Cannot multiply in food
- **May survive several days outside living cell**
- Millions released on vomiting
- **Mainly** airborne and person to person (**faecal oral route**)
- **Only** small numbers required (**10-100 particles**)

Onset period

- 10-50 hours (**dose dependent**)

Symptoms

- **Some** diarrhoea
- Vomiting (**often** projectile)
- Abdominal pain
- **Fever**
- **Nausea**
- **Fatalities rare**
- **Symptoms relatively mild**

Duration

- **12 to 60 hours (usually 24 to 36 hours)**
(specimens required within 48 hours)

Various types

- Norovirus (**up to 10% foodborne**)
- Rotavirus - **most common but very rarely foodborne**

Food vehicles

- **Food handled frequently,**
- **Sewage polluted water - fruit, lettuce, and shellfish**

Control

- **Reputable suppliers of shellfish**
- **Exclude ill people, prevent cross-contamination**
- **Thorough cooking**



Listeriosis

Organism

Listeria monocytogenes

Sources

- Intestines **and faeces** of humans and animals
- Effluent and sewage sludge
- Many cases of cross-infection
- Common environmental organism
- Specific foods **most susceptible** are soft cheeses and pâté
- **Possible, however, on most foods especially** manure contaminated vegetables

Incubation period

1 day to 3 months

Symptoms

- **Fever, flu-like illness and general malaise**
- **Diarrhoea and mild fever**
- **Septicaemia/meningitis especially in vulnerable groups**
- **Abortion - if mother infected**
- **Duration 48 to 72 hours**

Specific characteristics

- **Gram +ve**
- **Most at risk: neonates, pregnant women, immuno - suppressed persons, elderly**
- **Can grow slowly at low temperatures (between -1.5°C and 42°C)**
- **Tends to dominate other organisms at low temperatures**

Control factors

- Efficient sewage disposal
- Avoidance of cross-contamination
- Susceptible groups to avoid soft cheese and pâté and contact with farm animals
- Care with shelf-life of chilled foods
- Thorough cooking
- Effective cleaning and disinfection (dry cleaning preferred)



Typhoid and paratyphoid (enteric fever)

Typhoid

(*Salmonella Typhi*)

Sources

- Faeces/urine (sewage)
- Contaminated water and food
- Carriers

Incubation period

3 days to 1 month (usually 8 to 14 days)

Symptoms

- Fever
- Malaise
- Slow pulse
- Enlarged spleen
- Rose spots on trunk
- Constipation or severe diarrhoea
- Death rate between 2% and 10%
- Duration 1 to 8 weeks

Specific characteristics

- Present in faeces and urine
- Transmission faecal/oral route
- 5% of cases become permanent carriers

Control factors

- Safe water supplies
- Satisfactory disposal of sewage
- Heat treatment of milk
- Control over contaminated shellfish (approved suppliers)
- Exclusion of carriers
- High standard of personal hygiene, especially handwashing
- Use of effective HACCP

Paratyphoid (*Salmonella Paratyphi*)

Similar to typhoid but generally milder



Hepatitis A

Virus (two main types A and B)

Sources

- Carriers (faeces/urine/**blood**)
- Contaminated food, especially shellfish, salad vegetables and soft fruit
- Contaminated water

Incubation period

15 to 50 days

Symptoms

- **Abrupt onset**
- **Fever**
- **Malaise**
- **Nausea**
- **Abdominal pain**
- **Later jaundice**

Specific characteristics

- **Duration can be from one week to several months**
- **Transmitted via faecal-oral route (urine can be infective)**
- **Fatality rate less than 1%**

Control factors

- Safe water supplies
- Satisfactory disposal of sewage
- Heat treatment of milk
- Exclusion of carriers
- High standard of personal hygiene, especially handwashing
- Avoid suspect shellfish
- **Use of** approved suppliers
- Careful washing of salad vegetables and soft fruit



Dysentery

Organisms

- *Shigella sonnei*
- *Shigella flexneri*

Source

- Infected people (usually children)
- Contaminated food and water **e.g. cases from imported iceberg lettuce**

Incubation period

One to seven days (usually around 4 days)

Symptoms

- Acute disease
- Diarrhoea (often containing blood, mucus and pus)
- Fever
- Stomach cramps
- Often vomiting
- Death rate is less than 1% (*Shigella flexneri* more likely than *Shigella sonnei*)

Specific characteristics

- Outbreaks fairly common in infant and junior schools
- Spread through faecal-oral route

Control factors

- Good personal hygiene
- Attention to washing hands effectively after using toilet
- Cleaning **and disinfection** in toilet areas
- General cleaning and disinfection
- Exclusion of carriers
- Chlorination of water supplies
- Effective disposal of sewage
- Heat treatment of milk
- Avoid raw shellfish and shellfish from suspect waters
- **Use** approved suppliers



Brucellosis and Tuberculosis

Brucellosis (undulant fever)

Organisms

- *Brucella abortus*
- *Brucella melatensis*

Sources

- **Contact with** infected cow
- Raw milk/dairy products

Incubation period

5 to 21 days

Symptoms

- Intermittent fever and flu-like symptoms
- Extended depression and headache

Specific characteristics

Vets are also at risk

Control factors

Eradication scheme in 1960's and heat treatment have reduced the problem greatly

Avoid raw milk and products made from raw milk

Tuberculosis

- *Mycobacterium tuberculosis*
- *Mycobacterium bovis*

Sources

- Infected cows **via** raw milk/dairy products
- Person to person (**droplet spread**)

Incubation period

4 to 6 weeks, later stages may take years

Symptoms

- Affects lungs, bones, lymph nodes, kidneys, intestines and skin

Specific characteristics

Chronic bacterial disease

Control factors

Eradication scheme in 1970's and heat treatment have reduced the problem greatly

Avoid raw milk and products made from raw milk



Other diseases

B.S.E (Bovine Spongiform Encephalopathy)

- Neurological disease of cattle
- Epidemic started in 1986
- 1993 1000 cases a week
- Causative agent: a prion (resistant to heat, chemicals and irradiation)
- I.P. in cattle up to 10 years, average 5
- Detected in brain and nerve tissues of affected cattle suspected in lymph tissue not isolated from muscle
- 1988 ban: on infected material in feed.
- In 1997 cattle over 30 months slaughtered and incinerated
- Transmission? Scrapie infected bonemeal
- Infected carcass into food chain
- Vertical transmission - cow to calf
- Organophosphorous pesticides (warble fly)
- C.J.D (Creutzfeldt-Jakob Disease)
- Usually a long incubation (up to 40 years)
- Fatal within a year
- Progressive decline in cognitive and motor functions of brain

Kuru (cannibals eating brain)

Protozoa - *Giardia lamblia*/cryptosporidium

- Faecal/oral route
- Cysts persist in environment and water
- Outbreaks often from water contaminated with animal faeces

Incubation period

- Giardiasis - 6-22 days
- Cryptosporidiosis - around 10 days

Parasites

- A parasite is a plant or animal
- Lives and feeds on or in another plant or animal known as the host
- Can have complicated life cycles, which may involve different hosts

Examples

- *Taenia saginata* - tapeworms
- *Trichinella spiralis* - roundworms
- *Fasciola hepatica* - liver fluke
- *Echinococcus granulosus* - hydrated cyst



Comparison, food poisoning and foodborne disease

Food Poisoning

Usually millions of bacteria required

Bacteria multiply in food

Vehicles other than food **rare**

Person to person rare
common

Airborne unlikely

Short onset (**usually**)

Foodborne Disease

Small numbers only

Food a vehicle only

Other vehicles common

Person to person

Airborne common

Longer onset (**usually**)

Notes



Ask the delegates to list the five most important things they have learnt



Module 6

Personal hygiene and training

Aim

To provide an understanding of the need for high standards of personal hygiene and the knowledge to control and monitor staff

Key points

Most people carry food poisoning organisms from time to time

The role of management in securing high standards of personal hygiene and preventing contamination of food

Characteristics of protective clothing

Training should result in competency

Planned training is essential (training programme), training records should be maintained

The legal requirements relating to personal hygiene and training

Staff selection - importance of medical screening and exclusion

Awareness of the requirements of The Department of Health Guidelines "Food handlers, fitness to work"

Video/DVD

Visual aids

Items of protective clothing

Handouts

Medical screening questionnaire (HO25)

Examination questions (HO27)

Group exercise (HO26)

Groups to complete control chart for food handlers

Split the class into groups and ask each group to design a training programme for a specific group or function

Module 6



Highfield employee health questionnaire

Please complete all the following questions. Answers will be treated with strict confidence

HANDOUT

HO

25

MODULE 6

Name: Tel No:

Address:

.....

.....

Name & address of doctor:

.....

Current job: Position applied for:

Have you ever had or been a carrier of:

Please tick the appropriate box

A foodborne disease

☐ Yes

☐ No

Typhoid or paratyphoid

☐ Yes

☐ No

Tuberculosis

☐ Yes

☐ No

Parasitic infections

☐ Yes

☐ No

Has any close family contact suffered from any of the above:

☐ Yes

☐ No

Have you suffered from any of the following:

Serious diarrhoea or vomiting

☐ Yes

☐ No

Skin trouble

☐ Yes

☐ No

Boils, styes or septic fingers

☐ Yes

☐ No

Discharge from the ears, eyes, gums/mouth

☐ Yes

☐ No

If you have answered yes to any of the above, please provide details of dates and if the doctor was contacted:

.....

.....

Please give details of any other medical problems which may affect your employment as a food handler, for example, recurring gastrointestinal disorder:

.....

.....

Have you been abroad within the last two years:

☐ Yes

☐ No

Did you suffer any illness whilst abroad:

☐ Yes

☐ No

Where and when:

Should it be necessary, will you provide such specimens that may be required by the Company to ensure that you are not a carrier of any organism that may infect food:

☐ Yes

☐ No

I declare that all the foregoing statements are true and complete to the best of my knowledge and belief. A deliberate failure to provide accurate and truthful answers may be considered as gross misconduct.

Signed: Date:

Food handlers control chart

Hazards - Bacteriological and physical contamination

Sources and/or causes of hazards	Controls	Monitoring	Corrective action

Generic controls - staff training and vigilance - Effective supervision and instruction
• Generic corrective action (GCA)

Food handlers control chart

Hazards - Bacteriological and physical contamination

Sources and/or causes of hazards	Controls	Monitoring	Corrective action
Contaminated hands, e.g. after going to the toilet or handling a sick person	Effective hand washing. Provision of adequate facilities including wash basins, liquid soap, warm running water, nailbrush, paper towels and hand washing notices	Observation (CCTV) hand swabbing/UV light fluorescent dye Competency testing of staff and supervisors Auditing of facilities	Re-wash hands • Improved supervision/instruction/ training/motivation • Issue new procedures /instructions • Discipline staff if instructions ignored Provision of additional facilities
Food Handler ill or/and diarrhoea and vomiting	Use of medical questionnaire Exclusion policy (including reporting of illness)	Check policies adhered to	• GCA Relocation of suspect food handler Exclude suspect food handler
Boil/septic cut	Exclusion policy (including reporting of illness)	Check policies adhered to	• GCA
Cuts/abrasions	Appropriate waterproof dressing (blue)	Check policies adhered to Check first aid box	• GCA Replenish first aid box
Poor hygiene e.g. picking nose, sneezing over food, smoking etc.	High standards of personal hygiene/practices Sneeze, cough into shoulder	Check policies adhered to Regular auditing/inspection Competency testing of staff and supervisors	• GCA
Contaminated protective clothing	Effective system for provision and replacement of protective clothing	Regular auditing/inspection Check policies adhered to	Change protective clothing immediately • GCA
Jewellery	Clear instructions re: wearing of jewellery and enforcement of policy	Regular auditing/inspection Check policies adhered to	• GCA

Generic controls - staff training and vigilance - Effective supervision and instruction
• Generic corrective action (GCA)

Examination questions

Subject Training

Training is an important area with regards to the safety of food production

- 1. What are the main points you would incorporate into a staff training programme?**
- 2. Outline how you would ensure that new staff would not endanger the food**
- 3. What are the legal requirements with regards to training?
Please refer to the Industry Guides to Good Hygiene Practice and the differing standards of training required**

Personal hygiene



Legislation

**Regulation (EC) 852/2004 on the hygiene of foodstuffs
(Guides to Good Hygiene Practice)**

Every person working in food handling areas must maintain a high degree of personal cleanliness and wear suitable clean, and where appropriate, protective clothing

(Industry guides)

- **Personal cleanliness includes hygiene practices**
- **Onus on the proprietor to ensure compliance**

Staff selection

Requirements for food handlers

- **Clean and tidy appearance**
- **Absence of skin infection**
- **Clean hands, short fingernails, no signs of nail biting**
- **Absence of excessive personal jewellery/make-up**
- **A belief in the importance of hygiene**
- **Willingness to attend food safety training**

Pre-employment - medical screening

- **Applicants should complete a medical questionnaire**
- **Suspect carriers should have to provide specimens**



Class discussion - Merits of requiring high-risk food handlers to submit annual faecal specimens



Return to work forms

- **Food handlers visiting countries where serious foodborne diseases, such as typhoid are endemic**
- **Forms may be completed when off work through sickness**
- **Medical clearance may be required if form reveals possible risk to food e.g. potential carrier status**

Food handlers - sources and causes of hazards

Class to identify likely pathogens on each of the sites identified in the illustrations, how they can be transferred to high-risk food and what controls can be implemented

Hand washing

Essential to prevent contamination

Class to discuss how manager can ensure hands are washed properly whenever necessary

Role of supervisor

- Hand washing
- Instruction/demonstration/supervision
- Lead by example
- Ensure soap, hot water, clean nailbrush and suitable drying facilities always available

Cuts, boils, septic spots and skin infections

- Exclude food handlers with open boils and septic lesions from food area
- *Staphylococcus aureus* is the main problem
- Waterproof dressings (preferably blue) must cover cuts etc.
- Loose dressings replaced immediately
- Consider waterproof finger-stalls and gloves

Use of disposable gloves:

NB If disposable gloves are worn for handling high-risk food the hands must be washed thoroughly before putting on the gloves and after taking them off.
The gloves must be replaced immediately if damaged
The gloves should be discarded once removed, for example, breaks or leaving the food room

Reasons for food handlers not smoking

- Bacteria transferred from lips to hands to food and via saliva to work surfaces
- Encourages coughing
- Risk of physical contamination (cigarette ends or ash)
- Unpleasant atmosphere



First aid

- Ensure staff aware of need for coloured waterproof dressings and to report losses
- Loose dressings to be replaced
- Ensure staff know where to obtain dressings and procedure in event of accidents
- Ensure adequate provision of first aid materials
- Exclude food handlers with septic lesions/boils if food at risk
- Discuss use of finger-stalls

Discuss how to minimize risk from staff smoking (breaks/outside foodroom/toilets etc.)

Class discussion - prioritize risk of contamination from food handlers who have not washed hands e.g. smoking versus visiting toilet



Effective handwashing

Regulation (EC) 852/2004 on the hygiene of foodstuffs

An adequate number of washbasins must be available, suitably located and designated for cleaning hands. Must be provided with hot and cold running water, materials for cleaning hands and for hygienic drying. Where necessary must be separate from food sinks.

Surveys have indicated that cases of diarrhoea and vomiting, and even colds, can be reduced by up to 50% if staff wash their hands when necessary and properly.

Ask each person in the class which are the most important occasions for food handlers to wash their hands i.e. when the hands are most likely to be contaminated with large numbers of transient pathogens.

Hand washing is particularly important on the following occasions:

- After entering a food room **before handling food**
- Visiting the toilet (**when using toilet paper**)
NB Some cultures do not use toilet paper and this should be addressed in training
- Changing **or putting on** a dressing **especially a boil or septic cut (may be preferable to exclude)**
- Cleaning up dog dirt (**guide dogs/guard dogs**), **other animal faecal material**
- Handling a soiled nappy (**maybe left in toilet**)
- Dealing with an ill person (**vomiting/diarrhoea**)
- After handling raw food, **especially meat, poultry or "soily" vegetables, before handling ready-to-eat food**
- **After handling external packaging contaminated with, e.g. bird droppings**

On the above occasion a double wash recommended. A soft nailbrush being used on the first occasion to remove pathogens from the fingertips/nail areas.

Hands should be washed

- After touching hair, nose or face
- After smoking, eating, coughing, sneezing or blowing the nose
- After cleaning



- After handling waste **or refuse containers**
- After handling money **or soiled cloths**
- After handling external packaging, **plants or flowers**
- **After touching a contaminated surface**

Removing bacteria during hand washing:

Reductions

- **Brushing fingertips under running water (1000 to 1)**
- **Rubbing hands vigorously with liquid soap (100 to 1) and rinsing under running water**
- **Drying with paper towel (100 to 1)**

Discuss use of the nailbrush, liquid soap, bactericidal soap, (increased risk of dermatitis), non-hand operable taps, running water and methods of drying. Temperature of water (10°C to 49°C) not a critical factor in removing bacteria, but around 40°C makes it a pleasant experience.



Protective clothing

Discuss - Properties of and reasons for wearing clean protective clothing

Formulating and implementing a policy in relation to protective clothing

How to ensure staff wear protective clothing properly

The order of putting on and taking off protective clothing: hairnet, hat, jacket, trousers, shoes

Consider

- **When to remove protective clothing (travelling to work, shopping, canteen, visiting toilet)**
- **The procedure for changing protective clothing**
- **Use of colour coding**
- Light/**dark** coloured
- Press studs/velcro/**buttons**
- **Home** laundering/in-house
- **Long/short sleeves**
- Hairnets/**snoods/hats**

Health and safety

- **Thick overall (protect against heat)**
- **Loose clothing (in case of boiling water spillage)**
- **Stout, non-slip shoes**
- **Waterproof aprons**
- **Protective head covering (factory environment)**

Regulation (EC) 852/2004 on the hygiene of foodstuffs

Adequate changing facilities for personnel must be provided where necessary

Food handlers shall wear suitable clean and, where necessary, protective clothing

Industry guides (catering)

Provision required to change and store street clothes and personal effects away from open foods

Group discussion - which food handlers do not need to wear protective clothing?



Notification and exclusion

Medical questionnaire **should be completed and assessed before starting work.**

Regulation (EC) 852/2004 on the hygiene of foodstuffs

Food handlers must advise the food business operator if they are a carrier of or suffering from a foodborne disease or have an infected wound, skin infection sore or diarrhoea which may contaminate food with pathogens. They must not be permitted to handle food or enter a food handling area if there is any risk of contamination.

Action by supervisor

- **Exclude from food service if there is a risk of contamination (direct or indirect)**
- **Transfer to low-risk work e.g. if carrier but no symptoms**
- **May be required to see a doctor**
- **May advise environmental health practitioner**
- **Normal duties resumed when medical clearance obtained**

Department of Health Guidelines (1995)

"Food Handlers: fitness to work"

Requirements for return to work following gastrointestinal infection:

- **No vomiting for 48 hours**
- **Bowel habit normal for 48 hours**
- **Good hygiene practice, particularly hand washing, is observed in all circumstances**

Class to discuss potential hazards associated with symptomatic and asymptomatic carriers

Class to discuss potential hazards associated with visitors



*Criteria for infected food handlers returning to work

Class discussion - merits of allowing a known carrier of, for example, salmonella, returning to work to handle high-risk foods

Typhoid and paratyphoid

6 consecutive negative specimens taken one week apart starting 3 weeks after completion of antibiotic treatment

NB 5% chance of next specimen being +ve

Class discussion - should typhoid carriers ever be let back to work with high-risk food?

VTEC *E. coli* O157

Until bowel habit normal for 48 hours and 2 negative faecal specimens at 48 hour intervals

Most important barrier to passing on infection is thorough hand washing

As there is up to 10% chance that the next specimen will be positive carriers who cannot be relied on to wash hands properly should not be allowed to work as food handlers

Hepatitis A

7 days after the onset of symptoms, usually jaundice

Staphylococcus aureus or streptococci

Anyone with scaling, weeping or discharging lesions on an exposed part of their skin which cannot be adequately covered should cease food handling work until healed

*Recommendations of PHLS Salmonella sub-committee 1995 and updated 2004.



Objectives/benefits of hygiene training



Training

The process of bringing a person to an agreed standard of proficiency by practice and instruction i.e. more than attending a course
Competency is required

Objectives

- Change attitudes positively to **food** hygiene
- Minimise risks

Benefits

- **Assists in the production of** safe food
- Reduces **food** wastage
- Reduces complaints
- **Higher staff morale, with pride in job**
- Increases job satisfaction
- **Contributes to** increased productivity
- **Ensures all** correct procedures **are followed**
- **Helps comply with** legal requirements
- **Complies with industry guides and codes of practice**
- **Promotes** good company image
- **Improves supervisory** skills of managers
- Reduces **the amount of** supervision **required**

It is useful to maintain detailed training records for all staff

This will allow some forward planning and management should be able to ascertain if a member of staff is trained to an appropriate level when an emergency occurs

Also useful to support a due diligence defence



Legal requirement for training

Regulation (EC) No 852/2004 on the hygiene of foodstuffs states:

The food business operator shall ensure that food handlers are supervised and instructed and/or trained in food hygiene matters commensurate with their work activity (**competency not certification**)

Industry Guides (catering) states:

- A food handler is any person involved in a food business who handles or prepares food whether packaged or unopened (includes drink and ice)
- All staff should be properly supervised and instructed

Greater supervision required for:

- New staff awaiting formal training
- Staff handling high-risk foods
- Less experienced staff

Training methods

- On-the-job instruction, in house or external courses
- **Approved courses (to provide underpinning knowledge NOT competency)**
- Reinforcement, demonstrations, group exercises, role playing, quizzes **etc are all effective techniques**
- **Computer based training (available 24 hours per day)**
- **Remember the more people actually do the more they remember**

- | | | | |
|-----------|---------------|---|------------|
| • EXPLAIN | • DEMONSTRATE | ➤ | COMPETENCY |
| • INVOLVE | • TEST | | |

Supervisors can determine if training has been understood and good practices implemented by discreet observation and completing competency testing cards.

Certification is not the same as proficiency. If food handlers have, for example, a food safety certificate but do not implement and practise what they have been taught then they will not comply with legal requirements.



Training programme

- Planning and implementation
- Structured approach
- Consider future skill requirements
- Allocate budget
- Do sufficient skills exist to implement in-house

Stages

Management of training programme

- One person responsible, total support of management
- Food safety policy statement
- Appropriate trainers appointed
- Workforce assessment
- Assess existing competency and levels required

Establish training committee

- Workforce participation preferred to management imposition
- Representatives - all disciplines/all levels preferred

Content of the training programme depends on

- Existing skill levels, time and finance available
- Who will be trained and to what level
- Is training in-house or external
- What provision will be made for induction training
- What training and examination technique will be used
- Type of continual assessment system

Organisation of training sessions

- Consider individuals whilst determining methodology
- The location/timing of the training sessions, convenient to both management and staff

Visual aids equipment

Selected to suit level of training, room and budget

Piloting of the programme

To a cross-section of staff, followed by accurate, constructive feedback

Implementation

Built in flexibility is essential

Evaluation

Whole programme and each session is essential

Reinforcement

An essential part to ensure staff motivation

Training programme

- Induction training (essential) all food handlers prior to starting work

AWARENESS (include monitoring CCPs) within 1 month

INTRODUCTION to hazard analysis

FOUNDATION Level (High-risk food handlers) within 3 months

INTERMEDIATE Level (Supervisors)

ADVANCED Level (Managers)

PRACTICE & IMPLEMENTATION (Supervision)

REINFORCEMENT (Notices/ on-the-job instruction/supervision)

UPDATE TRAINING (as and when necessary e.g. new legislation or new process)

Low-risk food handlers should be trained to awareness level All food handlers must know the hazards and controls relevant to their job

N.B. Refresher training should be continuous (NOT re-certification or refresher training every 3 years). This is best achieved by on-the-job supervision or computer based training which is permanently available

Training as part of hygiene policy

Prerequisites to successful training

- Culture of the organisation
- Support of Directors
- Commitment of managers/supervisors
- Adequate resources
e.g. wash-hand basins/time to wash hands

Essential components of hygiene policy

- **Demonstration of commitment** to high standards of hygiene
- Company standards must be set **out**
- Dangerous practices spelled out
- Legal obligations outlined
- Commitment to train staff
- Change attitudes

Problems - lack of finance, expertise and motivation.

Ask the delegates to list the five most important things they have learnt



27



5

Module 7

Food hazards from purchase to serving

Aims

To provide an understanding of the hazards, controls and monitoring throughout food storage, preparation, thawing, cooking, cooling, reheating and serving.

Key points

The major hazards are:

- Contamination of the food
- Multiplication of bacteria
- Survival of bacteria
- Formation of toxins
- Germination of spores

Good stock rotation essential

Illegal to sell or use food after its "use-by" date

Can defects

Chilled food storage 1-4°C legal 8°C

Thawing raw meat and poultry

Vacuum packs require refrigeration

Cook food to 75°C and reheat to at least 75°C and 82°C in Scotland,
store at 63°C

Cool hot food rapidly and then refrigerate

Temperature control after cooking is critical

The cook-chill process

The cook freeze process

Sous vide cook-chill

Video/DVD

Visual aids

Probe thermometer

Containers illustrating various types of coding

Handouts

Definitions (HO28)

Correct use of refrigerators (HO29)

Rules for handling raw eggs (HO30)

Examination questions (HO31)

Group exercises

Groups to suggest ways of preventing customers contaminating food in a self-service buffet

Split class into two, one group to list hazards the other group to list controls (then swap roles)

Module 7



Definitions

Control measures	Actions or activities required to prevent or eliminate a food safety hazard or reduce it to an acceptable level.
Critical control point	A step in the process where control can be applied and is essential to prevent or eliminate a food safety hazard or reduce it to an acceptable level.
Hazard	A biological, chemical or physical agent in, or condition of, food with the potential to cause harm (an adverse health effect) to the consumer.
Monitoring	The planned observations or measurements of control parameters to confirm that the process is under control, and that critical limits are not exceeded.
Prerequisite programmes	The good hygiene practices a business must have in place before implementing HACCP, to enable the HACCP plan to concentrate on the most significant hazards.
Risk	The likelihood of a hazard occurring in food.

Correct use of refrigerators

High-risk food should be stored under refrigeration

Clean - Cool - Covered

NB: The modern trend of not using preservatives means that some bottles or jars of food, once opened, have now to be stored in a refrigerator.

Rules for refrigerators:

- **Keep at correct temperature (1°C - 4°C recommended)**
- **Check dial temperature each time used and record at beginning and end of day (calibrated thermometer). Unless on automatic recording.**
- **Check temperature profiles of food (variation in temperatures)**
- **Practise stock rotation (FIFO)**
- **Do not overload. No food stored above or in front of, the load line.**
- **Defrost regularly (most are now automatic).**
- **No hot food that raises the temperature of food already stored in the refrigerator**
- **Do not open the door for longer than necessary**
- **Alarmed units (when temperature rises above, for example, 8°C) are recommended**
- **Separation of high-risk from raw food. Separate units preferable. Raw food always below ready-to-eat food and raw meat below salad/vegetables**
- **Keep clean and disinfected**
- **Protect salad, vegetables etc. from dripping blood**
- **Food should be covered, labelled and date coded where appropriate**
- **Site away from radiant heat sources. Good ventilation for motors**
- **Do not obstruct cooling units**
- **Easy clean construction**
- **No opened cans**
- **Maintain door seals**
- **Train staff appropriately**
- **Maintenance contract recommended**
- **Contingency plan in the event of breakdown/high temperatures**

Most pathogens do not grow below 5°C, but spoilage organisms do.

Rules for handling raw eggs

- Reputable source/supplier
- Storage - cool and dry < 20°C (if 21 days or older, must be kept under refrigeration)(avoid fluctuating temperatures)
- Stock rotation (if practicable, avoid using eggs older than 21 days)
- Do not accept or use cracked eggs
- Wash hands after preparation
- Avoid cross-contamination (care with whisks/mixers)
- Avoid use of raw shell eggs in products which are lightly cooked or not cooked (use pasteurized egg). For example, mayonnaise, mousse, binders to sandwich fillings etc.
- Cook thoroughly
- Eat quickly/refrigerate
- Use liquid pasteurized egg within code. If opened, treat as fresh, keep refrigerated and use within 48 hours
- Store away from raw meat or strong smelling foods (egg shells are porous)
- Don't re-use left over egg dishes
- NB 'Lion Quality' egg standard
- Eggs laid in the UK by hens vaccinated against *Salmonella* Enteritidis

Examination questions

Subject Temperature control

- 1 a. What foods require temperature control?**
- b. What are the main areas covered by the Food Safety (Temperature Control) Regulations 1995?
Include any exemptions from their requirements in your answer**
- c. How would you ensure that safe temperature standards were maintained in a catering situation?**
- 2. a. Outline the points of control to which you would draw attention when asked for your comments on a barbecue. Food includes burgers, sausages, chicken pieces served with rolls, salad including rice dishes and sauces.**

Subject Food preparation

Domestic kitchens are commonly used in connection with catering businesses

- 3 a. What are the main problems which could be encountered?**
- b. Discuss the various methods available for transporting the food to the various venues and explain which method you consider the best**
- c. Explain what responsibilities the owner of such a business has with regards to registration**
- 4. What are the factors that are likely to affect the safe operation of a general purpose refrigerator in a catering business?**

Good hygiene practices (prerequisite programmes)

This module considers hazards, controls and monitoring from the purchase of food to its service.

Management commitment, and adequate resources are essential for the successful implementation of prerequisite programmes and HACCP.

It is assumed that the following prerequisite are in place at all relevant stages:

- **Satisfactory design and construction of premises and equipment**
- **Adequate facilities (water supply, drainage, waste management, cleaning facilities, storage areas, lighting, ventilation and temperature control)**
- **Approved suppliers**
- **Effective cleaning and disinfection (where appropriate)**
- **Maintenance contracts**
- **Good personal hygiene, training, staff controls, staff vigilance and effective supervision - competent staff**
- **Integrated pest management**
- **Contingency plans**
- **Satisfactory transportation - protects food from contamination and prevents multiplication of micro-organisms**
- **Product information (clear labelling)**





Purchase

Regulation EU 852/2004

Contaminated or decomposed raw material which would remain unfit after normal sorting and hygienic preparation, must be rejected

Hazards

- Contamination (microbiological, physical, chemical and allergenic)

Controls

- Choose safest ingredients
- Use approved suppliers
- Set suitable specifications

Monitoring (checks) and recording

- Audit suppliers' premises/records
- History of deliveries/complaints
- Bacteriological sampling
- Customer references
- Food safety systems in place, including HACCP documentation

Delivery and unloading

Hazards

- Contamination and multiplication

Controls

- Approved suppliers
- **No food exposed to risk of contamination**
- Specific delivery requirements
- Chilled food <5°C frozen food <-18°C (**Refrigerated delivery vehicle**)
- Quick removal to store (<15 minutes)
- Food protected/covered
- Deboxing area

Monitoring

- Food temperatures/time (**reject above 8°C or above -12°C (-15°C for quick frozen food). Inform line manager if any food delivery rejected**)
- Condition of delivery vehicle **and driver (including toxic chemicals)**
- Condition of packaging
- Date coding/**labelling**
- Organoleptic checks on food **where practical (quality and quantity)**
- Condition of canned foods

Food Storage

Regulation 852/2004

All food must be protected against contamination during handling, storage, packaging, display and distribution.

Satisfactory storage of food is important to:

Ensure adequate provision throughout the year

Overcome fluctuations in supply

Take advantage of bulk discounts.

Maintain safety, quality and wholesomeness

Satisfactory temperature control and an effective stock control system are crucial to food safety

Storage conditions

Raw meat and poultry

- **-1° to + 1°C - hang where possible**

Eggs

- **Clean and dry - below 20°C - use within 21 days**

Meat pies, pasties and sausage rolls

- **Below 8°C if nothing added after cooking otherwise below 5 °C**
- **Rotate stock**

Ice cream

- **Below -18°C or -12°C prior to serving**

Milk and cream (includes imitation cream)

- **Below 5°C**
- **Refrigerated on receipt**
- **Stock rotation**

Flour and cereals

- **Clean, dry, cool**
- **Pest proof containers where possible**
- **Sacks etc stored minimum 15 cm off ground**
- **Stock rotation**

Canned foods

- **Clean**
- **Dry**
- **Cool**

Fruit and vegetables

- **Optimum conditions vary with type of fruit**
- **Generally cool and dry**
- **Avoid physical damage**



Chilled food storage

Regulation (EC) 852/2004

Where necessary, to provide suitable temperature controlled handling and storage conditions of sufficient capacity for maintaining foodstuffs at appropriate temperatures to be monitored and, where necessary, recorded.

Hazards • Contamination • Multiplication

NB Some bacteria may multiply slowly in a refrigerator e.g. *Listeria* or spoilage bacteria.

Vacuum packs of meat, fish and other high-risk or perishable products must be stored under refrigeration and used strictly in accordance with their use-by date. Reduced levels of preservatives e.g. in sauce, means bottles should be stored under refrigeration when opened.

Class to discuss types of food stored in refrigerator

Controls

- **Operating temperature** 1°C to 4°C. **Legal temp - food below 8°C (Advise line manager if food is above 8°C immediately)**
- **Alarmed units**
- **Avoid high humidity**
- Separation of high-risk and raw foods
NB Risk of drip from raw meat to salad or high-risk food
- **Separate eggs from high-risk food**
- Cover food
- Stock rotation
- Reject unfit, **contaminated or out-of-date food**
- Do not overload **or exceed load line**
- Do not open the door for longer than necessary
- **Door seals in good repair**
- Effective defrosting (automatic), **cleaning & disinfecting (easy clean construction)**
- No hot food if **temperature of food in refrigerator raised. Cool for 90 mins prior to refrigeration**



- No open cans, **especially acid food**
- Label food when necessary
- **Staff training/supervision**
- **Eggs should be stored cool and dry <20°C and avoid fluctuating temperatures. (If 21 days or older must be stored in fridge)**
- **Maintenance contract**

Monitoring

- Check **and record** temperatures (**thermometer available**)
- **Regular** audit/inspections
- Check condition of food
- Date codes(use-by dates)

Checking temperatures

Check dial temperature at the start of the day and regularly throughout the day. Check and record temperature using an accurate, calibrated digital thermometer at beginning and end of the day. (check warmest part of refrigerator)

Notes



Ambient (dry) storage



Hazards

- Contamination (**especially from pests**)
- Multiplication (**dry products becoming damp**)

Problems

- **Spoilage/mould growth/staleness**

Good hygiene practices

- **Stores should be well lit, ventilated and pest proof**

Controls

- Stock rotation
- Cool (**preferred 10° to 15°C**) and dry
- Clean and tidy (**good housekeeping**) **clear away spillages**
- **Goods** clear of wall and off floor (**15 cm**)
- Rodent proof containers (**protected/covered**)
- No chemicals (**separate store**)
- No incompatible goods (**strong smelling**)
- Care with handling
- Separate deboxing **area prior to storage if possible**
- Suitable shelving (**slatted for ventilation**)

Monitoring

- Audits/inspections
- Date codes
- Condition of food
- Condition of packaging
- Condition of canned food

Defects of cans

Problems - do not use if:

- | | |
|-------------------------|---|
| • Punctured | |
| • Dented | badly/seam damaged |
| • Blown | |
| • Flat sour | acid produced but no gas/swelling of can |
| • Rusty | |
| • Flipper | end bulge pushes back |
| • Springer | end bulge goes to other end when pressed |
| • Soft swell | both ends slightly extended |
| • Hard swell | both ends greatly extended |
| • Hydrogen swell | gas produced with acid fruits |
| • Labels missing | contents unknown |

Blown cans or vacuum packs usually occur because of the production of gas by bacteria or, in the case of cans, the production of hydrogen from the reaction between acid food and the can wall. Food in blown or damaged containers may be contaminated with pathogenic bacteria and should not be consumed.

Unfit, damp, damaged, contaminated or out-of-date stock should be rejected and kept separate. For example, placed in a container marked "unfit for human consumption - do not use".

Controls

- Reputable supplier
- Care in handling
- Stock rotation
- **Catering cans of ham stored under refrigeration**

Monitoring

- Regular audits (**storage conditions**)
- Visual checks (**cans**)



Frozen food storage

Hazards

- Contamination
- Multiplication

NB Bacteria do not multiply in a freezer unless there is serious temperature abuse and thawing of food.

- **Some spoilage organisms can grow as low as -10°C**
- **Enzyme action can cause problems even in frozen food**
- **Contingency for freezer breakdown(prerequisite)**

Controls

- Store -18°C
- Alarmed units
- Reject above **-12°C** or -15°C if quick frozen food (**thaw use as fresh**). **Thawed food not to be refrozen**
- Not above load line
- Effective stock rotation
- Handle carefully
- Suitable packaging (**covered/wrapped**)
- Label with date and description
- **Prevent temperature gain**
- Separate raw and high-risk foods
- **Do not open the door for longer than necessary**

Monitoring

- Check and record temperatures **at least daily**
- Audits and inspections
- Check condition of food
- Date codes

Reject unfit, contaminated or out-of-date food

Storage times

- **Vegetables, fruit, most meat up to 12 months**
- **Pork, sausages, offal, fatty fish, butter, soft cheese up to 6 months**

Problems with prolonged storage

- **Loss of texture, flavour, tenderness and nutritional quality**
- **Rancidity in fatty foods**
- **Freezer burn**
- **Freezing and refreezing**



Thawing frozen poultry



Regulation (EC) 852/2004

The thawing of foodstuffs is to be undertaken in such a way as to minimize the risk of growth of pathogenic micro-organisms or the formation of toxins in food.

Hazards

- Contamination
- Multiplication

Controls

- **Use fresh or chicken portions where possible**
- Separate from high-risk **and other** foods
- Thaw completely (10°C)
Check if thawed completely - pliable, legs flexible, no ice crystals. (Could use probe thermometer).
Refrigerate when thawed (cook within 24 hours)
- **Remove giblets**
- Cook thoroughly
- **Cook stuffing separately**
- Clean **and** disinfect **contact surfaces, including equipment**
- Eat immediately **or as soon as possible after cooking** or rapid cooling (**or keep above 63°C**)
- **Risks of inadequate thawing**
- **Risks of cross-contamination, especially from thawed liquid**
- Minimise handling **of cooked bird, always wash hands after handling**

Thawing

- Thawing cabinet
- Cool, well-ventilated room (around 10°C)
- Cold running water (< 15°C)
- Refrigerator (weight of bird and temperature of refrigerator are critical to thawing time)
- Microwave - as manufacturer's instructions

NB The main danger is failure to thaw completely prior to a predetermined cooking time. Thawing in a refrigerator at around 1-4°C can be very slow and if inadequate time is

allowed the bird may still be frozen in the centre. Thawing overnight, even at around 20°C, is perfectly safe as the temperature of the chicken will be too low for most of the time to allow salmonella to multiply. Salmonella on the surface will be easily destroyed during normal cooking. S.aureus even if present does not compete well with spoilage organisms and will not produce exotoxin below 15°C. The final safeguard is to ensure the coolest part of the bird achieves 75°C during cooking - usually the deep thigh.

Notes



Stock rotation

- Ensures that older food is used first (FIFO)
- Avoids spoilage mould, slime, unfit food
- Avoids wastage
(loss of stock/infestations)
- Guarantees a constant quality
(customer satisfaction)
- Maintains correct stock levels
- Reduces risk of pest infestation

Stock management

- Label accurately - description of products (nuts - allergies)
Specific storage information e.g. below 5°C
- Daily checks - short life foods
- Weekly checks - other foods
- Written stock control records recommended

Coding of food

- Colour coding/**date coding**

Use-by date on perishable high-risk foods

- Considered unfit after date
- Offence to contravene
- Offence to change **or remove** date
- **Food usually stored under refrigeration**

Best-before date(Low-risk food)

- No offence to sell after date if fit
- Manufacturer guarantees quality to this date
- **Foods usually stored at ambient or in a cool, dry store**

Date only valid if storage conditions satisfactory



Food preparation

Regulation (EC) 852/2004

All food must be protected against contamination during handling, storage, packaging, display and distribution.

Hazards

- Contamination
- Multiplication

Sources of hazards

- Food handlers
- Structure
- Equipment
- Environment
- Pests
- Raw food

Good hygiene practices (prerequisites)

Controls

- **Effective** separation of high-risk from raw foods
- Colour coding
- Disposable cloths
- Organisation/workflow
- Minimise time **high-risk food is** at ambient **temperature**
- Minimise quantities prepared **and avoid preparing food too far in advance**
- **Minimise handling**
- **Separate sink for washing raw food**
- **Follow food safety instructions on packaging**

Monitoring

- **Regular** audits/inspections
- Time at ambient
- Temperature of food



Cooking/processing



Hazards

- Contamination (**esp. flies and foreign bodies**)
- Multiplication (**slow cooking**)
- Survival (**pathogens/spores/toxins**)

Sources of hazards

- **Equipment**
- **Environment**
- **Food handlers**
- **Pests**
- **Cleaning chemicals**

Good hygiene practices (prerequisites)

Controls

- Cook **thoroughly** (>75°C)
- **Heat source under whole of pan**
- Stir liquids **regularly**
- **Avoid slow cooking (centre of large boned joints) at low temperatures**
- Care with minced products and rolled joints
- Ensure **frozen poultry is** completely thawed
- Cook near to eating time
- Protect from contamination
- Care **with copper and aluminium pans** (especially for acid food)
- **Follow any food safety instructions on packaging**

Monitoring

- Check **and record** times and **core-cooking** temperatures
 - **use** disinfected probe thermometer
- **Regular** audit/inspections

Microwave cooking

- **Follow manufacturers' instructions**
- **Only use commercial microwave ovens**
- **Stir as instructed**
- **Allow standing time after cooking**
- **Probe to ensure thorough cooking**

Cooling

Regulation (EC) 852/2004

Where food stuffs are to be held or served at chilled temperatures they are to be cooled as quickly as possible following the heat processing stage, or final preparation stage, if no heat process is applied, to a temperature that does not result in a risk to health.

Hazards

- Contamination
- Multiplication - spore germination/**toxin production**

Good hygiene practices (prerequisites)

Controls

- **Legal requirement to cool high-risk food as** quickly as possible, **90-120 mins maximum recommended**
- Reduce bulk (**prior to cooking**)
- **Recommended maximum joint size 2.25 Kg (5lbs)**
- Maximise surface area and maximise temperature differential
- **Use blast chillers if available as they preserve: appearance, texture, flavour, nutritional value**
- **If no blast chiller use a cool, well ventilated store**
- **Stand in a pan in a food sink in cold running water or use ice bath**
- **Use fan blowing over surface of covered food (food raised off surface as most heat lost from base)**
- **For large joints:**
 - American standard
 - < **21°C within 2 hours then**
 - < **7°C within further 4 hours**
 - Campden **F.D.R.A < 50°C within 1 hour then < 12°C within further 6 hrs then < 5°C within 1 hour**
- Refrigerate when close to room temperature **or immediately** after cooling
- Cover/protect food
- **Remember that not contaminating food after**



cooking is paramount - keep separate from raw food

- **Liquids should be stirred and/or decanted to maximum depth of 2.5cm**

Monitoring

- Check **cooling** times/temperatures
- **Regular** audits/inspections

Notes



Reheating and hot holding



Hazards

- Contamination
- Multiplication
- Survival (reheating) **of spores and toxins**

Good hygiene practices (prerequisites)

Controls (reheating)

- **Reheat just before eating**
- **Food should be reheated rapidly to a recommended temperature of at least 75°C and 82°C in Scotland (legal requirement)**
- **Specialist regeneration ovens recommended**
- **Commercial grade microwaves and convector-microwave ovens are also successful**
- **Maintain liquid products boiling for several minutes**
- Minimise bulk (**stir frequently**)
- Never reheat food more than once
- Protect from contamination
- **Serve immediately or hot hold above 63°C**
- **Follow manufacturers' instructions**
- **Avoid long slow cooking at low temperatures**

Controls (hot holding)

- **Hold above 63°C until served.**
- Thoroughly cook **food before hot-holding.**
- Pre-heat **hot holding** equipment (**Bains marie, hot cupboards etc. prior to putting in the food**)
- Minimum quantities
- Protect from contamination
- **Stir liquids frequently**

Monitoring (reheating and hot holding)

- Check **and record** temperatures **and holding** time
- **Regular** audits/inspections

Serving food

Hazards

- Contamination
- Multiplication

Sources of hazards

- Food Handlers
- Structure
- Equipment
- Environment
- Pests
- Raw food
- Customers

Good hygiene practices (prerequisites)

Controls

- Serve quickly (**keep <5°C or >63°C**)
- Minimise time **high-risk food is** at room temperature
(refrigerated buffets preferred)
- Stock rotation
- **Colour coding**
- Small quantities **replenish regularly (provide new containers of food; don't top up)**
- Minimise handling
- Separate staff **for raw/high-risk/ready-to-eat**
- Protect from contamination (**sneeze guards**)
- **Avoid customers handling food (low-dose pathogens)**
- **Serving equipment too long to drop into food containers**

Monitoring

- Check temperatures/times
- **Regular** audits/inspections
- Date codes
- Condition of food

Remove and destroy any product suspected of being contaminated or with damaged packaging

How can customers contaminate open food in retail premises? Suggested answer to include:

- **Sneezing**
- **Coughing**
- **Handling**
- **Spitting whilst talking**
- **Outdoor clothing**
- **Dogs (if allowed into shop)**
- **Smoking (mouth to hand contact etc)**



Cook-chill - the 9 stages

Hazards

- Contamination
 - Multiplication
 - Survival
 - Bulk storage
 - Preparation
 - Cooking
 - Portioning
 - Blast chilling
 - Storage
 - Distribution
 - Regeneration
 - Serving
- Temp control/avoid contamination**
Including portioning if possible
Min. 75°C (70°C for 2 minutes)
Max. 30 mins, better prior to cooking
<3°C within 2 hrs of cooking (2.5 hrs for joints)
At or below 3°C (stock rotation)
At or below 3°C
Insulated containers
Refrigerated vehicles (not used for non-food or raw food)
At or above 75°C , 70°C for 2 mins (82°C in Scotland)
Start reheating within 15 mins of removal from chill (infra-red/ microwave/forced air)
Should start within 15 mins of regeneration (never below 63°C)
Destroy unused

Cook-chill additional safety rules

High standards essential - often used for vulnerable groups e.g. hospitals

- Good quality **raw** materials (**approved suppliers**)
- Specification enforced
- Raw products stored correctly (**temp/contamination**)
- **Refrigerated transport**

Good design

- **Take account of food not subject to cook-chill e.g. frozen peas, cooked gammon, chips, sandwiches etc.**
- Avoid cross-contamination
- **Ensure physical separation of non compatible foods**
- Separate equipment, **e.g. cutting boards for raw and high-risk**

Notes





- Separate staff **for raw preparation and high-risk**
- Controlled thawing (**thawing cabinets 10°C to 15°C**)
- High hygiene standards - **good hygiene practice (prerequisites to HACCP)**
- Good personal hygiene
- Suitably trained staff **especially in relation to control/monitoring of CCPs**
- **Suitable** temp. control **throughout storage/cooking**
- **HACCP system**
- **Date marking**
- **Hygienic food containers**
- **Life 5 days (incl. prep and consumption)**
- **If over 5°C consume within 12 hours**
- **Over 10°C destroy**
- **Regenerate quickly after removal from storage**

Benefits of cook-chill

- It is more cost-effective because:
- Less wastage
- Lower staff turnover
- Fewer staff (centralisation)
- Energy consumption reduced
- Less floor space
- Benefits of bulk purchase
- Better equipment utilisation, 5 day week

Controls

HACCP - essential

Microbiological guidelines

- TVC < 100,000 per gm (2 days at 37°C)
- **Salmonella/Listeria monocytogenes not detected in 25gms**
- *S. aureus* and *C. perfringens* <100 per gm
- *E. coli* (not *E. coli* O157) <10 per gm (100gm samples taken immediately prior to regeneration)

Cook freeze

Hazards

- Contamination
- Multiplication
- Survival

- Bulk storage
- Preparation (**portioning**)
- Cooking (**portioning**)
- Blast freezing (<-5°C within two hours of cooking and the temp is then reduced to -18°C as quickly as possible)
- **Temperature reduced to -20°C**
- **The safeguards built into cook-chill are not quite as stringent for cook-freeze, but high standards of food hygiene are still essential**
- Packaging and labelling
- **The food normally has a shelf-life of 12 months**
- Regeneration (75°C or 70°C for 2 minutes)

Notes



Sous-vide cook-chill

Also known as cuisine sous-vide

A cook-chill process in which food is sealed in a vacuum pack before cooking and chilling (an interrupted catering system)

Hazards

- Contamination
- Multiplication
- Survival
- **Failure in vacuum**
- **Post process contamination**
- **Shelf-life may be several weeks**
- **Therefore psychrophiles a problem**
(*Listeria* and *Clostridium botulinum*)

The process

Raw material:

- **Storage and preparation**
- **Vacuum packing** (anaerobic conditions)
- **Heat-treated by controlled cooking, moist heat, low temp/long time**
- **Rapidly chilled (blast chilled)**
- **Stored <3°C**
- **Reheated for service**

Advantages

- Extended shelf-life
- Less shrinkage
- Enhanced sensory quality
- Improved nutritional value

Disadvantages include

- **Significant capital and operating cost**
- **Limited number of suitable products**
- **Serious consequences if it goes wrong**

Controls

- Rapid cooling
- **Store <3°C**
- Maintain pouch integrity
- ***Cl. botulinum* controlled by preservatives/salt content, a_w , shelf-life, pH and storage temp <3°C**

Ask delegates to list the five most important things they have learnt



31



5

Module 8

Food spoilage and preservation

Aims

To provide an understanding of the causes of food spoilage and preservation techniques to delay spoilage

Key points

Spoilage commences immediately after harvesting, slaughter or fishing

Spoilage may be due to enzymes, bacteria, moulds, yeasts or pests

Rancidity (oxidation), physical damage (bruising or ice formation) or tainting

The rate of spoilage varies with temperature, number of organisms, type of food, competition, acid/alkali balance, available water and the atmosphere

Preservation slows spoilage and multiplication of pathogenic organisms

Low and high temperatures, dehydration, chemicals, controlled atmospheres and physical methods,

Botulinum cook in canning, 121°C for 3 minutes core temperature

Video/DVD

Visual aids

Packages etc. of different preserved foods

Handouts

Examination question (H032)

Group exercise

Ask each member of the class in turn to name a different method of food preservation, continue around the class until the answers are exhausted, record the answers. Ask the members of the group to state why each method works and how effective or limited it is

Quote any additional method they have missed

Module 8



Examination question

Subject Food Preservation

- 1. Explain briefly why it is essential to preserve food**
- 2. Explain why each of the following are effective methods of food preservation:**
 - a) Pasteurization**
 - b) Canning**
 - c) Dehydration**
 - d) Freezing**
- 3. a) Name 6 methods of food preservation**
 - b) Describe in detail the process of milk pasteurization**
 - c) What are the food hazards associated with unpasteurized milk? Explain how pasteurization controls these hazards.**



Causes of spoilage

Natural decomposition commences (at varying rates) immediately food is harvested or slaughtered or taken from the sea. Food is spoiled once it is undesirable to eat
Enzymes produced by bacteria, moulds and yeast

Spoilage may be caused by:

Bacteria - e.g. pseudomonas

Moulds and yeasts

Able to tolerate high pH, low a_w

Autolytic enzymes

E.g. proteolytic enzymes (break down proteins)
tenderise the meat which is why it is better to hang beef for 2 weeks after slaughter

Overripening

Caused by autolytic enzymes

Enzymic browning

e.g. Apple and potato-brown on damaged/cut surface

Biochemical changes

E.g. staling of bread (when dough is baked the starch grains absorb water then swell and soften) occurs when individual starch molecules no longer have the ability to retain water and become crystalline and hard

Physical damage

Bruising, ice formation

Tainting

Foods, especially fatty foods, can absorb smells

Insects and vermin

Stored products, insects may be a problem

Parasites

E.g. liver fluke, *Trichinella spiralis* (problem in Biblical times, hence Jews do not eat pork) *Echinococcus granulosus*

Signs of spoilage

Off odours, discolouration, slime, mould **presence**, texture change, taste deterioration, pest evidence, rancidity, blown cans/packs, gas production

Rate of spoilage

The rate of spoilage is affected by the way in which the food is handled and stored (recap on conditions necessary for microbial growth)

Factors affecting rate

- Age and condition **of food**
- Temperature
- Number **and type** of organisms present
- Type of food
- Damage present
- Competition
- Acid/alkali balance
- Available water
- Atmosphere (**presence or absence of oxygen**)
- **Presence of** preservatives

Spoilage can be delayed by satisfactory storage i.e. dry, chilled or frozen



Types of spoilage

Mould

- Chlorophyll free
- **Produces thread-like filaments** (hyphae)
- **Forms branched network of** mycelium
- Optimum growth temperature 20-30°C
- Can grow as low as -10°C
- Aerobic
- **High humidities and fluctuating temperatures assist growth**
- **Affects most foods**
- **Normally mouldy food is "unfit for human consumption"**
- **Stock rotation and "best before" dates important**
- **Some moulds such as *Aspergillus flavus* can produce mycotoxins**
- **Mould may be various colours including:**
 - **Black spot** **Cladosporium**
 - **White spot** **Sporotrichum**
 - **Green/blue** **Penicillium**
 - **Pink** **Monilia**

Yeasts

- Microscopic fungi
- **Reproduce by** budding
- **Majority prefer** acid foods (pH 4-4.5)
- **Reasonable level of moisture required**
- **Many grow in high concentrations of** sugar and salt
- Growth range 0°C to 47°C (optimum 25-30°C)
- **Most are** aerobic (**obligate and facultative**)
- **Many used in food manufacture**
- **Some cause spoilage**

Spoilage bacteria

- **Lactobacillus**
- **Micrococcus**
- **Clostridium**
- **Pseudomonas**
- **Acinetobacter**
- **Achromobacter**
- **Flavobacterium**
- **Bacillus**



Harmless changes

Salmon

- Struvite crystals
- Ammonium-magnesium phosphate
(dissolve in vinegar)

Grapefruit

- Naringen crystals
- Bitter taste
- White spots

Mandarins

- Hesperidin
- White spots

Notes



Preservation of food

Preservation is the treatment of food to prevent or delay spoilage or growth of pathogens

High temperature

- Pasteurization
- Ultra Heat Treatment
- Canning
- Sterilization
- Cooking (sometimes)

Low temperature

- Above freezing
- At freezing
- Below freezing

Moisture reduction

- Rely upon the water activity(a_w)/available water
- Accelerated freeze drying
- Sun drying
- Artificial drying

Chemicals

- Salt (reduces a_w)
- Sugar (reduces a_w)
- Nitrates or nitrites
 - (curing meat, sodium nitrite/nitrate)
 - helps to retain colour/reduce spoilage
- Sulphur dioxide
 - antioxidant
 - inhibits mould and bacterial growth
- Pickling/acidification
 - Acetic acid (vinegar)
 - Lactic
- Antibiotics
 - Nisin (cheeses and canned foods)
 - strictly controlled

Fermentation

- e.g. Salami, yoghurt, bread and soy sauce

Controlled atmosphere

- Air, oxygen, nitrogen, carbon dioxide and vacuum (sometimes used inadvisably for leftovers)

Smoking

- Hot (treat as high-risk)
 - Cold (treat as raw)
- Smoked products should be stored under refrigeration, especially if in vacuum packs because of the risk of *Clostridium botulinum*

Irradiation



Pasteurization, sterilization and ultra heat treatment (UHT)

Survival of the organism depends on initial numbers, strain of organism, time/temperature used, pH and a_w of food

Pasteurization

- **Relatively** low temperature and time **e.g. milk 72°C for 15 seconds**
- **Liquid egg 64.4°C for 2.5 minutes**
- Destroys pathogens and some spoilage
- Shorter shelf-life
- Slight reduction in vitamins and nutritional value

Sterilization

- Destroys all micro-organisms
- Over 100°C **for a suitable time**
- Prolonged shelf-life
- Greater loss of nutrition and vitamins
- Noted texture and flavour change

Commercially sterile

Not total destruction (low-acid foods etc.)

Ultra Heat Treated (U.H.T.)

- **135°C for 1 second**
- **Will keep several months unopened, without refrigeration**
- Destroys all micro-organisms
- Less **nutritional, vitamin/flavour** problems **than sterilization**

Cooking

Core temperature >75°C



Preservation - Canning

Basic canning process

Raw materials

Inspection/washing/peeling/preparation/blending/
sieving/removal of foreign bodies

Inspection

(Including metal detection and magnets)
Operatives removing physical contamination from
food on an illuminated inspection belt

Can washing

Filling

Sealing

(To create vacuum) and coding of can

Processing

(Botulinum cook) retorts, hydrostatic pressure vessels
or horizontal cookers

Cooling

(Chlorinated water)

Drying

Labelling

Casing and coding(shrink wrapping)

Storage and distribution/sale

Notes



Preservation - canning (2)



Food in hermetically sealed (airtight) container heated to achieve commercial sterility (not total destruction)
The food remains an ideal medium for bacterial growth

Imperative that anaerobic pathogens and spoilage bacteria, that could multiply at normal ambient storage, are destroyed

The closure of the can precludes the entry of micro-organisms but great care is taken post-process to avoid cross-contamination especially when wet

Clostridium botulinum

- Most heat resistant pathogen
- Canning time/temperatures are based on the destruction of spores
- "Botulinum cook", 121°C core temp for minimum of 3 minutes (probability of spores surviving 1 in 10¹²)
- Multiplies at a pH above 4.5
- Vegetables are above 4.5 (low acid foods)
- Fruits are below 4.5 and subjected to reduced process temperatures
- Large catering cans of ham - pasteurized, therefore store under refrigeration

Types of containers

Rigid

Cans/jars

Semi-rigid

Shallow containers with heat sealed lids, often made of plastic or aluminium

Flexible

Laminated plastic films bonded to aluminium foil

Aseptic packaging

E.g. fruit juice/milk

Refrigeration

A means of delaying food spoilage

Spoilage organisms can multiply under refrigeration

Psychrophiles

- Pseudomonas
- Acinetobacter
- Flavobacterium
- Listeria

Moulds

- Penicillium
- Mucor
- Cladosporium
- Enzyme **action continues at a reduced level**
- **Most common food poisoning and foodborne disease organisms are incapable of multiplication or toxin formation under 5°C**
- **Some psychrotropic pathogens are capable of growth and/or toxin formation below 5°C**
 - *Yersinia enterocolitica* (1°C)
 - *Listeria monocytogenes* (0°C)
 - *Aeromonas hydrophila* (1°C)
 - *Clostridium botulinum* type E (3°C)

The growth or toxin formation is, however, slow and can take days/ weeks

Prolonged refrigeration, of e.g. vacuum packs of meat or fish, pâté, soft cheeses, may be a hazard.

The nearer a refrigerator operates to 1°C the better

Consideration should be given to:

- Siting
- Construction and design
- Defrosting and cleaning
- Operating temperatures
- Hot food
- Contamination
- Packing and rotation of food
- Staff responsibilities
- Storage life
- Chilled display cabinets
- Monitoring temperatures
- Selection of units



Freezing

- **Inhibits enzyme reactions and** reduces **available** moisture
- A_W **of ice** at -15°C is 0.85
- **Freezing food** kills **some bacteria** including some pathogens **and parasites** (*Cysticercus bovis*)
- **A gradual reduction of survivors occurs during frozen storage**
- **The lower the temperature the greater the survival rate**
- Spores and toxins are relatively unaffected **by freezing and storage**
- **If foods are quick frozen, ice crystals are smaller than if the food is frozen slowly. This ensures the best quality of the food due to reduced cell damage and less drip on thawing**
- **Domestic freezing takes up to 72 hours**

Methods of freezing

- Tunnel
- Fluidised bed
- **Some vegetables (Individual Quick Freezing IQF)**
 -40°C in 3 to 8 minutes

Air blast

- **Commonest method**
- **Trolleys of boxed product pushed through**
- **Continuous belt type**
- **Spiral belt -30°C to -40°C in 2 to 3 hours**

Cryogenic

Liquid nitrogen, sprayed or dipped

Plate

- **Packed in flat cartons**
- Between **narrow** metal shelves **with circulating refrigerant inside** -33°C in 2-3 hours

Pellofreeze

Liquids and semi solids in **pellet form**

Gyrofreeze

Temperatures around -60°C for a relatively short time



Reduction of water activity/moisture



Survival of micro-organisms

- Most bacteria require an a_w of 0.95 to multiply but may survive in dried foods for many years (NB *S. napoli* in chocolate and *S. ealing* in dried baby milk)
- *S. aureus* will grow at a_w of 0.89
- Spores may also survive and germinate when water or milk added (*Bacillus cereus*)
- Xerophilic organisms, mainly moulds and yeasts, tolerate lower levels of a_w as low as 0.62

Dehydration

- Reduction of available water (a_w)
- Most dried products around 0.6 a_w
- Essential that packaging is air-tight

Methods of drying

Sun drying

- Fruit, vegetables, milk, eggs, fish and meat

Hot air

- More likely to destroy protein, greater flavour changes
- Foods more difficult to reconstitute

Tunnel

Fluidised bed

Roller drying

Spray drying

Warm air (accelerated freeze drying)

- Food is frozen then subjected to vacuum to remove water from food (sublimation)
- Heat applied
- Ice to steam
- Texture and quality of food less impaired
- Rehydrates more readily

Advantages of dehydration

- Lighter weight
- Storage relatively cheap
- Relatively long shelf-life

Disadvantages

- Great care in packaging
- Non-enzymic browning may occur
- Significant change in flavour possible
- Lowering of nutritional value
- Affects vitamins
- Spores survive
- Changes in quality
- Rehydration damages cell walls and increases decomposition rate
- Chemical changes possible

To minimize chemical changes

- Keep moisture level as low as possible
- Minimise the level of reducing sugars
- Use clean blanching water
- Use sulphur dioxide as a preservative
- Store at low levels of relative humidity

Fermentation (acidification)

- Lactic acid produced in food by lactic acid bacteria
- Reduces a_w and pH
- Salami, yoghurt and soy sauce

Salt

- Used since ancient times, effectiveness depends on concentration
- Reduces available water by osmosis

Added

- By rubbing into surface of meat
- By soaking in a brine solution
- By injecting into meat
- As ingredient
- By layering (fish)

Sugar

- Sucrose acts similarly to salt, but requires 6 times the concentration
- Moulds and yeast can survive up to 60% of sucrose
- If artificial sweeteners are used as alternative, care must be taken (NB botulism in yoghurt)
- Sugar is an energy source for nitrite reducing bacteria



Curing

- **Use of salt, sugar and other chemicals e.g. nitrites/nitrates**
- **Especially** meat and fish
- **Sodium nitrite stabilises haemoglobin/mycoglobin - red colour**
- **Used in pasteurized hams to combat production of botulinum toxin**
- **Care taken when using nitrites direct as they can react with amines to form nitrosamines (some are carcinogenic)**

Curing of bacon

Traditional

- **Sides chilled (24 hrs), injected with brine**
- **Packed in vats, covered in salt or brine solution**
- **Removed after 4/5 days and stacked for at least 7 days at 7°C to 9°C**

Rapid curing

Arterial pumping, multiple injection, tumble method

Smoking

- Food suspended over smouldering hardwood, **e.g. ash (may be used after curing or brining)**
- Adds flavour
- Dries food at surface (temp up to 71°C)
- Chemicals **in wood include phenols, aldehydes and creosols**
- Destroys **most non-sporing** vegetative bacteria
- Antioxidant on fat
- **Hot smoking - treat fish as high-risk**

NB *C. botulinum* spores and mould may survive
- therefore store <3°C

Cold smoking of fish

- **Gutted - washed - salted - brined - smoked**
- **6 hours at 27°C and 15 to 20 mins at 33°C**
- **Treat fish as raw**

Store smoked products under refrigeration





Chemicals

Wide range used to prevent

- Microbial spoilage
- Chemical deterioration
- Mould growth
- Additives strictly controlled by legislation
- Maximum permitted levels are usually specified
- In UK a positive list is utilised (only those specified to be used)
- Modern trend to reduce chemical preservatives, extreme caution should be taken so that any risk is dealt with effectively

Benzoic acid

- Occurs naturally in some foods (cranberries)
- Normally used in high-acid foods to inhibit moulds and yeast
- Excess benzoate can cause an unpleasant burning taste

Sorbic acid/potassium sorbate

- Only effective in high-acid foods to inhibit moulds and yeasts
- Used in hard cheese, bread, jam, syrup and cakes

Sulphur dioxide/sulphite

- Use as gas, liquid or as a salt
- Antioxidant - inhibits moulds and bacteria
- Used in wine, beers, fruit juice, sausages etc.

Acetic acid

- Lowers pH below normal growth range
- Some yeasts and moulds are unaffected
- Pickling using acetic acid (vinegar), pH must be below 4.5 throughout

Sodium and calcium propionate

Active in low-acid foods such as bread, cheese and grain etc.

Antibiotics

- Strictly controlled
- Nisin is sometimes used in cheese and canned foods
- Nisin is destroyed in the stomach, overcoming drug resistance problems

Controlled/modified atmospheres (MAP) - gas flushing



Modifies normal gas composition

(O₂ 20%, CO₂ <1%, N 79%)

e.g. 10% CO₂ provides 70 day shelf-life for chilled beef

2-10% CO₂ used for storage of fruits

Possible example

- **Reduced amount of oxygen, higher nitrogen and carbon dioxide therefore - bacterial growth slows (both spoilage and pathogens)**
- **Mould growth slowed**
- Enzyme action reduced
- Oxidation reduced

Vacuum packing

- All air removed
- Prevents **oxidative** rancidity
- Chilled storage **essential for cooked meats and fish** (<5°C)
- Controls **strict** aerobes

Risk

Growth of anaerobes especially germination of *C. botulinum* spores and growth of vegetative organisms

If shelf-life >10 days additional controls required in addition to storage temperatures (<5°C)

e.g. Heat 90°C for 10 minutes (or equivalent)

pH <5 throughout the food

salt level of 3.5% and a_w less than 0.97

Bacterial counts can increase from 1,000 to 10,000,000 after:

- 39 days at 2°C
- 20 days at 5°C
- 7 days at 15°C

Irradiation

("Cold pasteurization process")

Food subject to ionising radiation e.g. gamma rays from cobalt 60, X-rays or high speed electrons

Max dose 10kgy (to limit adverse effects)

- **Food commonly irradiated: chicken, fish, fruit, onions, potatoes, spices and strawberries**
- **UK only plant licensed for irradiation of spices**

Advantages

- **Shelf-life extended**
- Destroys vegetative bacteria, moulds, yeasts and insects, inhibits sprouting **e.g. potatoes**, delays **fruit** ripening **and** inactivates parasites
- No temperature rise
- **Products such as fish remain "fresh"**
- Packages/frozen foods **may be treated**

Main disadvantages

- **Enzymes not deactivated**
- **Encourages oxidative rancidity in fatty foods**
- **Long term effects on consumer unknown**
- **Some nutritional loss, particularly vitamins**
- **Absence of test to determine if food is irradiated**
- **Some undesirable flavour changes e.g. dairy products**
- **May lead to premature softening in some fruits**
- **Spores and toxins not destroyed (at levels used)**
- **Type E *Cl. botulinum* can produce toxins more rapidly than in non-irradiated fish**
- **Food of poor bacteriological quality and shelf-life may be irradiated to disguise fact**
- **Complacency - reduction in hygiene standards as relying on irradiation**
- **Spoilage organisms easily destroyed - therefore less competition for pathogens if food contaminated**
- **More dangerous mutants of pathogens may be formed**

Ask the delegates to list the five most important things they have learnt



32



5

Module 9

Design and construction of food premises and equipment

Aims

To provide an understanding of satisfactory design and construction of food premises and equipment and their importance in maintaining high standards of food safety

To explain the importance of linear work flow

Key Points

Site selection and good design and materials, are essential

Segregate clean and dirty (raw and high-risk)

Linear (continuous) workflow

Suitable washing and disinfecting facilities

Potable (drinking) water

Well lit and ventilated

Suitable drainage and waste management

Adequate washing equipment

Adequate methods of disinfection

Equipment clean and in good condition

Colour coding where appropriate

Video/DVD

Visual aids

Photographs

Examples of suitable finishes

Handouts

Well designed kitchen illustration (HO34)

Examination questions (HO35)

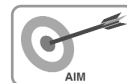
Group exercise

List requirements when building a restaurant on a green field site or when converting an existing building

Complete waste management control chart (HO33)

Design features of a food premises e.g. kitchen, small factory or retail premises

Module 9



Waste management control chart

Hazards - bacteriological and physical contamination

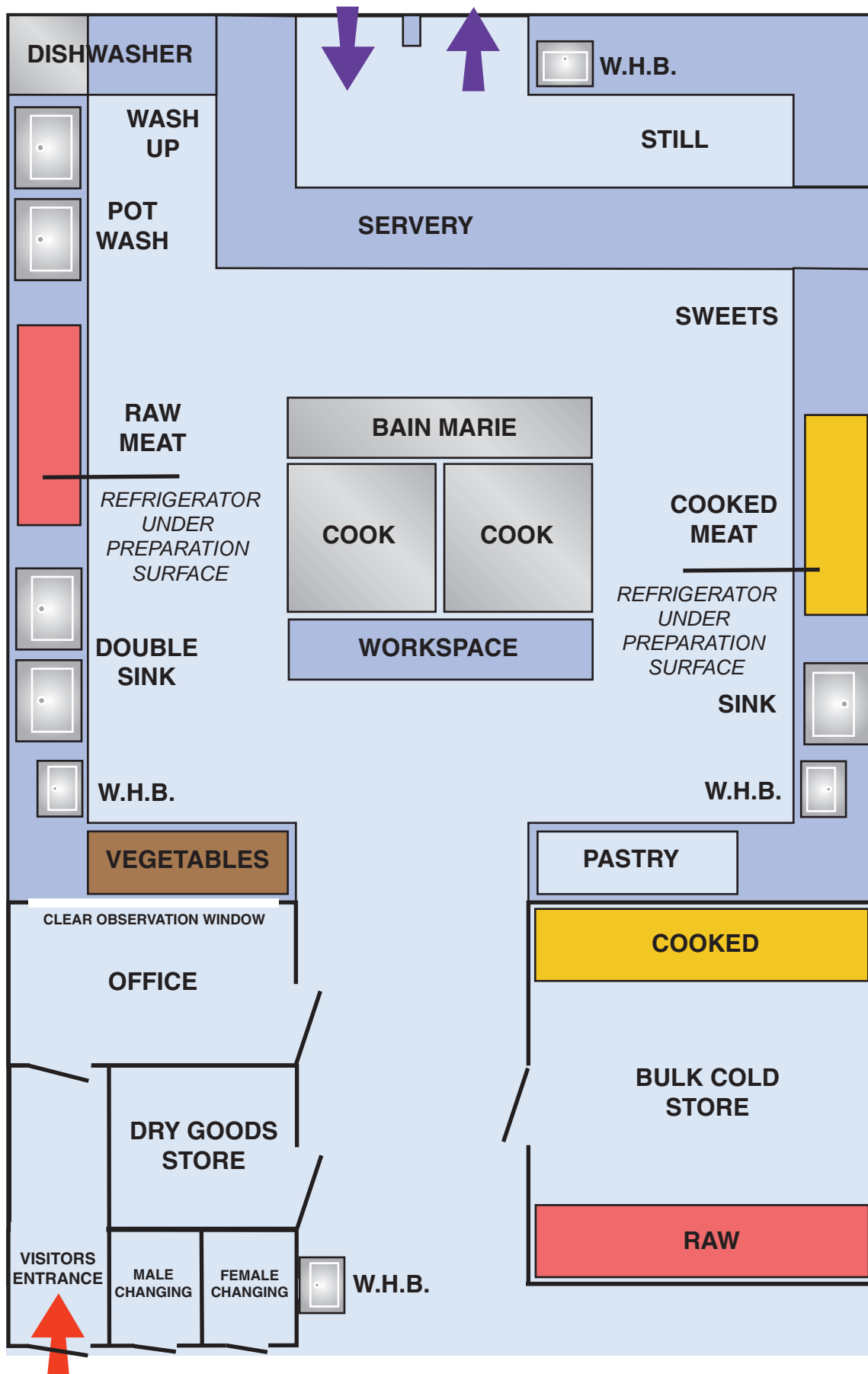
Sources and/or causes of hazards	Controls	Monitoring	Corrective action

Waste management control chart

Hazards - bacteriological and physical contamination

Sources and/or causes of hazards	Controls	Monitoring	Corrective action
<p>Overflowing waste receptacles attracting pests</p> <p>Uncovered external waste containers attracting pests</p> <p>Decomposing/maggot infested waste</p> <p>External waste storage containers wrongly sited</p>	<p>Suitable and sufficient waste receptacles</p> <p>Staff vigilance/training/supervision</p> <p>Supervision (waste not allowed to accumulate).</p> <p>Site external waste areas to minimise risk of contamination to food/food equipment or staff</p>	<p>Regular checking of systems/procedures and waste containers</p> <p>Competency testing of staff/supervisors</p> <p>Audits</p>	<p>Discard contaminated food</p> <p>Refresher training of staff/supervisors</p> <p>Improved supervision/instruction</p> <p>Provision of new waste receptacle</p> <p>Change system to reduce amount of waste produced</p> <p>Increase frequency of collection</p> <p>Resite external waste storage areas</p>

Well designed kitchen



Examination questions

Subject Design and construction



- 1. You are employed by a large company who wish to convert a disused warehouse into a food supermarket, write notes on the following:**
 - a) Site services**
 - b) Structural surfaces**
 - c) Washing facilities**
 - d) Temperature controlled storage**
- 2. Write short notes on the factors you would take into account when considering the size and layout of a kitchen**
- 3. A supermarket is replacing its counters in areas for selling raw meat, raw and cooked fish and delicatessen products.**
 - a) Outline the design features to ensure food safety**
 - b) Describe the key points to include in the staff training programme**

Site selection

Services

- Electricity
- Gas
- Water supply
- Effluent disposal
- Waste disposal
- Roads
- Transport

Problems to be avoided

- Flooding
- Chemicals
- Odour
- Dust
- Pests

Also regard should be had to the premises in the neighbourhood so as not to cause nuisance from:

- **Noise**
- **Odour**
- **Traffic etc.**

Notes



Design of food premises

Regulation (EC) 852/2004

The layout, design, construction and size of food premises shall:

- a. Permit adequate cleaning and/or disinfection, minimize airborne contamination and provide adequate space
- b. Prevent accumulations of dirt, condensation or mould growth. Materials must be non-toxic and non-flaking
- c. Permit good hygiene practices and prevent cross-contamination especially from pests
- d. Provide suitable temperature conditions for food handling and storage, including monitoring and recording

General principles of design:

Segregation of clean and dirty processes

Where possible post-cook and pre-cook separation
Deboxing area

Continuous workflow

Distances travelled by raw materials, utensils, containers, waste material, packaging material and staff should be minimised

Personal hygiene facilities

Should be appropriate to each process area

Washing and disinfection facilities

Positioned where appropriate

Temperature control facilities

Provided and positioned where appropriate

Readily cleansable surfaces

Suitable for disinfection where necessary

Pest precautions

Access and harbourage must be denied

Yards and roads well surfaced

Adequate drainage and refuse storage

Staff welfare facilities

Dependent on number of staff

Good lighting

Suitable and sufficient

Suitable ventilation

Mechanical where required



Construction of food rooms



Regulation (EC) 852/2004

Suitable and sufficient natural or mechanical ventilation is required. Mechanical airflow must not be from a contaminated (dirty) area to a clean area. Filters and other parts requiring cleaning must be readily accessible. Adequate natural and/or artificial lighting must be provided. Adequate drainage facilities which do not expose food to contamination must be provided. There must be an adequate supply of potable water. Ice used in food and drink must be made from potable water

Internal finishes

Non-toxic, durable, easy-to-clean and maintain. All surfaces must be maintained in sound condition

Ceilings

Washable, non-flaking, smooth, easy to clean, resist condensation, light coloured, fire resistant, coved, suspended ceilings an advantage

Walls

- Smooth, impervious, non-flaking, durable, light coloured, coved; avoid voids and internal cavities (pests). Easy to clean and disinfect
- Protect as necessary (corners)

Lighting

Suitable and sufficient; 150 lux in storerooms, 500 lux in preparation areas, diffusers recommended

Ventilation

- Suitable and sufficient; temperature below 25°C
- Adequate air changes to remove odours, condensation etc.
- Flow from clean to dirty areas

Doors and windows

- Self-closing doors, handles to allow disinfection, pest proofed and fly screens as necessary
- Avoid glare. Windows preferably north facing

Floors

Anti-slip, impervious, chemical resistant, without crevices, suitably drained, coved at junction with wall, easy to clean, durable

Services

- **Pipes to allow access for cleaning or be concealed, or flexible where feasible; waterproof sockets etc.
Potable water, external water supply**
- **Adequate drainage, trapped gullies, pest-proofed**
- **Grease traps, flow from clean to dirty**

Notes



Washing facilities

Regulation (EC) 852/2004

An adequate number of accessible wash-hand basins and flush lavatories must be provided. Lavatories must not lead directly into food rooms and must have adequate natural or mechanical ventilation. Wash-hand basins must be provided with hot and cold, running water, materials for cleaning hands and hygienic drying. Separate food washing facilities must be provided, where necessary. Adequate changing facilities must be provided for personnel.

Hand washing (Personal Hygiene)

Easily accessible, adjacent to entrance, separate in clean and dirty areas, near sanitary accommodation
Non-hand operable taps recommended

Food washing

Separate to wash-up sinks where practical, may have cold water only

Equipment washing/cleaning/disinfection

Provide adequate facilities, two sinks preferable to one, flexible services

Cloakrooms and lockers

Adequate for outdoor clothing
Two compartments (own/work clothing) recommended

Sanitary conveniences

Adequate facilities, well lit, well ventilated, no direct communication with food room, **adjacent hand washing facilities**

Waste disposal

Food waste and other refuse must not be allowed to accumulate in food rooms. It must be deposited in appropriate containers which must, where necessary, be easy to clean and disinfect. Adequate provision must be made for the removal and storage of waste.
Refuse stores must be kept clean and pest proof.
Stores must be designed so as not to contaminate food, water, equipment or premises.



Internal

Refuse collectors should not enter food rooms; remove waste at least daily; foot-operated lids or open (risk of contamination). Polythene sacks

Care when siting waste disposal units

External

Store containers on hard base capable of being cleaned, keep clean; all receptacles must have tight-fitting lids, be durable, cleanable and kept clean

Compactors

Drainage

Suitable

Group to complete waste management control chart

Notes



Work Flow

Storage, cooking, serving

- Clearly identified and separate flows need to be considered
- All should be unidirectional where possible
- Avoid backtracking
- Avoid crossover
- Distance travelled by the following should be minimised

Product

- High-risk
- Raw (contaminated) food

Personnel

Separate personnel for each area is preferred

Utensils, equipment and containers

Separate washing areas preferred

Waste

- Plan routes carefully
- Plan location carefully

Notes



Kitchen design

Significantly influenced by the purpose for which it will be used

Size required - consider

- Type of operation and frequency of deliveries
- Number of meals prepared (breakfast, lunch and dinner)
- Number of sittings at each meal
- Provision of additional external catering e.g. banquets
- State of raw materials, ready prepared vegetables, cooked ham, pastries, gateaux etc.
- Extent of menu (table d'hote/a la carte) prepared in advance or in the evening
- Equipment used
- Operating system e.g. traditional, microwave or cook-chill
- Extent of ancillary functions, e.g. dishwashing (use of disposable cutlery and crockery etc.)
- Use of ready prepared chilled or frozen
- Maximum output e.g. Christmas meals

Design and layout - characteristics

- Work flow from deliveries, storage, preparation, cooking, assembly, hot holding to service
- Consider cleaning of production equipment and services (crockery and cutlery)
- Minimise distance staff need to walk, especially in relation to safe procedures. Make the safest way the quickest way
- Areas allocated according to compatibility
- Good working conditions, effective lighting and ventilation, adequate accessible wash-hand basins and staff changing facilities
- Ensure compliance with food and health and safety legislation
- Adequate space for contingency in event of essential equipment breakdown (may require "spare" refrigerator or oven)
- Mobile equipment, consider connections/cleaning
- Provision of services; gas, electricity, water and drainage
- Use of standard-size equipment



Equipment

Regulation (EC) 852/2004 requires that food contact equipment and fittings:

- Are kept clean (disinfected) at frequency to avoid any risk of contamination
- Constructed to minimize risk of contamination
- Enable thorough cleaning/disinfection
- Can be disinfected where necessary
- Installed so equipment and surrounding area can be cleaned

In addition the following is recommended:

- Easy to clean
- Smooth
- **Moveable to facilitate cleaning**
- Durable
- Lacking crevices, **ridges, projections and sharp edges, and** no recesses
- Non-toxic/non-tainting
- Non-porous(**impervious**)
- Non-flaking
- Corrosion resistant
- **Suitable for intended use**
- **Regularly maintained**

**Colour coded where appropriate
(avoid cross-contamination)**

Suggested:

- | | |
|----------|----------------|
| • Red | Raw meat |
| • Blue | Fish |
| • Yellow | High-risk |
| • Green | Salad |
| • White | Dairy |
| • Brown | Raw vegetables |

e.g. Cutting boards, knife handles, cloths, cleaning equipment and protective clothing.

Defective equipment should not be used. Use of soft, open-jointed wood is unacceptable. Hard wooden boards in good condition are better than some plastic boards e.g. polyethylene. Use food grade stainless steel or polypropylene.

Ask each delegate to list the five most important things they have learnt



35



5

Module 10

Cleaning and disinfection

Aims

To provide an understanding of the principles and importance of cleaning and disinfection of food premises

To provide an understanding of the systems of monitoring cleaning and disinfection necessary to assist in ensuring the production of safe food

Key Points

Effective cleaning and disinfection essential

Properties and functions of detergents and disinfectants

Cleaning presents significant hazards when carried out badly

Should reduce risk of contamination

Staff involved in cleaning **MUST** be trained

Disinfect food and hand contact surfaces

Disinfect cleaning equipment regularly and always after use

Good cleaning schedules help to ensure effective cleaning, and assist 'due diligence'

Effective management of cleaning techniques is essential

Video/DVD

Visual aids

Cleaning equipment and chemicals

Handouts

Definitions (cleaning) (HO36)

An example of a cleaning schedule (HO38)

Examination questions (HO39)

Group exercise

Groups to complete cleaning control chart (HO37)

Groups to discuss the methods available for monitoring standards

Module 10



Cleaning definitions

Cleaning	The application of energy to a surface to remove dirt and grease. Energy may be physical, thermal or chemical.
Detergent	A chemical used to remove dirt, grease and food particles.
Disinfectant	A chemical used to reduce micro-organisms to a safe level, can be hot water at 82°C for 30 seconds.
Sanitizer	A detergent and disinfectant combined.
Sterilizing	The process of destroying all micro-organisms and their spores.

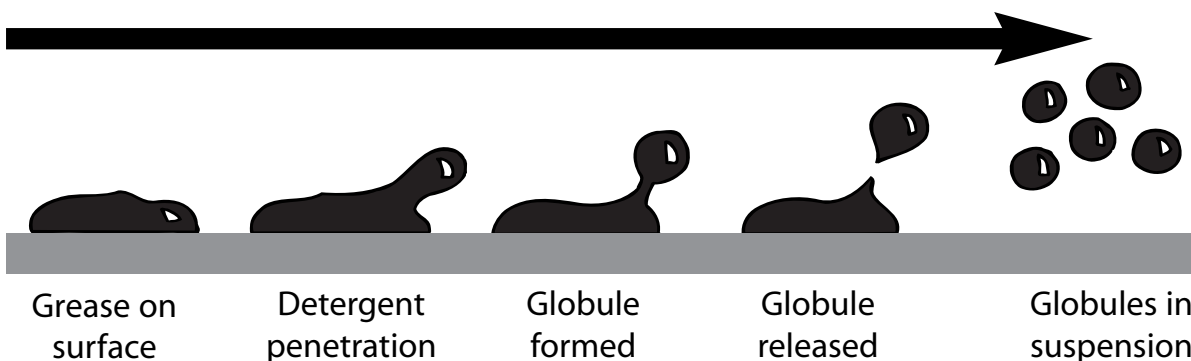
Cleaning in place (CIP)

The circulation of non-foaming detergents and disinfectants (or sanitizers) through assembled equipment/pipes.
Mainly brewing and dairy industry.



Detergent action

The reduction of surface tension enables detergent solutions to penetrate dirt and grease and lift them from the surface to form a suspension



Cleaning control chart

Hazards - Bacteriological, chemical and physical contamination. Survival of pathogens

Sources and/or causes of hazards	Controls	Monitoring	Corrective action

Cleaning control chart

Hazards - Bacteriological, chemical and physical contamination. Survival of pathogens

Sources and/or causes of hazards	Controls	Monitoring	Corrective action
Cross-contamination from contaminated cleaning equipment and/or cleaning raw food areas before high-risk areas	Effective cleaning and disinfection (use schedules) Clean and disinfect cleaning equipment after use Use separate cleaning equipment for high-risk and raw food areas Effective training/instruction and supervision of cleaning staff	Audit/check cleaning schedules ATP/swabbing Competency testing of staff/supervisors	Discard/destroy unfit food Change cleaning schedule Improve training/instruction/supervision Provide additional cleaning equipment
Failure to destroy pathogens	Follow manufacturer's instructions Correct chemicals/contact time	Audit/inspection ATP/swabbing	Re-clean and disinfect surfaces/equipment Change cleaning chemicals/equipment Improve training/supervision/instruction
Chemical contamination of food e.g. tainting with phenols	Effective training/instruction and supervision Follow manufacturer's instructions Store cleaning chemicals separately	Competency testing Audits/inspections	Discard/destroy contaminated food Improve training/supervision/instruction Change storage arrangements
Physical contamination of food from cleaning equipment e.g. bristles from brushes	Use the right cleaning equipment in good condition	Inspection of cleaning equipment	Replace/repair equipment Discard/destroy contaminated food

Equipment/surface:

[illegible]

Equipment/surface:

[illegible]

First aid:

Inhalation:

Ingestion:.....

Skin contact:.....

Eye contact:

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Manager: Date:

HIGHFIELD CLEANING SHCEDULE


(C15)

Club:
Equipment/surface:
Date issued: 6th January 2005

FLOORS

Cleaning method	Frequency	Time required	Chemical and dilution	Equipment required	Protective clothing	Safety precautions
Ensure all food etc. removed	Daily and as required	30 mins	Degreaser X	Brush and pan	Gloves	Erect warning sign
Remove loose debris or deposits			1: 40	Bucket and mop	Safety glasses	advising of wet floor
Make up cleaning solution with warm water				Scrapers		
Mop thoroughly with a clean mop				Warning signs		
Leave for 5 minutes contact time						
Mop over surface with clean hot water						

Equipment/surface: REFRIGERATOR A

Cleaning method	Frequency	Time required	Chemical and dilution	Equipment required	Protective clothing	Safety precautions
Make up sanitizing solution in clean bucket	Weekly and as required	1 hour	Sanitizer Y	Bucket and cloth	Gloves	Erect warning signs
Switch off and disconnect plug			1: 20	Abrasive pads		
Wash hands and transfer food to refrigerator B				Warning signs		
Remove shelves for cleaning in sink						
Wipe down all surfaces with clean cloth						
including handles and seals using sanitizer Y						
Allow 20 minutes contact time						
Rinse with clean water and allow to air dry						
Replace shelves						
Reconnect, switch on and reload when temperature satisfactory						

First aid: Inhalation:
Ingestion:
Skin contact:
Eye contact:

Manager: Date

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Examination questions

Subject Cleaning



1.

- a) Explain how a cleaning schedule is a benefit to food premises**
- b) What are the main components of a cleaning schedule?**
- c) What is a disinfectant?**
- d) What precautions would you take regarding the use of cleaning chemicals?**

2. Write short notes on:

- a) Hypochlorites**
- b) Detergents**
- c) Sanitizers**

3.

- a) Define disinfection**
- b) What should be included in a cleaning schedule?**
- c) i) What are the benefits of cleaning?
ii) How would you ensure standards of cleaning were satisfactory?**

The hazards & benefits of cleaning

Hazards from cleaning

- Cross-contamination (redistribution of contamination)
- Chemical contamination (including tainting)
- Failure to remove/destroy micro-organisms

Reasons for cleaning (benefits)

- Reduces the risk of food poisoning
- **Less wastage**
- Removes **bacteria and** food on which bacteria grows
- To enable disinfection
- Aids pest control (removes food - pests discouraged/easier to see)
- Removes physical contaminants
- Removes dirt and grease
- **More customer confidence** (promotes favourable image)
- To comply with the law
- Fewer customer complaints
- Pleasant and safe environment
- Less breakdown **of equipment**
- Less **machine** wear/damage

Bactericide

A substance which destroys bacteria

Cleaning

The application of energy to a surface to remove dirt and grease (energy may be physical, chemical or thermal)

Detergent

A chemical used to remove dirt, grease and food particles

Disinfectant

A chemical used to reduce micro-organisms to a safe level e.g. bleach (also hot water at 82°C for 30 seconds or steam)

Sanitizer

A detergent and disinfectant combined

Sterilizing

The process of destroying all micro-organisms and their spores

Discuss 'clean as you go'

Keep work surfaces clean and tidy whilst working
Clean equipment such as slicing machines immediately after use
Clear up spillages immediately



Cleaning and detergents

Cleaning

The systematic application of energy to a surface or substance with the intention of removing **waste**, dirt and **grease**

Dirt/soiling

- **Organic** - fats, proteins and sugars
- **Inorganic** - waterscale and milkstone

Energy is available for cleaning in three distinct forms

- Kinetic - physical, mechanical, turbulence
- Thermal - hot water
- Chemical

Saponification

Process of making soap e.g. by boiling vegetable oils with an alkaline chemical such as caustic soda; soap is anionic

Sequestrant

- **Counteracts effect of water hardness**
- **Salts** - prevent scum

Detergents

- **Chemicals or mixtures of chemicals made of soap or synthetic substitute**
- **Remove grease and other soiling**

Three main characteristics

- Surfactancy (**wetting power**)
(**surfactants may be anionic +ve or cationic -ve charged and should not be mixed**)
- Dispersion
- Emulsifying **action (suspension)**

Available as powders, liquids, gels, foams

Alkaline (caustic soda) or acid (never mix with bleach - chlorine gas)

Group discussion - Properties of detergents



General characteristics

- **Non-toxic, non-tainting, non-irritant and non-corrosive**
- **Free rinsing and non-scum forming in hard water**
- **Soluble in water**

Cost-effective cleaning

- **Choose correct chemical**
- **Apply at optimum temperature and concentration**
- **Allow time to function**
- **Use it with correct equipment**

Cleaning, on its own, does not kill bacteria but may remove most

Remember cleaning equipment can be a source of contamination





Disinfection

- Removal of bacteria to a safe level
- Does not **usually destroy bacterial spores**
- **It usually follows cleaning**
- **Can combine with cleaning using a sanitizer**

Heat

- **Dry heat destroys cells by dehydration and oxidation**
- Hot Water (**wet heat causes coagulation of cell proteins**) **88°C for 15-90 seconds, 82°C for 30 seconds**
- Steam

Bleach(hypochlorite)(oxidises proteins)

Cheap, wide spectrum of activity, unaffected by hard water, pungent, corrosive, no surfactancy, inactivated by organic soiling

Quaternary ammonium compounds (QACs)

Safe, odourless, stable and non-corrosive, inactivated by hard water, organic material and some plastics

Amphoterics

Alcohols ("dry" disinfection)

Biguanides

Iodophors

Surfaces requiring disinfection

- Food contact **e.g. food utensils/equipment**
- Hand contact/**touch points e.g. handles on drawers**
- Cleaning materials and equipment (**don't leave soaking overnight**)
- **Fruit and vegetables, when consumed raw**
- **The hands (only when essential)**

Sanitizing = cleaning and disinfection

Read manufacturer's instructions

- **Presence of food residues, dirt, grease or detergent may prevent effective disinfection**
- **Effectiveness of disinfection determined by bacteriological monitoring (swabbing) and ATP, not by visual inspection**

Group discussion - Properties of disinfectants

When choosing a disinfectant

It should be:

- Broadbased
- Not affect equipment adversely
- Non-toxic, non-tainting and non-irritant
- Able to kill the target micro-organisms required
- Act in the contact time available (varies)
- Odourless and tasteless
- Cost-effective



Choice of disinfectant depends on:

- Amount of soiling
- Type of cleaning equipment
- Water hardness
- Contact time available
- Micro-organisms to be destroyed
- Type of surface (smoothness/imperviousness)
- Stability
- Likelihood of taint
- Temperature of application
- Toxicity - effect on personnel (safety)
- Ionic nature of detergent used before disinfection (never mix anionic and cationic)
- Method of application (care with resistance of bacteria - always use a fresh solution of adequate strength/performance on clean surfaces)

Notes



Six stage cleaning and disinfection



Work surfaces etc.

Pre-clean

- Sweeping
- Wiping
- Scraping
- Pre-rinsing
- Pre-soaking

Main clean

- Detergent - loosen main soiling

Intermediate rinse

- Removal of loose dirt, neutralisation or removal of residue

Disinfection

- Destruction of residual micro-organisms (if required)

Final rinse

- Removal of disinfectant residues (not always required)

Drying

- Removal of final rinse water
- Air drying preferred
- Stored to prevent contamination

Stages 2, 3 and 4 can be combined when using a "sanitizer"

Discuss the way in which the coloured cutting boards are all stored together in the last illustration.

Washing crockery (two sink method)

Similar to above with following comments

- Pre-clean
- Main clean, hot water 45 - 55°C
- Intermediate rinse
- Disinfection (Chemical - around 65°C) Can be hot water >82°C for 30 seconds. NB safety risk and condensation/mould growth
- Final rinse if chemical used
- Air drying and inverted storage

Mechanical dishwashing

Machines are effective at disinfection as well as cleaning

Procedure as follows:

- Pre-clean/scrape/rinse
- Pack machine efficiently
- Wash between 49 and 60°C
- Rinse cycle 82 - 88°C (Disinfection)
- Remove racks
- Allow to air-dry and inverted storage

Four stage pre-cleaning and sanitizing

- Pre-clean
- Sanitize
- Rinse (**may not be necessary**)
- Air dry and storing to prevent contamination

Class to discuss storage together of different coloured cutting boards(as shown on acetate)

Different coloured cutting boards and utensils should not be washed in the same sink at the same time or in the same water unless they are being disinfected. However, it is preferable to disinfect boards used for raw food separately from those used for ready-to-eat or high-risk food.



Management of cleaning

Cleaning schedule

- Must be clearly and concisely written
- **The entire premises should be covered**
- **All equipment/surfaces included**

Written schedules should specify:

Surface

- What **is to be cleaned**
- How **it is to be cleaned (method)**
- When **it is to be cleaned**
- **How much time is to be allowed**
- **What standard is required**

Person

- Who **cleans it**
- **What protective clothing should be worn**
- What precautions should be taken
- **What specific risks are identified**
- **What monitoring is used e.g. bacteriological**
- **Who monitors** standard and records
(assessment of cleaning - visual/swabs)

Chemical

- **What chemicals are to be used (type and amount)**
- Dilution (**dosing**)
- Contact time
- Storage

Equipment used for cleaning

- **Foams and gel applicators**
- **Dosing aids**
- **Pressure jet cleaners**
- **Mechanical aids - scrubbers and scarifiers**
(heavy floor cleaners with built in detergent tanks)
- **Mops, cloths (disposable), brushes**
- **Storage**

Safety of cleaning

- **Always follow manufacturers instructions**
- **Wear protective clothing as necessary**
- **Store chemicals safely**
- **Always use proper container, never dispense into, for example, lemonade bottle**
- **Place safety cones on floor if wet**
- **Never mix chemicals**

After cleaning, clean and disinfect the cleaning equipment and wash your hands



Cleaning in place (CIP)

The circulation of non-foaming detergents and disinfectants through process equipment in the assembled state.

Used in:

- Dairies
- Breweries
- Potable liquid manufacturers
- Uses turbulence, heat and chemical energies to attain a satisfactory result
- Careful design with CIP in mind is essential

Typical CIP sequence consists of 5 steps

- Pre-rinse **removes gross soil**
- Detergent circulation **removes residual debris and dissolves grease/soiling**
- Intermediate rinse **cold water**
- Disinfectant circulation **destroys remaining organisms**
- Final rinse **cold water**

Notes



The cleaning and disinfection of a meat slicer



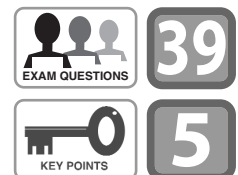
Only trained staff over the age of 18

- Switch off power and unplug
- Set the slice thickness control to zero
- Dismantle
- Pre-clean
- Use dishwasher for removed parts **where possible**
- Otherwise use hot water at approximately 55°C and detergent. **Use a clean cloth/brush**
- The blade should be cleaned **with hot water and detergent in situ or adjacent to the slicer. If removed, a blade carrier should be used - care at all times**
- Disinfect in 'second sink' **or with chemical disinfectant - allow appropriate contact time**
- Reassemble
- Disinfect with spray, parts that have been handled **during reassembly**
- Check guards and test machine, **carry out any adjustments**
- Switch off, unplug and cover with clean cloth **or similar**
- Supervisor to check

Cleaning contractor

- **May be required occasionally for deep clean**
- **Dismantling equipment**
- **Use of dangerous chemicals**
- **Cleaning of ventilation ducts (fryers)**
- **Difficult areas e.g. bottom of lift shafts, dumb waiter**

Delegates to list the 5 most important things they have learnt



Module 11

Integrated pest management

Aims

To provide an understanding of the hazards and controls involving food pests

To provide an understanding of integrated pest management

Key points

Pests can spread disease

Many prosecutions and closures result from pest problems

Staff training to recognise and respond to signs of pests is essential

Proofing and good housekeeping prevents many problems

Physical controls are preferred to chemical control

Competent contractors are required for chemical control

Always monitor the pest control contractor

Video/DVD

Uninvited Guests

Visual aids

Pests and photographs

Bait, bait boxes, traps

Handouts

Life cycle of fly and cockroach (HO40)

Denial of access (HO41)

Role of supervisor (HO43)

Information from pest control company (tutor to provide)

Examination questions (HO44)

Group exercise

Groups to complete 'pest control chart' (HO42)

Groups to design a pest control contract

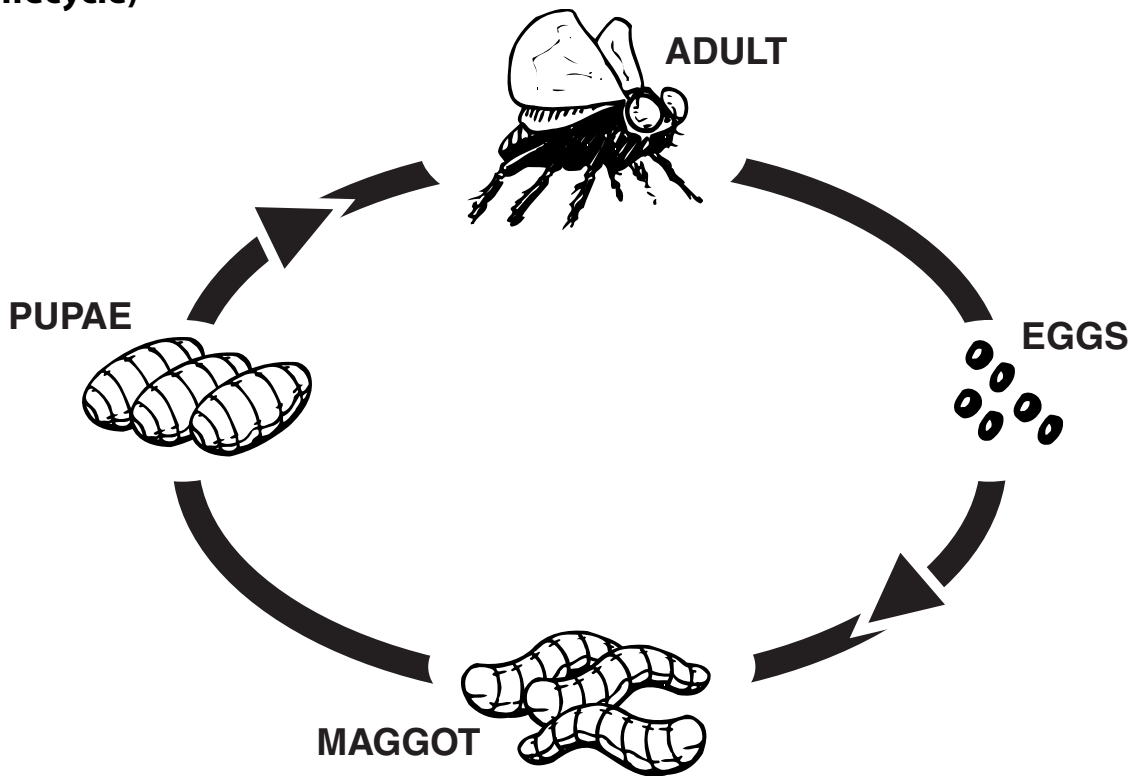
Groups to suggest how effective monitoring of the pest control contractor can be organised

Module 11

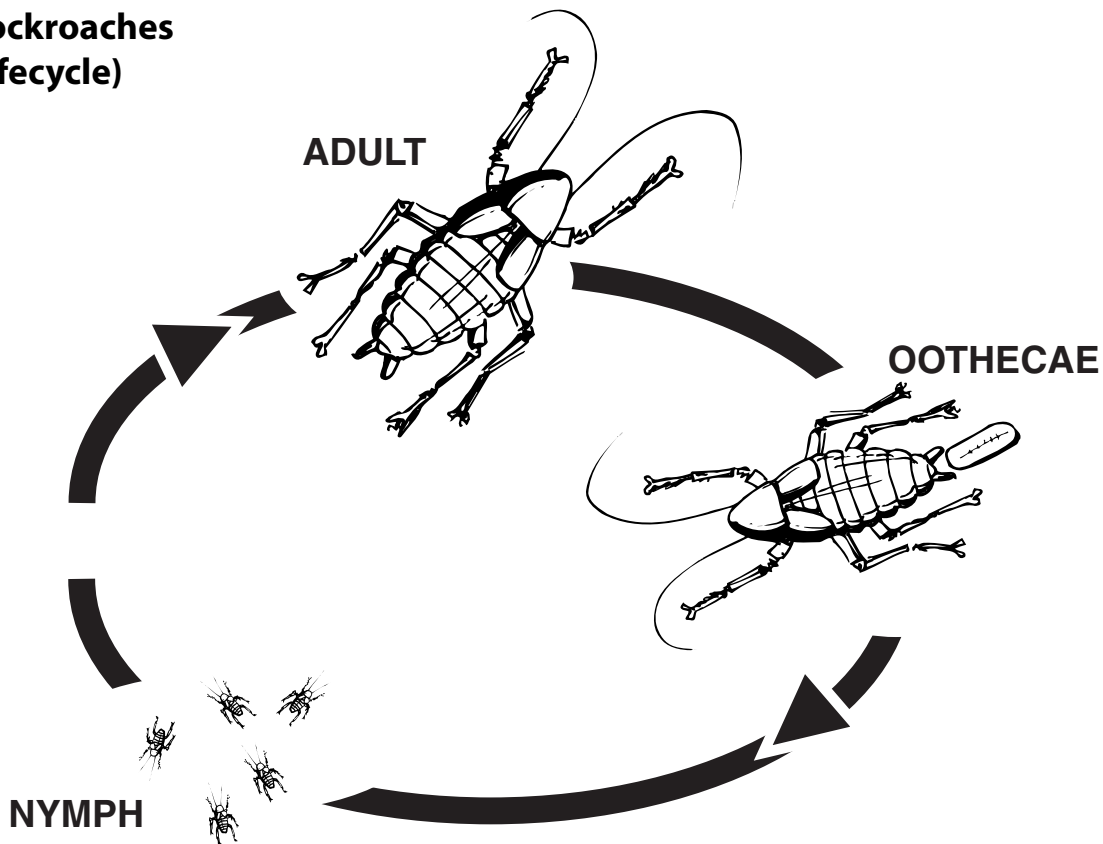


Pest control

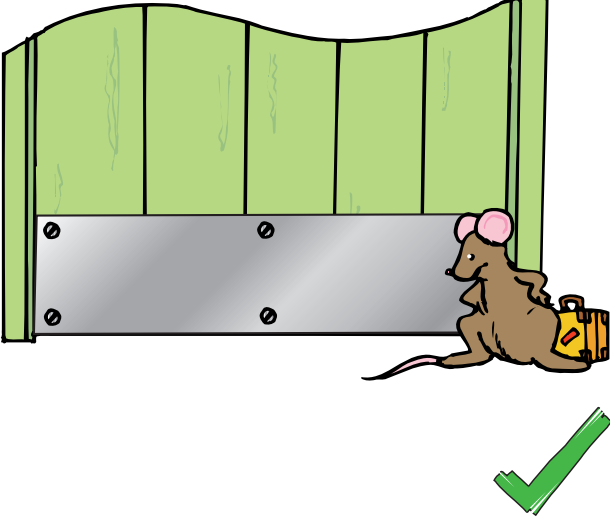
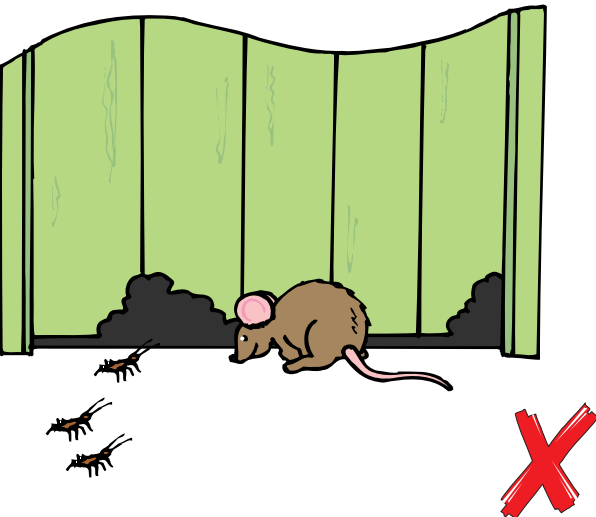
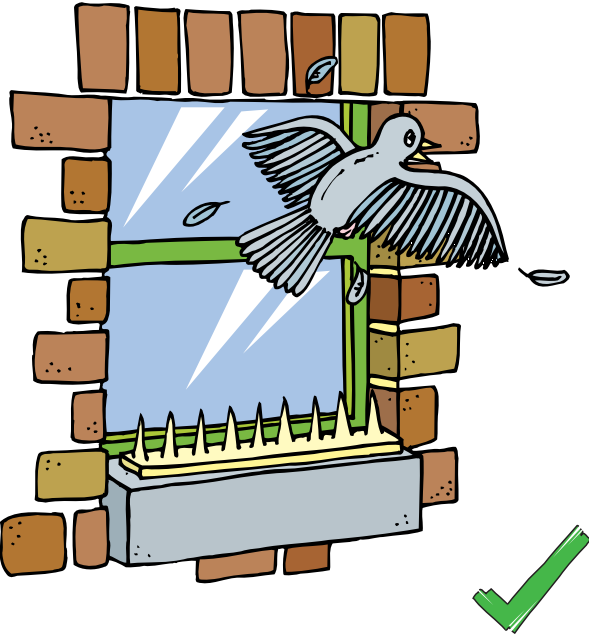
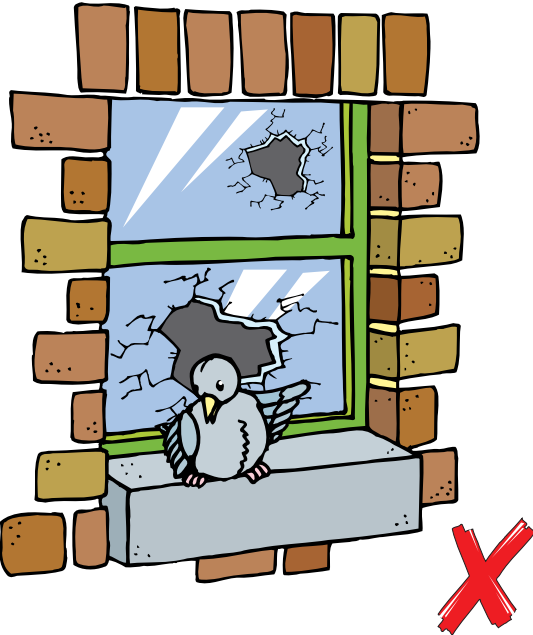
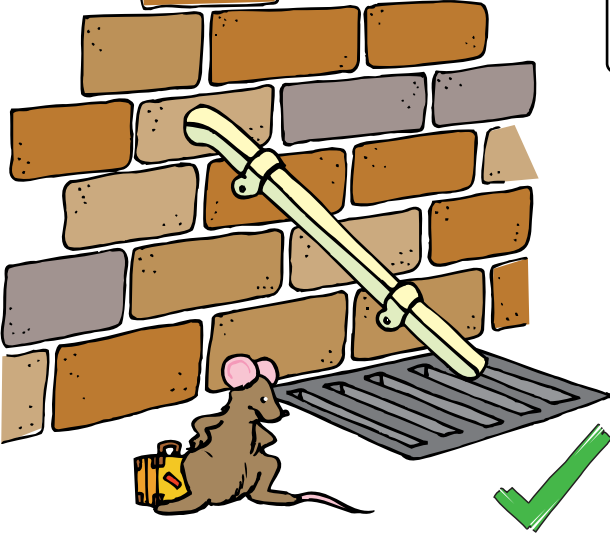
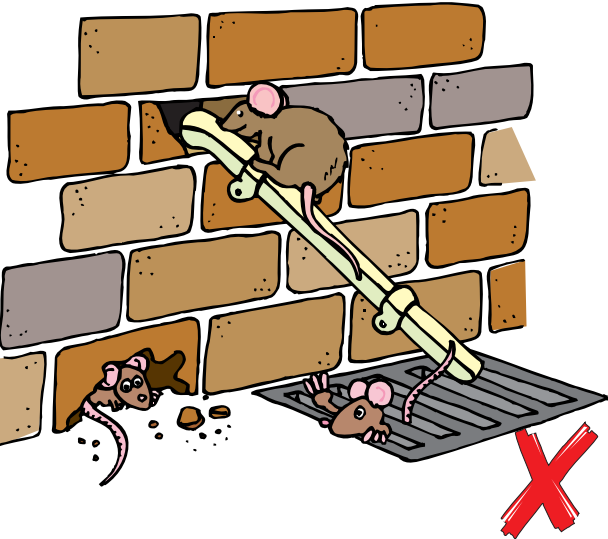
Flying insects e.g. flies (housefly, bluebottle) wasps (lifecycle)



Cockroaches (lifecycle)



Denial of access



Pest control chart

Hazards -

Bacteriological and physical contamination(from pests).

Chemical from pesticides

Sources and/or causes of hazards	Controls	Monitoring	Corrective action

Pest control chart

Hazards - Bacteriological and physical contamination(from pests). Chemical from pesticides

Sources and/or causes of hazards	Controls	Monitoring	Corrective action
Contamination of food and food contact surfaces from pests	Integrated pest management, including effective maintenance, proofing, good housekeeping and control. Food stored in pest proof containers Use of reputable pest control contractor Staff vigilance/reporting/training Store products off floor and away from wall. Don't leave undisturbed for prolonged periods.	Regular audits/inspections Check pest control book Check EFks/baitboxes Check customer complaints	Segregate/reject/destroy contaminated food Thorough cleaning and disinfecting of contaminated surfaces, especially food and hand contact surfaces Call in, or replace, contractor Issue new procedures/instructions to staff Implement recommendation from pest control contractor Improve, training, instruction, motivation and supervision of staff Replace defective U/V tubes in EFks
Flies dropped out of EFks onto food or food contact surfaces	Position of EFks Remove food etc. before treatment Clean surfaces after treatment Use reputable contractor	Audit/inspection Inspection/observation	Reposition EFks (Destroy contaminated food) Discard/destroy contaminated food Issue new instructions Replace contractor
Contamination of food or food contact surfaces with pesticide			

Examination questions

Subject Pest control



1.

- a. List 5 pests associated with problems in the food Industry**
- b. Why are these five pests a problem?**
- c. How would you help to ensure that such infestations were prevented?**

2. How can food be contaminated by:

- a. Mice?**
- b. Birds?**
- c. Pesticides?**

3.

- a. List and explain the ways in which a food premises can be protected from an infestation by rats**
- b. State 5 conditions to be imposed on a contractor before signing an agreement**
- c. Outline the proprietor's responsibilities to keep his food business free of rats, even though a contractor is employed**

Food pests

Regulation (EC) 852/2004

Adequate procedures must be in place to ensure pests are controlled.

Food premises and refuse

Stores must be designed to prevent access by pests

A food pest is:

'An animal, insect or bird which lives in or on man's food and is noxious, destructive or troublesome'

Signs of infestation

Rodents

Brown rat
Black Rat

House mouse



Rat droppings(>1cm), mouse droppings (<5mm)
Bodies, spillages, sighting, food loss
Damage to structure, food and packaging (gnawing). Noise, nests, smell, footprints, fur, smears and runs

Insects

Flies

Wasps

Cockroaches

- Oriental

- German

Psocids

Stored product insects:

- Flour beetle

- Larder beetle

- Grain weevil

- Mill moth

- Flour moth

- Mites

- Pharaoh's ant

- Silver fish



Bodies, pupae, larvae (maggots) and eggs

Bodies, nymphs, moultings and oothecae (egg cases) Faecal smears, droppings and smell

Bodies, pupae, larvae and eggs
Insect trails in dust e.g. flour beetles

Holes in grain, or packaging
Webbing (moths/larvae)
Frass (small piles of dust/material)

Birds, cats, dogs (wild or pets)



Pests require

- Food (some require water/moisture e.g. rats)
- Shelter
- Security

NB some pests, such as cockroaches, prefer to live in the dark.

Group exercise

Groups to list signs of rodents, cockroaches and stored product insects

Notes



Reasons for control

To prevent disease

Rodents

Salmonella/typhoid
E. coli O157
Leptospirosis (Weil's)
Cholera
Trichinosis/parasites

Insects

Salmonella
E. coli O157
Dysentery

To prevent contamination - bacterial and physical

Contaminants

Rodents

Droppings
Bodies/feet
Urine/saliva
Hairs
Nesting material

Insects

Droppings(flies/
cockroaches)
Bodies/feet
Pupae/larvae/eggs
Regurgitation (flies)
Webbing (moths)

NB Also birds - contaminants; feathers, nests and mites, droppings

Food wastage

Contaminants/spillage/consumption

Damage

- Gnawing of cables/pipes (flooding, fires, gas leaks)
- Structural damage/ foundations/drains

Lost custom

Complaints

Staff losses

All of the above affect profits

Legal requirement

Regulation (EC) 852/2004

Windows that can be opened must, where necessary, be fitted with insect-proof screens, which can easily be removed for cleaning.

The Food Hygiene (England) Regulations 2006

- Sale of unfit/unsatisfactory food
- Prevention of damage by Pests Act 1949



Integrated pest management

The cost-effective implementation of prevention and eradication strategies, based on the biology of pests, intended to ensure a pest-free food operation. **Emphasis is placed on non-toxic solutions and least toxic treatments**

Environmental control

PREVENT ACCESS

- Good design - **minimise cavities and voids**
- **Traps to drainage system**
- **Provision of lobbies**
- **Keep windows and doors closed where appropriate**
- Check deliveries
- **Reduce harbourage**
- **Clear surrounding vegetation (breeding sites)**

PROOFING/MAINTENANCE

- **Windows, (fly screens), doors and eaves**
- **Replace broken windows**
- **Maintain all drains and water taps in good order**
- **Self-closing devices on doors**
- **Plastic strips/air curtains**
- **Improvement to structure of premises**
- **Defective roofs**
- **Pipes removed from walls, holes around pipes**
- **Gaps under doors (use brushstrips), kick plates**
- **Report any maintenance defects to your supervisor**

Denial of food and harbourage

GOOD HOUSEKEEPING

- **Premises and refuse areas should be kept clean**
- **Food covered where appropriate**
- **Effective stock rotation**
- **'Clean as you go' policy**
- **Food not left outside**
- **Food stored off floor and away from walls**
- **Pests are denied favourable conditions**
- **Pest-proof containers where appropriate**
- **Regular audits**
- **Staff alert and well trained**

STAFF TRAINING

- **Trained to recognise pests and signs of pest activity**
- **Advise supervisor of poor housekeeping or remedy**
- **Report pests/signs of pests to supervisor immediately**
- **Any surfaces on which rodents may have walked should be disinfected before use**
- **Contaminated food segregated and disposed of**



Eradication

Physical control

Pest caught dead or alive

Preferred to poisons and includes:

- Fly killers u/v **light**/electric **grid**/sticky (**care in siting, regular emptying, change tube annually**)
- Cockroach **monitoring** traps
- Rodent traps (live or dead) - **useful for monitoring**
- Hormone (**pheromone**) traps, (**moths and wasps**)
- **Bird** mist nets

Do not encourage pests by feeding birds or other animals

Class discussion - effective and safe siting of electronic fly killer. Use of sticky fly papers in non-public areas e.g. dry storage rooms

Chemical control

- Rodenticides
Solid blocks, paste, bait and powders, narcotizing
- Insecticides (knockdown or residual - **break life cycle**)
Dusts, baits, gels and sprays, fumigation

Use a reputable pest control contractor

The use of pest control contractors does not absolve managers from their responsibility of keeping premises pest free

Risk of contamination from:

- Dead pest **ending up in food**
- Pesticides

NB Rodents dying in inaccessible places (odour/fly problem)

Food which is contaminated must be immediately segregated and/or destroyed



Rodents

Spread of disease

- **Salmonella**
- ***E. coli***
- **Typhoid**
- **Typhus**
- **Clostridium**
- **Trichinosis**
- **Leptospirosis (Weil's)**

Transmission methods

- **Consumption of food contaminated by rodent urine or droppings**
- **Contact with rat urine (Weil's disease)**
- **Eating undercooked pork (Trichinella)**
- **Parasites which live on rats**
- **Rat bites**

Identification, signs of infestation

- Droppings
- Bodies
- Sightings, smell or noise
- Holes and nests
- Food loss
- Gnawed food, food packaging or structure
- Smears
- Fur and footprints, tail marks etc.

Treatment

- Rodenticides:
 - Chronic (**multiple feed**) (anticoagulants includes **warfarin**)
 - Acute (**single feed**) also toxic to humans
e.g. alphachloralose
 - Contact **dust or gel** includes **bromadiolone**
- Tracking powder
- Traps
- Rodent sticky boards



Insects

Spread of disease including:

Salmonella, *E. coli*, typhoid, clostridium, shigella

Flies

Methods of contamination

- Regurgitation of stomach contents
- Faeces, bacteria from feet, hairs on body and legs, pupal cases, eggs, larvae
- Dead bodies

Treatment and prevention

- Good housekeeping
- Proofing
- **Lobbies**
- **Self-closing doors**
- **Cover** refuse - areas clean and tidy
- **Electric fly killers** (care when siting)
- **Sticky fly papers** (not in public areas)
- **Insecticides** (with appropriate care)

Cockroaches

Methods of contamination

- Bodies dead or alive
- Faeces
- Mouth parts
- Egg cases
- Nymphal moults
- Contamination of food contact surfaces after visiting sewers/refuse

Treatment and prevention

- **Good housekeeping**
- Check goods on arrival
- **Sound building structure**
- **Seal crevices**, particular care with pipes through walls
- **Clean drains and gullies**
- **Cockroach traps** (detection)
- **Specific residual insecticides**
- **Contact dust, gels**
- **Examine roof voids, cellars etc. regularly**



Stored product insects (SPI)

- A large group of insects which attack foodstuffs
- Includes:
Beetles, weevils, moths, mites and their larvae
- Foods:
Cereals, flour, beans, dried products
- **These insects have no direct health significance**
- **They do cause great economic loss**
- **Infestations often difficult to detect**
- **Many are nocturnal**

Signs of infestation vary with insect, can include:

- Strands of webbing (**Flour Moth**)
- Holes in food (**Biscuit Beetle**)
- Frass (**Larder Beetle, Grain Weevil**)
- Trails in dust (**Confused Flour Beetle**)
- Bodies

Treatment

Varied, dependent on:

- **Type of insect**
- **Source of infestation**
- **Size of infestation**
- **Location**

By specialist pest control company

- **Fumigation of food/warehouse (methylbromide)**
- **Specific insecticides (with great care)**
- **Destroy all the food**

NB In 2005 Insect-o-cutor launched 'cryonite' which uses low temperature carbon dioxide to freeze insects to death. It has been applied to successfully to control stored product insects, for example, in machinery. Helps maintain a pesticide free environment and avoids chemical contamination.



Birds

Birds such as:

Sparrows, pigeons, starlings

Other specific reasons for bird control

- Contamination from feathers and nesting material
- Source of insect and mite infestation
- Prevent blockage of gutters etc.
- Prevent defacement of buildings
- Prevent damage/soiling of food packaging

Methods of control

External

- Elimination of ledges and perches (design stage if possible)
- Good housekeeping, **especially in the waste food area**
- Use thick inert gels or sprung wire systems to prevent perching on ledges (repellents)

All openings proofed including:

(Use 15mm galvanised chicken wire or nylon netting)

- Roof apex
- Open eaves
- Louvres
- Ventilation openings

Internal

- Scaring devices - **loud bangs/flashing lights**
- **Thick inert gels**
- Traps - **some success with pigeons**
- Shooting - **used with care**
- Narcotizing, **alphachloralose** - **protected species released - licence required**
- Mist netting, **very fine fitted over door openings etc.** - **protected species released, licence required**



Pest control contractor

Integrated pest management

- Type of pest
- 24 hour cover
- Trained and experienced staff (**in the food industry**)
- Methods and materials/frequency of visits
- Professional body member (**reputable**)
- Written report/recommendations

Staff/management responsibility

- **Trained to recognise signs**
- **Report problems to supervisor and in "pest control book"**
- **Advise contractor if problem (quick and accurate)**
- **Accompany contractor**
- **Report poor housekeeping to supervisor**
- **Record bait box positions**
- **Respond to recommendations**
- **Nominated person to check work has been done**
- **Manager always responsible for keeping premises pest free**
- **Contractor does not absolve managers of responsibility**

Role of supervisor in pest management

- **A responsibility to assist in ensuring the provision of a proactive pest control management (due diligence)**
- **To routinely inspect vulnerable areas for pest infestation**
- **Advise/instruct staff to recognise pests/signs of pests**
- **To ensure thorough checking of all relevant deliveries (food/packaging/laundry)**
- **To notify the authorised pest control contractor (and manager) if evidence of infestation**
- **To ensure the contractor does not expose food to risk of contamination (no spraying where open food/food preparation)**
- **Ensure cleaning of food-contact surfaces etc after spraying**
- **To ensure food/hand contact surfaces are cleaned prior to food handling/sale/preparation when there has been a risk of contamination, for example, mice infestation overnight-cleaning first thing in morning**
- **To report/act on defects, such as broken windows, doors/ windows left open and defective tubes on electric fly killers**
- **To accompany contractor (after survey/treatment completed)**
- **To remedy poor housekeeping- maintain high standards of hygiene**
- **To know how to deal with bait/dead bodies**
- **To act on recommendations of contractor**
- **Check or arrange for bait boxes/traps to be checked regularly, to be aware of bait box positions**

Record keeping

- **Ensure all records of visits/actions are maintained and the correct number of visits are undertaken**

Delegates to list the five most important things they have learnt



Module 12

Supervisory management

Aims

To provide the knowledge to enable managers to effectively control and monitor their staff and food safety systems

To provide an understanding of HACCP and the knowledge to implement an effective food safety management system based on the principles of HACCP.

Key points

Managers have a key role in food safety

Standards ensure consistency and customer satisfaction

Food safety policies should demonstrate the company's commitment to operate high standards and produce safe food

QC is reactive and QA is proactive

HACCP/food safety management systems identify hazards, the implementation of controls and monitoring and corrective action, provides documentation, verification and review to ensure safe food production

Bacteriological monitoring/sampling assists in the provision of food safety

Video

Critical steps to food safety or HACCP how the system works

Visual aids

Handouts

- The role of the supervisor in securing food safety (HO45)
- Definitions (HACCP) (HO46)
- Legal requirement for HACCP (HO47)
- Safer food better business (HO48)
- 7 HACCP principles (HO49)
- Stages in the implementation of HACCP (The HACCP study) (Codex logic sequence) (HO50)
- HACCP control chart (HO51)
- Codex CCP decision tree (HO52)
- Generic flow diagram for catering (HO53)
- Examination questions (HO54)

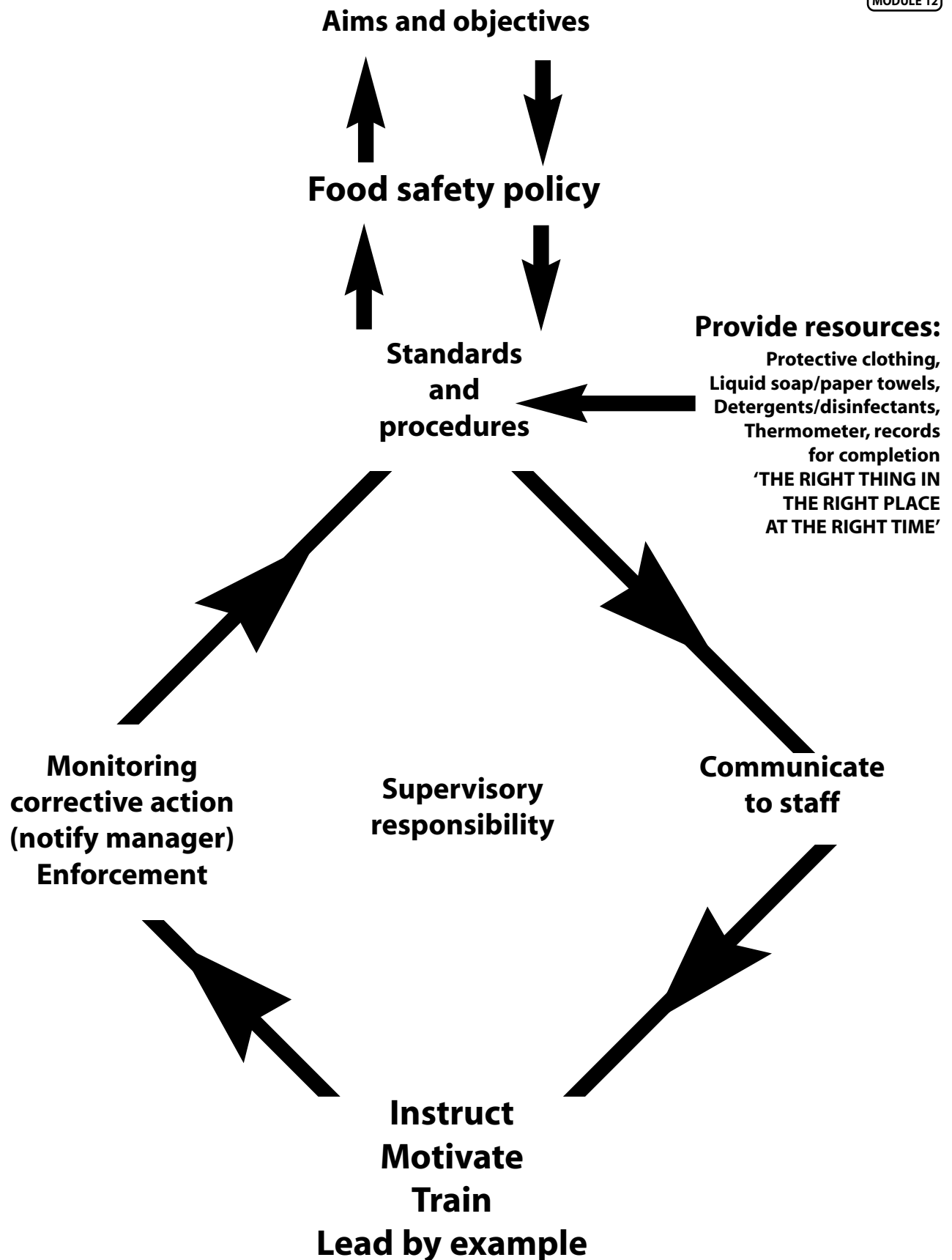
Group exercises

Describe the contents of a food safety policy

Groups to progress through the various steps required to complete the HACCP control chart - limit number of steps



The role of the supervisor in securing food safety



Definitions (HACCP)

Acceptable level	The presence of a hazard at a level that is unlikely to cause an unacceptable health risk.
Control measures	Actions or activities required to prevent or eliminate a food safety hazard or reduce it to an acceptable level.
Control point	A step in the process where control may be applied, but a loss of control would not result in an unacceptable health risk.
Corrective action	The action to be taken when results of monitoring at a CCP indicate a loss of control i.e. a critical limit is breached.
Criteria	Specified characteristics of a physical (e.g. time or temp), chemical (e.g. pH) or biological (e.g. sensory) nature.
Critical control point (CCP)	A step in the process where control can be applied and is essential to prevent or eliminate a food safety hazard or reduce it to an acceptable level.
Critical limit	A monitored criterion which separates the acceptable from the unacceptable.
Decision tree	A sequence of questions to determine if a step in the process is a critical control point.
Deviation	Failure to meet a critical limit.
Flow diagram	A systematic representation of the sequence of steps or operations involved with a particular food item or process, usually from receipt of raw materials to consumer.
Food business	Means any undertaking, whether for profit or not, and whether public or private, carrying out any of the activities related to any stage of production, processing and distribution of food.
Food safety management system	The policies, procedures, controls and documentation that ensure the food sold by a food business is safe to eat and free from contaminants.
HACCP (hazard analysis critical control point)	A food safety management system which identifies, evaluates and controls hazards which are significant for food safety.
HACCP plan	A document prepared in accordance with the principles of HACCP to ensure control of hazards which are significant for food safety of the food chain under consideration.
Hazard	A biological, chemical or physical agent in, or condition of, food with the potential to cause harm (an adverse health effect) to the consumer. (NB most biological hazards are microbiological.)
Hazard analysis (Codex)	The process of collecting and evaluating information on hazards and conditions leading to their presence to decide which are significant for food safety and therefore should be addressed in the HACCP plan.
Microbiological hazard	The unacceptable contamination, the unacceptable multiplication, the unacceptable production or persistence of toxins and/or the unacceptable survival of pathogenic micro-organisms in food. (Includes bacteria, viruses, parasites, protozoa and moulds).

Definitions (HACCP)

Monitoring	The planned observations and measurements of control parameters to confirm that the process is under control and that critical limits are not exceeded.
Prerequisite programmes	The good hygiene practices a business must have in place before implementing HACCP, to enable the HACCP plan to concentrate on the most significant hazards.
Review	A reassessment of the HACCP system to ensure its continued validity.
Risk	The likelihood of a hazard occurring in food.
Risk assessment	The process of identifying hazards, assessing risks and severity and evaluating their significance.
Severity	The magnitude of the hazard or the seriousness of the possible consequences.
Target level	Control criterion that is more stringent than the critical limit, and which can be used to reduce the risk of a deviation.
Tolerance	The specified degree of latitude for a control measure, which if exceeded, requires immediate corrective action.
Validation	Obtaining evidence that elements of the HACCP plan are effective, especially the critical control points and critical limits.
Verification	The application of methods, procedures and tests, and other evaluations, in addition to the monitoring, to determine compliance with the HACCP plan. (Includes prerequisite programmes.)

Legal requirement for HACCP

REGULATION (EC) No 853/2004 ON THE HYGIENE OF FOODSTUFFS Requirements in relation to HACCP

Article 5

1. Food business operators shall put in place, implement and maintain permanent procedures based on the following HACCP principles:
 - (a) identifying any hazards that must be prevented, eliminated or reduced to acceptable levels;
 - (b) 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;
 - (c) establishing critical limits at critical control points which separate acceptability from unacceptability for the prevention, elimination or reduction of identified hazards;
 - (d) establishing and implementing effective monitoring procedures at critical control points;
 - (e) establishing corrective actions when monitoring indicates that a critical control point is not under control;
 - (f) establishing procedures, which shall be carried out regularly, to verify that the measures outlined in subparagraphs (a) to (e) are working effectively; and
 - (g) establishing documents and records commensurate with the nature and size of the food business to demonstrate the effective application of the measures outlined in subparagraphs (a) to (f).

When any modification is made in the product, process, or any step, food business operators shall review the procedure and make the necessary changes to it.

Paragraph 1 shall apply only to food business operators carrying out any stage of production, processing and distribution of food after primary production and those associated operations listed in Annex I.

Food business operators shall:

- (a) provide the competent authority with evidence of their compliance with paragraph 1 in the manner that the competent authority requires, taking account of the nature and size of the food business;
- (b) ensure that any documents describing the procedures developed in accordance with this Article are up to date at all times;
- (c) retain any other documents and records for an appropriate period.

ANNEX 11 Chapter XII Training

Food business operators are to ensure:

1. that food handlers are supervised and instructed and/or trained in food hygiene matters commensurate with their work activity;
2. that those responsible for the development and maintenance of the procedure referred to in Article 5(1) of this Regulation or for the operation of relevant

- guides have received adequate training in the application of the HACCP principles; and
3. compliance with any requirements of national law concerning training programmes for persons working in certain food sectors.

HACCP and Safer food better business (SFBB)

Flexibility and HACCP

Regulation (EC) 852/2004 requires food business operators to put in place a food safety management system based on HACCP principles, **to control significant hazards at steps in the operation critical to food safety. This system should involve:**

- **identifying significant hazards specific to their operation**
- **implementing effective control measures at these critical steps**
- **monitoring the control measures to ensure they are effective**
- **taking corrective action if something goes wrong**
- **verifying and reviewing the control measures periodically, and whenever there is a significant change in the operation**
- **documentation and recording appropriate to the size and nature of the business**

However, the FSMS does not have to follow the traditional HACCP approach as long as the outcome is safe food (Regulation allows flexibility). Depending on the size and type of business, this enables systems to:

- **avoid using HACCP jargon**
- **use generic controls**
- **use pre-validated procedures (e.g. by FSA)**
- **combine good hygiene practice and HACCP**
- **use practical craft skills, sensory observation and supervision instead of numerical critical limits**
- **use minimal documentation**
- **use exception recording, i.e. when something changes or goes wrong**

Managers must have the skills to maintain the FSMS proportionate to their business

Safer food better business (SFBB)

SFBB takes advantage of the flexibility allowed for small businesses.

SFBB is a practical food safety management system developed by the Food Standards Agency (FSA) to help small catering businesses comply with the law regarding HACCP and to produce safe food. It is provided in an A4 binder divided into two parts. The first part provides safe methods and the second part contains monitoring records.

The safe methods relate to cross-contamination, (including personal hygiene), cleaning, (including handwashing), chilling and cooking.

There is also a section on management which provides guidance on opening and closing checks, proving methods are safe, a safe method completion record, training and supervision, stock control and selecting suppliers and contractors.

The second part includes a cleaning schedule, a supplier's list, staff training records and a diary to record daily events and a four weekly review.

The safe method sheets are based on good catering practice. They identify generic hazards and critical control points and describe how to prepare safe food. Safe method sheets must be completed by each business to ensure that the pack is customised to reflect the critical control points specific to their operation. The following table shows how SFBB can be mapped back to the principles of HACCP.

SFBB Headings	Explanation	HACCP principle
Safety points	Advice on how to make safe food	Generic control measures
Why	Provides details of why the control measures are required	Identifies the hazards i.e. what could go wrong)
How you do this	Controls specific to the business used to make the food safe (customisation of the pack)	specific control measures and documentation
Check it	What to look for to ensure control measures are effective (photographs are provided to identify critical limits, for example, to distinguish between cooked and undercooked products	monitoring
What to do if things go wrong	Advice on dealing with suspect food and bringing the process back under control	Corrective action
How to stop this happening again		Corrective action

The completion of the diary and the records provide additional documentation. Carrying out the self audit, the four weekly review and inspections by authorised officers provide the verification of the system. The “prove it” part of the management section is also part of the verification principle. This could involve, for example, using a disinfected probe thermometer to confirm that a particular process achieves a safe cooking temperature or that food can be cooled to a safe temperature in a specific time.

If the food business prepares a food dish not included in a safe method in SFBB, then the owner or manager must develop their own safe method. For example, if not using pasteurised egg when making lightly cooked egg dishes or preparing a donner kebab. This will require the procedures used to be validated to prove they are safe.

The manager must sign the diary every day to confirm that all safety checks were carried out and that the safe methods were followed. If something different happens or something went wrong, this should be recorded in the diary, together with the corrective action that was taken to make the food safe to eat.

The pack does not require the daily use of a probe thermometer or the daily recording of, for example, refrigerator or cooking temperatures. However, the correct use of a probe thermometer, for example, to check deliveries and storage temperatures of chilled food, to confirm cooking temperatures of food and to confirm that food on display is kept below 8°C or above 63°C, may enhance your control measures. Furthermore, accurately completed records should assist a due-diligence defence if this is needed.

SFBB does suggest the use of a thermometer to validate procedures or food preparation which is not included in a safe method, e.g. low temperature cooking.

When using probe thermometers you must always check the warmest part of chilled food and the coolest part of the food during cooking or hot holding. Thermometers must be cleaned and disinfected before probing each food and this is best achieved by hot water above 82°C.

7 HACCP principles

- 1 Conduct a hazard analysis. Prepare a flow diagram, identify the hazards and specify the control measures.**
- 2 Determine the critical control points.**
- 3 Establish critical limits, target levels and tolerances.**
- 4 Establish a monitoring system by scheduled testing or observations.**
- 5 Establish corrective actions to be taken when a CCP is out of control.**
- 6 Establish verification procedures which include appropriate supplementary tests together with a review which confirms that HACCP is working effectively.**
- 7 Establish documentation concerning all procedures and records appropriate to these principles and their application.**

Stages in the implementation of HACCP (The HACCP study) (Codex logic sequence)

- 1 Assemble and train the HACCP team and define terms of reference.**
- 2 Describe the product/recipe.**
- 3 Identify intended use.**
- 4 Construct a flow diagram and food room layout showing product, personnel, equipment and waste flows.**
- 5 On-site verification of flow diagram and food room layout.**
- 6 Identify hazard/risk/severity and control measures (Principle 1).**
- 7 Determine critical control points using the decision tree (Principle 2).**
- 8 Determine critical limits, target levels and tolerances for each critical control point (Principle 3).**
- 9 Establish monitoring system for each CCP (Principle 4).**
- 10 Establish actions to be taken when target levels are exceeded and corrective actions to be taken when a critical limit is exceeded (Principle 5).**
- 11 Establish verification and review procedures (Principle 6).**
- 12 Establish record keeping and documentation (Principle 7).**

Management commitment is required at all levels for the successful implementation of HACCP.

HACCP Control Chart

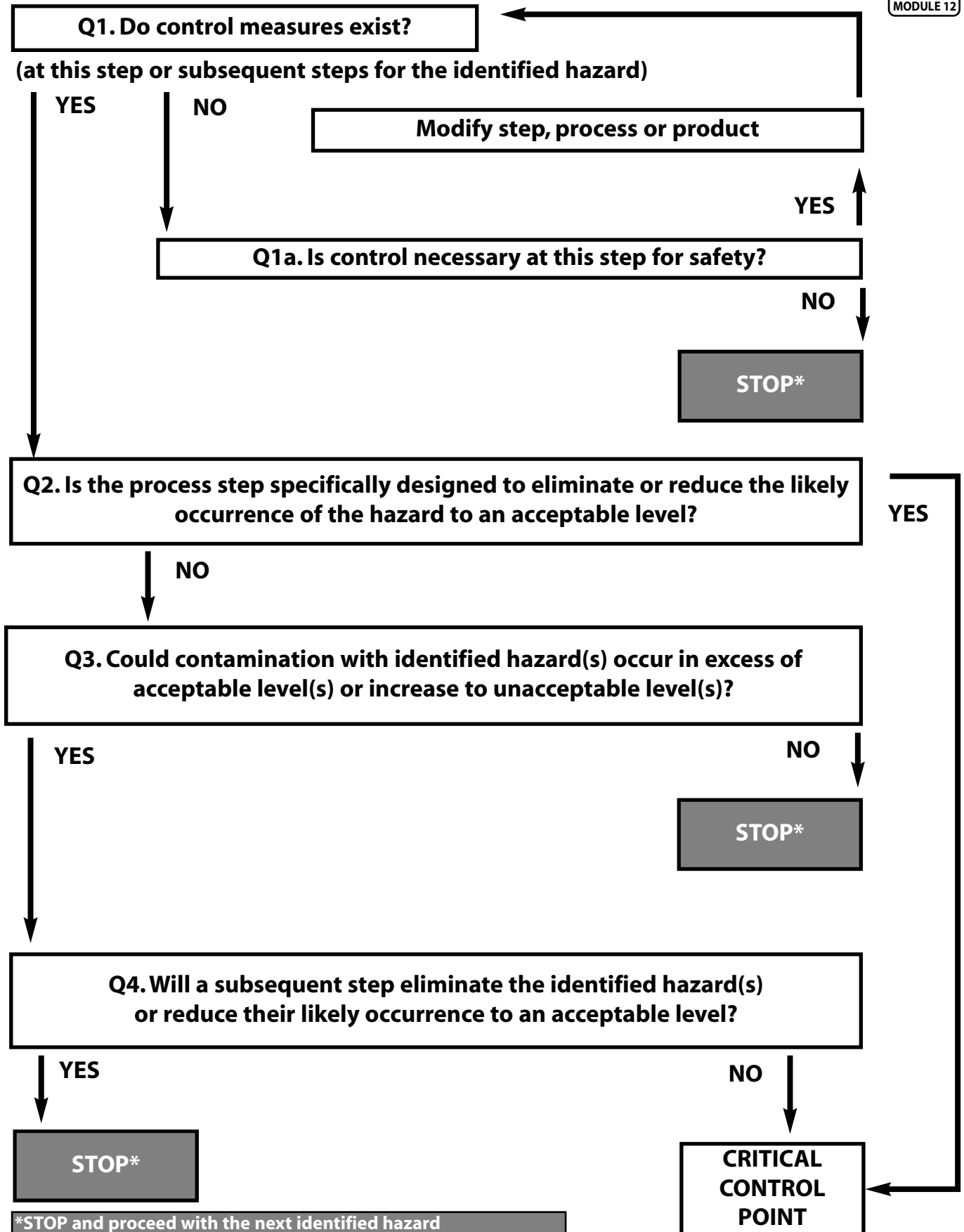
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PROCESS STEP	HAZARDS AND SOURCES CAUSES OF HAZARDS	CONTROL MEASURES	CCP Y/N/P	CRITICAL LIMIT	MONITORING & PERSON RESPONSIBLE (INCLUDE FREQUENCY)	CORRECTIVE ACTION AND RESPONSIBILITY (product and action to bring the CCP under control)*

P = prerequisites - approved suppliers, premises and equipment well designed and maintained, staff trained in general food safety and good personal hygiene, effective cleaning/disinfection, pest management and waste management.

*If there is a deviation it must be investigated to ascertain why the deviation occurred.

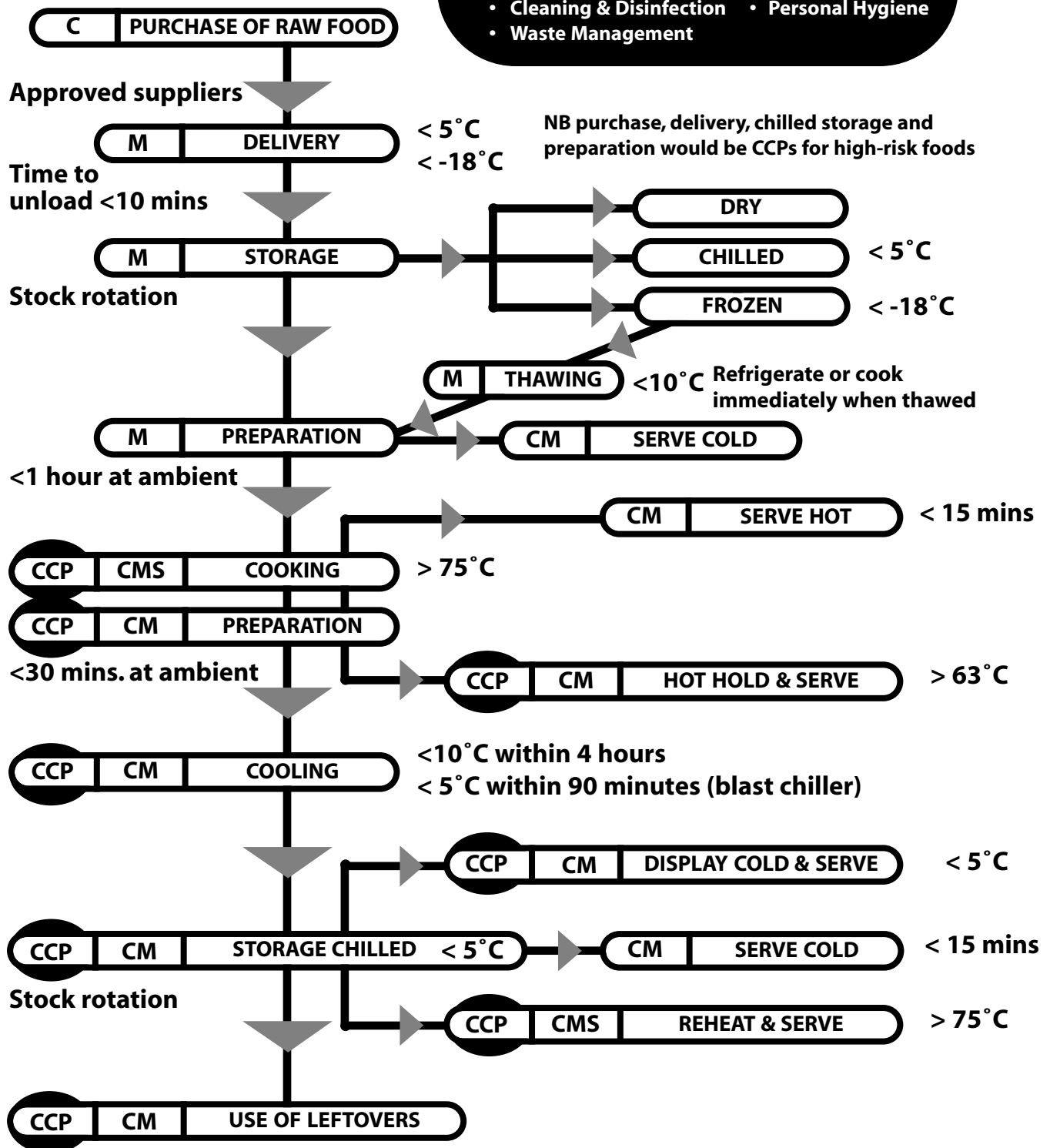
Codex CCP Decision tree



Generic flow diagram for catering

PREREQUISITES

- Good Hygiene Practices
- Cleaning & Disinfection
- Waste Management
- Pest Control
- Personal Hygiene



Check temperatures with a disinfected electronic probe thermometer

CCP = Critical control point

Generic hazards

C = Contamination

M = Multiplication

S = Survival

Examination questions

Subject HACCP/management



- 1. Explain what is meant by the abbreviation HACCP**
- 2. What is meant by the term linear work flow?**
- 3. Explain how HACCP can be used to ensure safety in the preparation of cooked roast beef for consumption hot the following day**

The role of the supervisor

Supervisors are the essential link in ensuring food safety

Supervisors' role:

- **To ensure company's aims and objectives are achieved**
- **To ensure the Food Safety Policy is enforced**
- **To develop and maintain standards and procedures**
- **To advise management of resource requirement**
- **To ensure standards are maintained**

Supervisors' responsibilities

- **They must be effective communicators to staff and managers**
- **Lead by example (demonstrate commitment)**
- **Instruct, train, motivate, control and monitor staff to ensure standards are achieved**
- **Instigate the relevant corrective action**

Standards

- **Needed to ensure consistency**
- **To provide a reference point target**
- **To facilitate control, monitoring and auditing**
- **May be voluntary, legal, international or in-house**
- **High standards = good reputation**



Food safety policy

- **Commitment to produce safe food**
- **Commitment to ensure legal responsibilities are met**
- **Commitment to provision of satisfactory premises, fixtures and equipment**
- **Outlines management (including supervisors) responsibilities**
- **Commitment to implement a food safety management system based on HACCP principles**
- **Used to communicate standards systems/operating procedures**
- **Useful for training**

Should include procedures for:

- **Approval and** monitoring of suppliers/**delivery of** raw materials
- Personal hygiene/screening/reporting
- Informing, training and supervising staff
- Implementing an effective training programme
- Integrated pest management
- Cleaning and disinfecting (schedules)
- Waste management
- Customer complaints
- Food poisoning outbreaks/**hazard warnings**
- Product recall
- Dealing with authorized officers (**EHPs/TSOs**) contractors and visitors

NB The HACCP system will deal with procedures relating to control of hazards especially temperature control and preventing contamination.



Quality control and assurance



Quality control

- Relies on 'end product testing' **as an indicator to consistent quality**
- **Significant testing to ensure safety**
- Reactive, identifies what has gone wrong **but not necessarily why**
- **Often expensive and tests may be destructive**

Quality assurance

- Is proactive
- **Prevents problems before they occur**
- Supervisors ensure policies and procedures are effectively implemented
- Action is instigated prior to the deviation occurring **to avoid need for product destruction/recall**

Its effective implementation requires:

- **The specification (what is to be done)**
- **Documented instruction (how it is to be done)**
- **The recording system (to confirm it has been done)**
- **The monitoring system**
(to confirm recording and corrective actions satisfactory)
- **Greater confidence in the safety of the food**
- **May assist "due diligence" defence**

HACCP

A food safety management system that controls significant food safety hazards. Developed in 1960 by Pillsbury and NASA to protect space travellers. It is a science-based documented system for identifying and assessing hazards and risks of food production and the implementation of cost-effective controls and monitoring procedures to ensure food safety.

Advantages of HACCP

- **Proactive therefore corrective action taken prior to problem**
- **Reduces product loss**
- **All staff involved not just QC/laboratory**
- **Cost-effective - resources concentrated at critical points**
- **May assist in due diligence defence**
- **Complies with the law**

It requires

- **Full commitment**
- **Multidisciplinary approach**
- **Consistent and standardised approach**
- **Detailed scientific knowledge**

Definitions

Control measures

Actions required to prevent or eliminate a food safety hazard or reduce it to an acceptable level

Corrective action

The action to be taken when results of monitoring at a CCP indicate a loss of control i.e. a critical limit is breached

Critical control point

A step in the process where control can be applied and is essential to prevent or eliminate a food safety hazard or reduce it to an acceptable level

Critical limit

A monitored criterion which separates the acceptable from the unacceptable

Targets need to be set so that corrective action is taken before a critical limit is breached and food needs to be destroyed



HACCP

Decision tree

A sequence of questions to determine if a step in the process is a critical control point

Flow diagram

A systematic representation of the sequence of steps or operations involved with a particular food item or process, usually from receipt of raw materials to consumer

Hazard

The potential to cause harm to the consumer and can be (micro)biological, physical, chemical or allergenic

Microbiological hazard

The unacceptable contamination, the unacceptable multiplication, the unacceptable production or persistence of toxins and/or the unacceptable survival of pathogenic micro-organisms in food. (Includes bacteria, viruses, parasites, protozoa and moulds)

Monitoring

The planned observations and measurements of control parameters to confirm that the process is under control and that critical limits are not exceeded

Risk

The likelihood of a hazard occurring in food

Target

Control criterion that is more stringent than the critical limit, and which can be used to reduce the risk of a deviation

Verification

The application of methods, procedures and tests, and other evaluations, in addition to the monitoring, to determine compliance with the HACCP plan (Includes prerequisite programmes)



Hazards

Microbiological

- Present in raw materials
- Contamination - pathogens
- Multiplication/toxin production
- Survival of pathogens/spores/toxins

Physical

- Present in raw materials
- Contamination - foreign bodies

Chemical

- Present in raw materials
- Contamination
- Excess additives

Allergenic

- Increasing problems
- Body's immune system reacts
- Anaphylactic shock may result in death
- Present in specific types of food, e.g. nuts

Notes



Prerequisites for HACCP

Requirements prior to the implementation of HACCP (may also be considered as generic controls)

- Management commitment
- Adequate resources

Prerequisite programmes

- Approved suppliers
- **Premises and equipment** well designed, **constructed and maintained. Unidirectional product flow (Maintenance contract and contingency plans)**
- **Segregation**
- **Suitable facilities (colour coding)**
- **Equipment calibration**
- **Potable water/ice supplies**
- Stock rotation
- **Good housekeeping**
- **Effective** waste management
- **Integrated** pest management
- **High standards of** personal hygiene, **staff vigilance/effective supervision (Suitable facilities)**
- Staff trained commensurate with their work activities (competent)
- **Health and exclusion policy. Visitor policy**
- **Effective planned** cleaning and disinfection (**Schedules**).
- **Labelling, traceability and recall procedures**
- Contingency plans

Prerequisites may be essential to reduce food poisoning but are excluded from the HACCP Control Chart to minimize the number of CCPs and avoid repetition.

However, prerequisites should be considered in the verification of the total system.



Legal requirement for HACCP

REGULATION (EC) No 852/2004 ON THE HYGIENE OF FOODSTUFFS

Article 5

1. Food business operators shall **put in place, implement and maintain permanent procedures based on the following HACCP principles:**

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- (c) establishing critical limits **at critical control points which separate acceptability from unacceptability for the prevention, elimination or reduction of identified hazards;**
- (d) establishing and implementing effective monitoring procedures at critical control points;
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Food business operators shall:

- (a) **provide the competent authority with evidence of their compliance with paragraph 1 in the manner that**



Manufacturing usually requires Codex HACCP, but catering and retailing may have a food safety management system based on the principles of HACCP, e.g. large/medium size - may use: process led; small use: Safer Food, Better Business.



- the competent authority requires, taking account of the nature and size of the food business;
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ANNEX 11 Chapter XII Training

Food business operators are to ensure:

1. That food handlers are **supervised and instructed and/or trained in food hygiene matters** commensurate with their work activity;
2. That those responsible **for the development and maintenance of the procedure referred to in Article 5(1) of this Regulation or for the operation of relevant guides** have received adequate training in the application of the HACCP principles; **and**
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Regulation (EC) 852/2004 requires food business operators to put in place a food safety management system based on HACCP principles, **to control significant hazards at steps in the operation critical to food safety. This system should involve:**

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- **documentation and recording appropriate to the size and nature of the business**

However, the FSMS does not have to follow the traditional HACCP approach as long as the outcome is safe food (Regulation allows flexibility). Depending on the size and type of business, this enables systems to:

- **avoid using HACCP jargon**
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What to do if things go wrong	Advice on dealing with suspect food and bringing the process back under control	Corrective action
How to stop this happening again		Corrective action



The completion of the diary and the records provide additional documentation. Carrying out the self audit, the four weekly review and inspections by authorised officers provide the verification of the system. The “prove it” part of the management section is also part of the verification principle. This could involve, for example, using a disinfected probe thermometer to confirm that a particular process achieves a safe cooking temperature or that food can be cooled to a safe temperature in a specific time.

If the food business prepares a food dish not included in a safe method in SFBB, then the owner or manager must develop their own safe method. For example, if not using pasteurised egg when making lightly cooked egg dishes or preparing a donner kebab. This will require the procedures used to be validated to prove they are safe.

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When using probe thermometers you must always check the warmest part of chilled food and the coolest part of the food during cooking or hot holding. Thermometers must be cleaned and disinfected before probing each food and this is best achieved by hot water above 82°C.

7 HACCP Principles

- 1 Conduct a hazard analysis
Prepare a flow diagram
Identify the hazards
Specify the control measures
- 2 Determine the critical control points
- 3 Establish critical limits
- 4 Establish a monitoring system **by scheduled testing or observation**
- 5 Establish corrective actions **to be taken when a CCP is out of control**
- 6 Establish verification procedures **which include appropriate supplementary tests together with a review which confirms that HACCP is working effectively**
- 7 Establish documentation **concerning all procedures and records**

Advantages of HACCP

- Resources concentrated at critical points
- Proactive not reactive
- Allows prompt corrective action to be taken
- Reduces product loss
- All staff involved
- Easy to monitor
- Helps to comply with the law
- Could assist in a due diligence defence
- Identifies potential hazards, which can either be removed or the risk reduced to an acceptable level



Implementation of HACCP

(Codex logic sequence)

- 1 Assemble and train the HACCP team (**if appropriate**) (**Consider knowledge required - appoint team leader**) and define the terms of reference - **decide on the scope which operation or process, which products which steps and which hazards (microbiological, physical and chemical).**
- 2 Describe the product/recipe/process. **Potential hazards and risks, suitability for multiplication, processing/cooking/packaging/labelling, storage temperatures and potential customer abuse**
- 3 Identify intended use/**likely customers. Babies, elderly, pregnant women, ill persons or institutional feeding.**
- 4 Construct process flow diagram(s)
- 5 On-site confirmation of flow diagram(s)
- 6 Identify hazards/risk/severity and control measures (hazard analysis) (Principle 1) **Hazards may be microbiological, physical, chemical or allergenic examples:**

- a) **Failure to segregate raw and high-risk food resulting in contamination**
- b) **Leaving high-risk foods at room temperature enabling pathogens to multiply**
- c) **Failure to cook to a centre temperature of 75°C (or equivalent) resulting in the survival of pathogens**
- d) **Siting an electric fly killer above a food preparation surface allowing dead flies to drop into food**
- e) **Using harmful chemicals adjacent to open food**

Control measures - may be specific to a particular hazard but in catering generic control measures, including prerequisite controls, are probably more common. For example, storage of all high-risk food under refrigeration (<5°C) or above 63°C, cooking to a centre temperature of >75°C, minimizing time at room temperature, specifying maximum size of joints (2.25kg). Some hazards require more than one control measure. It is often useful to avoid hazards by keeping sources of contamination out of food premises e.g. using ready-prepared vegetables, using cooked chickens instead of frozen. Having separate deboning areas - specifying type of packaging e.g. no staples. There should also be a glass policy to exclude risks from glass.

- 7 **Determine critical control points - may use the codex decision tree (Principle 2) (A simple decision tree is preferable in catering/retailing as the codex decision tree which was designed for manufacturing is complicated and results in inconsistencies unless applied with considerable scientific knowledge).**



Implementation of HACCP (2)

- 8 Establish critical limits (and target levels) (Principle 3) for each critical control point
- 9 Establish monitoring systems for each CCP (Principle 4)
- 10 Establish corrective actions to be taken when a CCP has moved out of control (Principle 5)
- 11 Establish verification and review procedures (Principle 6)
- 12 Establish documentation and record keeping (Principle 7)

Notes



Flow diagram

Stage (hazards)

Purchase

- Presence of contaminants
- Bacteria
- Foreign objects
- Chemicals

Delivery and unloading

- Presence of contaminants
- Multiplication of pathogens

Storage

- Multiplication of pathogens
- Contamination

Preparation

- Multiplication of pathogens
- Contamination

Cooking

- Survival of pathogens
- Multiplication of pathogens
- Contamination

Cooling

- Multiplication of surviving pathogens
- Spore germination
- Contamination

Service

- Multiplication of pathogens
- Contamination

Notes



Determine critical control points

The determination of the critical control points is fundamental to an effective HACCP system

- **Question asked:**
"If I lose control is it likely that food poisoning, injury **or harm** will result" (This includes dangerous foreign objects, burning, chemical poisoning or the presence of allergens).

Answer

- "No"
- **Then it's a control point**

Answer

- "Yes"
- **Then ask 2nd question:** "Will a subsequent step eliminate or reduce the hazard to a safe level?"

Answer

- "Yes"
- **Then it's a control point**

Answer

- "No"
- **Then it's a critical control point (CCP)**



Decision tree (CODEX) for manufacturer (consistent production)

Having identified a hazard at a particular step the following questions may be used to determine if the step is a CCP.

- Q1** Do control measures exist?
- Q1a** Is control required at this step to ensure food safety?
- Q2** **Does the step eliminate or reduce the hazard to an acceptable level?** Is the step specifically designed to eliminate or reduce the hazard to an acceptable level? (**Emphasis on the step NOT the control measure at the step**)
e.g. sterilization of milk, chlorination of water, use of an x-ray machine to detect bones, rapid cooling of cooked meat to prevent spore germination.
- Q3** Could contamination occur at unacceptable levels or could it increase to unacceptable levels?
('Is it likely?' NOT 'is it theoretically possible')
- Q4** Will a subsequent step eliminate or reduce the hazard to an acceptable level?



Supplier monitoring



- The amount of supplier monitoring carried out by companies is dependent on the size and turnover of the business
- Small companies may have to rely on the “reputation” of their suppliers
- All companies should ask for copies of their suppliers’ food safety policy, HACCP documentation and monitoring records
- Specifications **should be set and deliveries checked for compliance** (sampling results)
- References **from other companies could also be sought** (past records - **if existing supplier**)
- **Comparison of actual standards with those outlined in the companies’ food safety policy is essential**
- Staff competency **is an indication of standards**
- **Whenever possible audits or inspections of suppliers should be carried out, either by the companies’ own hygiene officers or by external consultants**
- **All official certificates should be in order**
- **Remember a “due-diligence defence” can only be relied on if reasonable care has been taken to ensure the safety of incoming goods**

Monitoring systems



Monitoring is required to:

- **Ensure that control measures remain in place and are effective** (CCP under control)
- Identify deviations **i.e. moving out of control**
- Trigger corrective actions

Provides records for:

- Verification
- Identifying reasons for complaints
- **Assisting with** due diligence

Monitoring must permit rapid detection and correction.

It may be:

- Manual
- Automatic
- Continuous or at set frequencies

Monitoring systems

Should state

What

- Critical limits **e.g. 8°C for 4 hours**
- **Temperature requirements**
- **Time at that temperature**
- Target levels **e.g. 5°C**
- Tolerances **e.g. 3°C**

How

- **Detailed methodology e.g. automatic timing**
- **Equipment to be used e.g. temperature probes**
- **Calibration requirements, often forgotten**

Where

- **At the control point or CCP or**
- As close as possible to the **control point or CCP**

Who

- Responsible for monitoring
- **Training requirements of personnel**
- **Ensures monitoring undertaken correctly (auditing)**

When

- The timing of the monitoring
- **Frequencies of monitoring**

Records

- **Accurate records must be maintained**
- **Poor records will damage a due diligence defence**



Thermometers - use and calibration



A digital, electronic probe thermometer(thermocouple) should be used to measure storage and cooking temperatures. Bimetallic coil thermometers are not reliable or accurate enough for measuring the temperature of food as they are not “tip sensitive”

Probe thermometers should be calibrated monthly

Calibration - in ice and boiling water

The temperature should read 0°C ($\pm 1.0^{\circ}\text{C}$) when the probe is inserted into melting ice.

The temperature should read 100°C ($\pm 1.0^{\circ}\text{C}$) when the probe is inserted into boiling water.

Each probe should be numbered and the result of the calibration should be recorded.

Probes which are more than 1.0°C adrift should be replaced.

External calibration is recommended annually.

Cross-contamination

Probes should be cleaned and disinfected between each use. Never probe raw food and then ready-to-eat food without disinfecting in between.

Always make sure the probe is then thoroughly cleaned before storing in disinfectant solution. Water above 82°C can be used to disinfect probes.

Methods of monitoring



To ensure control measures are effective

Bacteriological (**only used if rapid, not traditional**)

Organoleptic **assessment of food (look for the unusual)**

Smell

- **Good food should smell fresh, pleasant and natural**
- **Unusual, stale, musty or rancid smells should invite suspicion**
- **Chemical smells normally indicate chemical contamination**
- **Fatty foods can pick up taints from other foods**

Taste

Unusual bitterness/sweetness, a soapy taste or any untypical flavour may indicate unfitness

Appearance

- **Food should be visibly free from signs of spoilage, fungal growth, slime, darkening or other change in colour, untypical wetness or mechanical damage**
- **Absence of foreign objects, dirt etc. is also essential**
- **Meat and vegetables should be free from evidence of disease**
- **Excessive ice crystals may indicate mishandling in frozen foods**

Sound

Many packed foods especially canned goods, emit a characteristic sound on being tapped or shaken

Texture

- **Unusual softness, hardness, brittleness or change in texture may be indicative of unfitness**
- **Meat, fish, etc. should display a springy texture.**
- **Pitting on pressure can be a bad sign**

Checking controls/records, e.g. thermographs. (Usually throughout the day - checking records monthly - verification)

Observation/supervision

Visual inspections (premises, vehicles or practices)

Competency **testing (staff/supervisors)**

Measuring, e.g. temperature, weight or volume

Bacteriological monitoring



May be used to:

- **Assist** HACCP verification
- **Assist hazard analysis**
- **Build up a** profile of product quality
- Indicate trends **in product quality**
- **Ascertain whether handling techniques are satisfactory**
- Indicate safety **and the absence/levels of specific organisms**
- **Determine** the effectiveness of cleaning and disinfection
- **Determine the effectiveness of** product processing
- **Confirm that** legal standards **are being met**
- **Confirm that** customer standards **are being met**

The number of bacteria depends on:

- **Raw material, hygiene standards, types of food preservatives, food process, packaging, temperature etc.**

Interpretation of results - Aerobic colony count

- This is an indication of the numbers of organisms present
- Only effective as indicating trends if details same i.e. area, incubation time, media, incubation temperature etc.

Staphylococcus aureus

Usually indicates bad personal hygiene

Escherichia coli

Usually indicates faecal contamination in one form or another

Salmonella

Usually indicates faecal contamination (possibly via poultry), insufficient cooking or cross-contamination

Clostridium perfringens

Usually indicates faecal/soil contamination and/or slow cooling

Interpretation of results

Guidelines for the microbiological quality of ready-to-eat foods (published September 2000 PHLS)

Aerobic colony count

- (30°C for 48 hrs) - Total number of colonies (organisms) present
- If comparing trends - incubation time/temp and media etc. must be constant

Indicator organisms

- Enterobacteriaceae (more accurate than coliforms), however, fresh fruit, vegetables and salad vegetables have high levels in their normal flora - therefore - may not indicate a problem
- *Escherichia coli* (total) usually indicates faecal contamination and major risk of pathogens
- *Listeria spp* (total) indicates potential for presence of *Listeria monocytogenes*

Pathogens

- Salmonella, campylobacter, and *E. coli* O157 and *V. cholerae* should not be isolated, even in small numbers
- Presence indicates faecal or cross-contamination or inadequate cooking
- *Vibrio cholerae* has been isolated in fish products, fruits and vegetables imported into Europe
- *Listeria monocytogenes* - counts of 10² CFU may indicate poor hygiene standards or storage conditions; foods with this level are potentially hazardous
- *V. parahaemolyticus*, *S. aureus*, *Cl. perfringens* and *B. cereus* should not be present in ready-to-eat food, however, up to 10² CFU is considered acceptable *S. aureus* indicates poor personal hygiene, *Cl. perfringens* indicates contamination and/or faulty cooling



Management audits



Supervisors use daily checks to ensure that:

- Premises and equipment are clean and in good repair
- Food is in good condition and within shelf-life
- No hazards evident including signs of pests
- Food/equipment temperatures are satisfactory
- Controls are in place
- All records are completed satisfactorily
- **Records are not fudged**
- All hygiene practices are satisfactory
- **No evidence of short cuts**
- No cross-contamination **potential**
- Staff are competent **and following hygiene rules**
- Signage is satisfactory

If management cares so will staff

At the start of the day:

- Premises, equipment and surfaces should be clean/disinfected
- Adequate supplies of soap/drying facilities/cloths
- All food handlers fit/clean (including protective clothing)
- Fridge/freezer temperatures satisfactory

At the end of the day:

- All waste/rubbish should be removed
- Premises/equipment cleaned
- Date codes of food checked - discard out-of-date
- Fridges/freezers temperatures satisfactory and correct loading

Corrective action

- The action taken when a control point moves out of control or is starting to move out of control
- It is essential that suitable corrective action is instigated without delay
- This should be as simple as possible

The action plan should specify:

- The action to be taken when the target level has been breached
- The corrective action to be taken when a critical limit is breached
- The person responsible for the corrective action
- Who should be notified **when corrective action has been necessary**
- Whether production/sales should be stopped
- Treatment of affected product
- **At what stage** would recall be necessary
- Who can authorise production/sales to restart

Traceability

It is essential that the source of every ingredient of a particular product can be traced back to its supplier
If a problem occurs, the supplying company can be informed, or in the case of serious or recurring complaints a new supplier can be sought



Verification

The application of methods, procedures and tests, and other evaluations, in addition to monitoring, to determine compliance with the HACCP plan (includes prerequisite programmes).

Validation - elements of the HACCP plan are effective

HACCP audits

Random sampling/testing of product

- Microbiological/chemical
- Visual

Re-examine all data

Have any changes in ingredients, preservatives etc. occurred?

Examine documentation, monitoring records and skills of monitors

Confirm CCPs are under control

Observe staff and operations

Review of deviations and customer complaints

- Are there any serious complaints?
- Are there any recurring complaints?
- Do the complaints indicate lack of control?

Validation

Obtaining evidence that the elements of the HACCP plan are effective, i.e. checking that hazards will be controlled.



When to review the HACCP plan

- At regular intervals (minimum annually)
- If new scientific data emerges
- When a justified complaint occurs
- If an associated illness occurs
- When raw material **or supplier** change
- When there is a recipe change
- When there is a major change of equipment
- When there is a change in the process
- If storage conditions change
- If product use changes
- If packaging or distribution is changed
- If cleaning procedures are changed

Review documentation must be recorded

Notes



Documentation

Policy documents include:

The HACCP plan and details of how it was developed including HACCP team and responsibilities, flow diagrams, hazard analysis, HACCP control charts, CCPs and critical limit determination, corrective actions and verification procedures.

- **Prerequisite programmes**
- **Floor plan**
- **The approved supplier list**
- **Monitoring records (all signed and dated)**

Notes



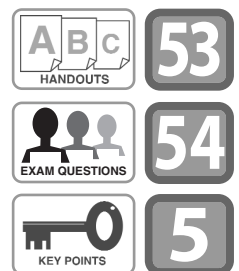
Records

Records include:

- CCP monitoring activities (time/temp/weight/foreign bodies) including corrective actions and recalls
- Modifications to the HACCP system
- Inspection/audit reports including enforcement officer inspection reports
- Staff records (training/exclusion)
- Customer complaints/allegations of illness
- Results of tests/samples
- Prerequisite programme monitoring activities
- Calibration of instruments
- Cleaning schedules
- Equipment maintenance/servicing
- Pest control book

All monitoring records should be signed, countersigned by a supervisor/manager and dated.

Ask delegates to write down the five most important things they have learnt.



Module 13

Food safety legislation

Aims

To provide an understanding of the main food safety legislation

To outline the role of authorized officers and enforcement authorities

Key points

Regulation (EC) No 852/2004 on the hygiene of foodstuffs, including the responsibility of the food business operator and food handlers and the requirements for HACCP, food premises and equipment

The Food Hygiene (England) Regulations 2006 including, orders, notices, the due-diligence defence, temperature control, offences and penalties

Responsibilities and powers of authorized officers and criteria for prosecution

Food Safety Act 1990

Legislation regarding the labelling and date coding of food

Purpose of Codes of Practice/Industry Guides

The inspection of food premises by authorized officers

Visual aids

Handouts

Newspaper cuttings (lecturer to provide)

Regulation (EC) No 852/2004 on the hygiene of foodstuffs (HO55)

The Food Hygiene (England) Regulations 2006 (HO56)

Temperature control for the storage of high-risk food (HO57)

Enforcement - food premises (HO58)

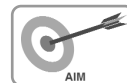
Enforcement - food (HO59)

Examination questions (HO60)

Group exercise

To examine the various industry guides with regards to certain subject areas, eg training, fly proofing, washing facilities etc. and feed back to the class their findings

Module 13



Regulation (EC) No 852/2004 on the hygiene of foodstuffs

This Regulation lays down general hygiene rules for all food businesses on the basis of the following principles:

- Primary responsibility for food safety rests with the food business operator
- The cold chain must be maintained for perishable and high-risk food
- Procedures must be based on good hygiene practices and HACCP principles
- Microbiological criteria and temperature control based on a scientific risk assessment

Food business operators must:

- Ensure that all steps in the production, processing and distribution of food satisfy the relevant hygiene requirements
- Implement a food safety management system based on HACCP principles
- Register with the local authority
- Not allow food handlers who are ill or affected with skin infections etc., to handle food if there is any risk of contamination
- Ensure that food handlers are supervised and instructed and/or trained in food hygiene matters commensurate with their work activity
- Ensure that those responsible for the HACCP system are trained in the application of the HACCP principles

Personnel must:

- Have high standards of personal hygiene
- Wear clean protective clothing
- Report to the food business operator when suffering, or suspects he/she is suffering, from a foodborne disease or condition (e.g. skin infection or sores) which may result in food contamination.

Premises must:

- Be kept clean
- Be maintained in good repair
- Have satisfactory design, layout and construction
- Have adequate washing facilities and potable water
- Have satisfactory lighting and ventilation

Equipment must:

- Be kept clean and in good condition
- Be installed to allow cleaning of surrounding area

Food must:

- Be protected against contamination and from pests
- Not be kept at temperatures that might result in a risk to health (adequate refrigeration required). Hot food to be cooled, must be cooled as quickly as possible

Waste must:

- Not accumulate in food rooms
- Be deposited in closable containers

Penalties:

- In Magistrates' Court - £5,000.00 for each offence
- In Crown Court - unlimited fine and two years' imprisonment

The Food Hygiene (England) Regulations 2006

Temperature control

Chill-holding requirements

High-risk foods must be kept at 8°C or below unless:

- it is hot food on display
- there is no health risk
- it is canned or dehydrated (until opened); or
- it is raw food intended for cooking/processing

NB Food on display may be kept above 8°C for up to 4 hours on a single occasion.

Hot-holding requirements

Hot food on display must be kept at or above 63°C

NB Hot food may be kept below 63°C for up to 2 hours on a single occasion.

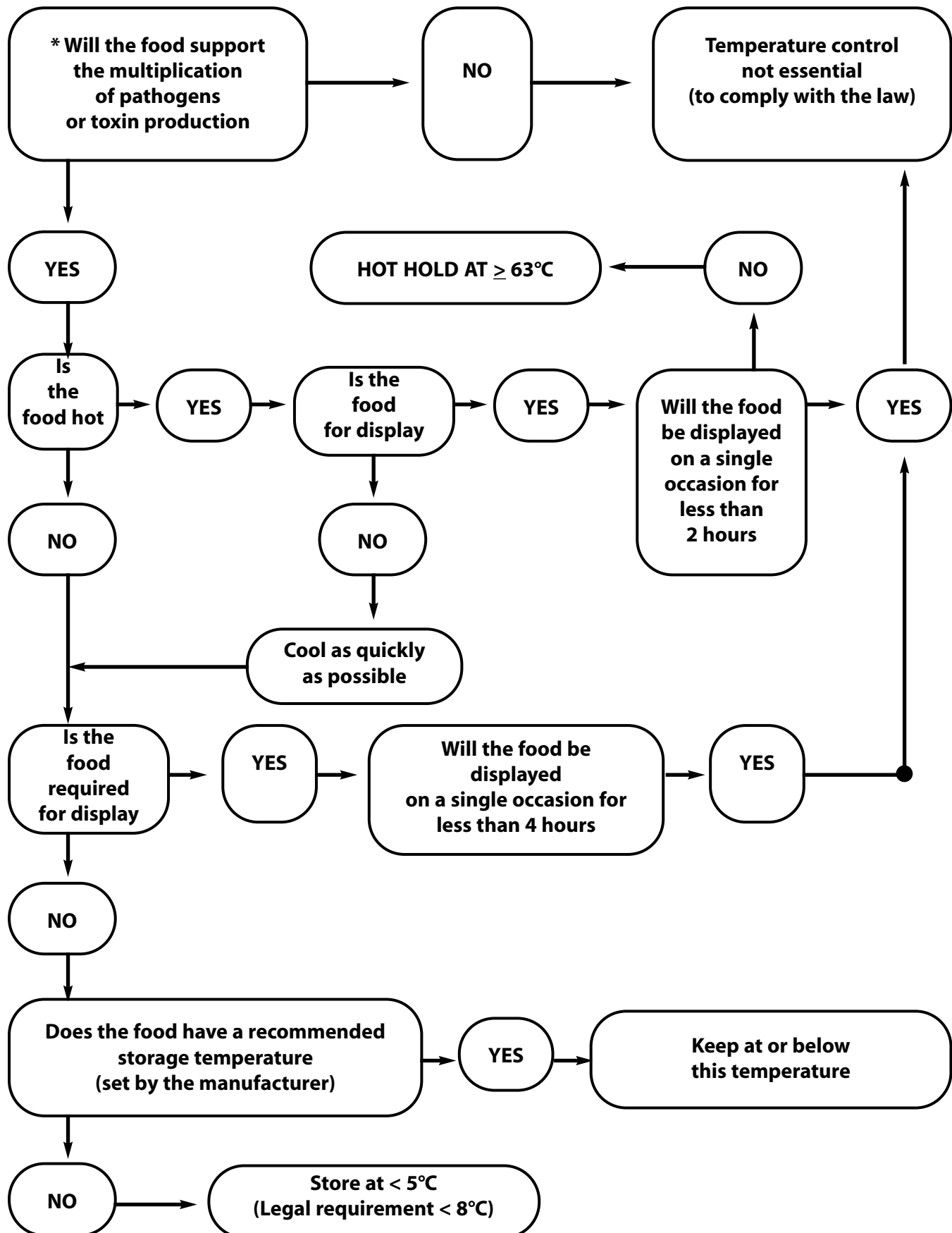
These Regulations also provide for the enforcement of the EU Hygiene Regulations and in particular:

- hygiene improvement notices
- hygiene prohibition orders
- hygiene emergency prohibition notices and orders
- the defence of due diligence
- powers for authorized officers
- offences, defences, penalties and rights of appeal
- seizing food which fails to comply with the food safety requirements

Restrictions on the sale of raw milk are included in these Regulations.

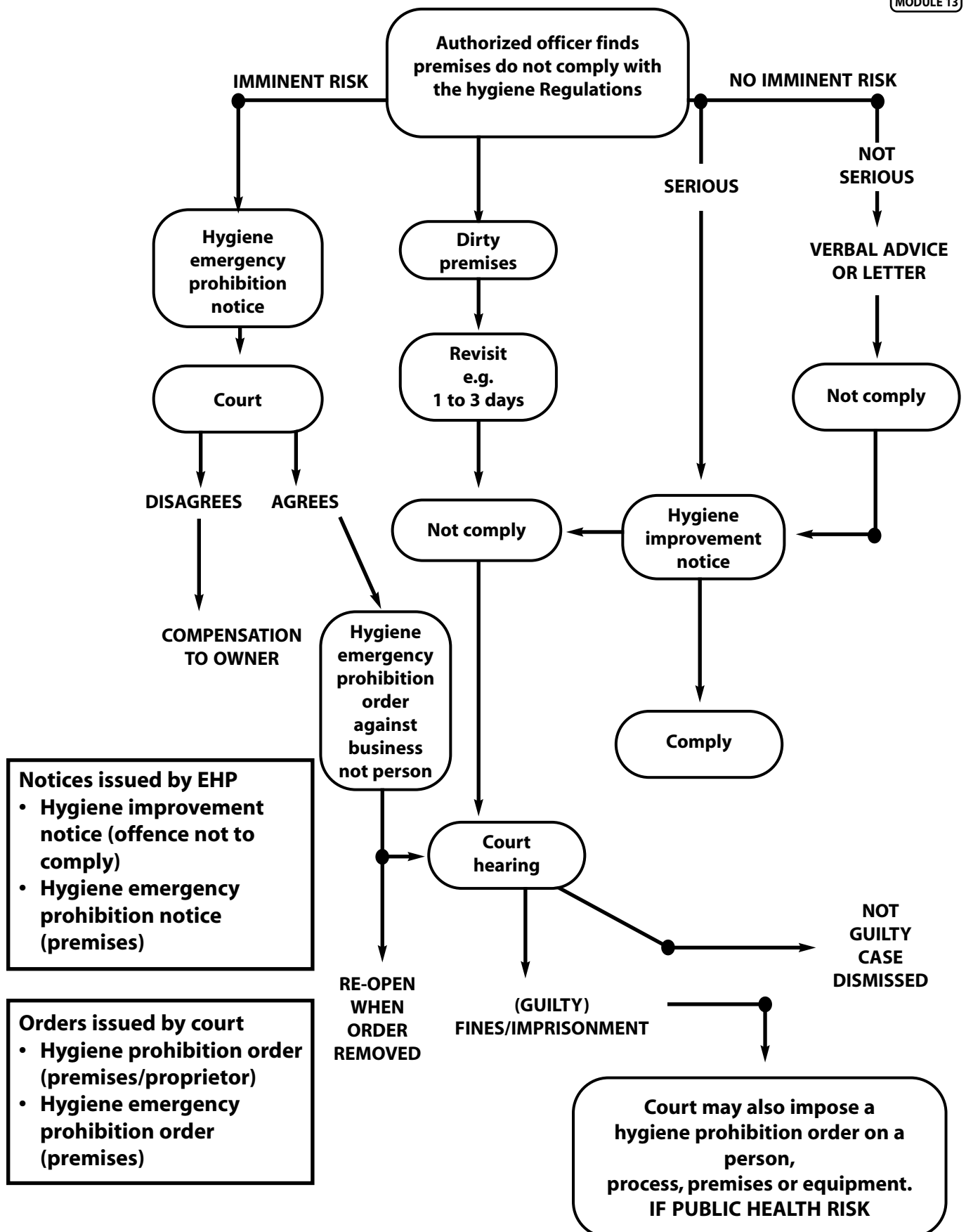
Temperature control for the storage and display of high-risk food

The Food Hygiene (England) Regulations 2006



Enforcement - food premises

The Food Hygiene (England) Regulations 2006

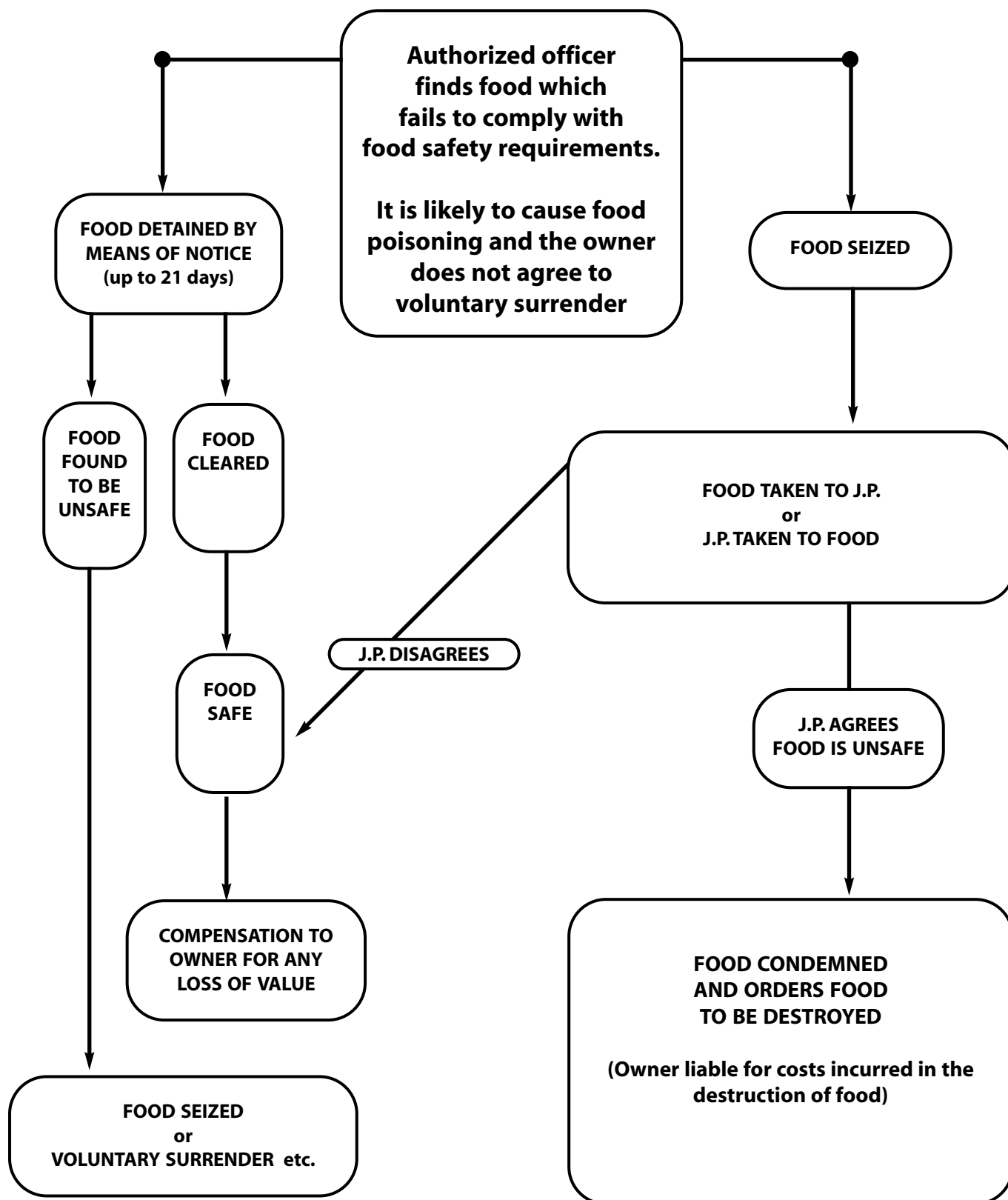


Enforcement - suspect food

The General Food Regulations 2004

The Food Hygiene (England) Regulations 2006

The Food Safety Act 1990



Examination questions

Subject Law

1. Write brief notes on the legal requirements/implications regarding the following:

- a) Action of Authorised officer with regards to finding a quantity of unfit food in a walk-in cold store**
- b) "Best-before" and "use-by" date coding**
- c) Work surfaces within a restaurant kitchen**
- d) Handwashing facilities**
- e) Due diligence**

2 a. Discuss the powers of entry to food premises of enforcement officers employed by food authorities

b. Outline the purpose of:

- i) An inspection**
- ii) A prohibition order**
- iii) An emergency prohibition notice**
- iv) An improvement notice**

Food safety legislation

Food safety legislation is required to set minimum standards for food business operators and food premises which reduces the risk of foodborne illness and the sale of contaminated food, thereby protecting public health.

Acts -	Principles of legislation
EU directives -	Member state issues regulations to implement requirements
EU regulations -	Apply to all member states directly
Regulations -	Subordinate legislation to enforce the requirements of acts and directives and to facilitate enforcement of EU regulations

Food safety legislation is concerned with:

- Preventing the production or sale etc. of injurious, unsafe, unfit or sub-standard food
- Preventing the contamination of food
- The hygiene of food premises, equipment and personnel (inc. training)
- Hygienic practices, including temperature control and HACCP
- Provision of facilities
- The control of food poisoning and foodborne disease
- Importation
- The composition, amount and labelling of food
- The registration/licensing of businesses

Offences and penalties

Food Safety Act	Max. fine £20,000
Hygiene Regs	£5,000 and/or 6 months in prison
On indictment of serious offences	Unlimited fines and/or 2 years in prison

Decision to prosecute - consider:

- Seriousness of offence/previous history
- In the public interest/setting precedent
- Willingness of complainant to be witness
- Willingness of management to prevent recurrence
- Adequacy of due diligence defence



Regulation (EC) No 852/2004 on the hygiene of foodstuffs

This Regulation lays down general hygiene rules for all food businesses on the basis of the following principles:

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- The cold chain must be maintained for perishable and high-risk food
- Procedures must be based on good hygiene practices and HACCP principles
- Microbiological criteria and temperature control based on a scientific risk assessment

Food business operators must:

- Ensure that all steps in the production, processing and distribution of food satisfy the relevant hygiene requirements
- Implement a food safety management system based on HACCP principles
- Register with the local authority
- Not allow food handlers who are ill or affected with skin infections etc., to handle food if there is any risk of contamination
- Ensure that food handlers are supervised and instructed and/or trained in food hygiene matters commensurate with their work activity
- Ensure that those responsible for the HACCP system are trained in the application of the HACCP principles

Article 5

Requirement for food safety management system based on HACCP Principles (see lecture 12 for details of HACCP).

Article 6

Food business operator to register with local authority.

Article 8

National Guides to good practice to be developed by food businesses.

Annex II General hygiene requirements for:

Food premises and food rooms, premises must:

- Be kept clean
- Be maintained in good repair





- Have satisfactory design, layout and construction
- Have adequate washing facilities and potable water
- Have satisfactory lighting and ventilation

Market stalls and vending machines

Protect against contamination and maintaining and monitoring temperatures.

Transport must:

- be kept clean and protect food from contamination

Equipment must:

- Be kept clean and in good condition
- Be installed to allow cleaning of surrounding area

Food waste must:

- Not accumulate in food rooms
- Be deposited in closable containers

Water supply:

Adequate potable supply so foods not contaminated.
(Includes ice).

Personal hygiene - personnel must:

- Have high standards of personal hygiene
- Wear clean protective clothing
- Report to the food business operator when suffering, or suspects he/she is suffering, from a foodborne disease or condition (e.g. skin infection or sores) which may result in food contamination

Foodstuffs - food must:

- Be protected against contamination and from pests
- Not be kept at temperatures that might result in a risk to health (adequate refrigeration required). Hot food to be cooled, must be cooled as quickly as possible

Wrapping and packaging of foodstuffs

- These must not be a source of contamination
- Reusable wrapping/packaging material must be easy to clean and, where necessary to disinfect

Heat treatment

- Food in hermetically sealed containers should be heat treated in accord with internationally recognized standards

Training - see Module 6

The Food Hygiene (England) Regulations 2006

Temperature control requirements

Chill-holding

Food which will support the growth of pathogens not to be kept above 8°C unless:

- **It is** hot food **on display**
- **There is** no health risk **at ambient temperatures**
- **It is** canned or dehydrated
- Raw **which will be cooked**
- **Scientific assessment indicates no risk**
- **It is for service or on display for one single occasion of** not more than 4 hours
- **Tolerance for defrosting/delivery/breakdown for a limited period consistent with food safety**

Baker's guide exemptions

- **Uncut baked egg products - dispose after 24 hours**
- **Pies and pasties encased in pastry (to which nothing has been added after baking) and sausage rolls - dispose after 48 hours**
- **Cream up to 12°C for 16 hours then dispose**

Hot-holding

Hot food on display must not be kept below 63°C unless:

- **Scientific assessment indicates no risk**
- **It is for service or on display for one single occasion of** not more than 2 hours

Regulation (EC) No 852/2004 also requires

- **Food must not be kept at temperatures that might result in a risk to health**
- **Food must be cooled quickly following cooking, if required to be chilled**
- **Food premises must have sufficient refrigerated storage**



The Food Hygiene (England) Regulations 2006

These Regulations provide for the enforcement of the EU Hygiene Regulations and in particular:

- **Reg 3 - Presumption that food is intended for human consumption**
- **Reg 5 - Enforcement Authority - Food Authority (Local Authority)**
Unless Food Standards Agency (mainly slaughterhouses and meat plants)
- **Reg 6 - Hygiene improvement notices - served by authorised officers for offence of the Hygiene Regulations. Failure to comply with the notice is an offence and results in prosecution (can appeal).**
- **Reg 7 - Hygiene prohibition order - issued by Court to prohibit use of process, equipment, premises or food business operator. Minimum 6 months. (Follows conviction for hygiene offences if there is a risk of injury to health)**
- **Reg 8 - Hygiene emergency prohibition notice and order - notice served by authorized officer if there is 'an imminent risk of injury to health' (e.g. rats or sewage pollution - premises closed but must apply to Court for an order confirming closure, within 3 days. Ceases to have effect when authorized officer confirms there is no longer a health risk.**

NB - If the Court refuses to issue a hygiene emergency prohibition order, the enforcement authority is liable for compensation.

- **Reg 11 - It is a defence to prove you took all reasonable precautions and exercised all due diligence to avoid offence.**

Accurate written records are useful to prove this defence. However, inaccurate or incomplete records are of little value and probably worse than having no records.



(It is not a legal requirement to have a due-diligence defence)

A suitable food safety management system is essential and will be taken into account by an EHP considering prosecution for a hygiene offence.

The burden of proof is on the defendant and discharged on 'the balance of probabilities'.

- **Reg 12 - Authorized officers may take samples of food for analysis.**
- **Reg 14 - Powers of entry for authorized officers to food premises at all reasonable hours (must show authority). 24 hours notice in business in domestic premises.**
- **Reg 15 - Offence to obstruct authorized officer.**
- **Reg 17 - Penalties - Magistrates Court £5000 for each offence - Crown Court - unlimited fine - up to 2 years' imprisonment.**
- **Reg 18 - Directors, managers or secretaries of corporate bodies may be prosecuted.**
- **Reg 20-22 - Appeals**
- **Reg 23 - Authorized officer may seize food which fails the food safety requirements.**
- **Schedule 6 - Restrictions on the sale of raw milk for direct human consumption, e.g. from restaurant or retail outlet.**



Statutory Codes of Practice

The Food Hygiene (England) Regulations 2006 and Food Safety Act 1990)

Issued by ministers for enforcement authorities regarding the enforcement of food law.

- Assist in producing a uniform standard of enforcement.
- Not legally binding, however, 'directions' given by ministers are enforceable through the courts.

Food Law Code of Practice - Enforcement authorities MUST have regard for

Food Law Practice Guidance - Enforcement authorities MAY have regard for

Divided into the following sections:

- Administration
- Communication
- General enforcement
- Inspections
- Product specific regulations
- Sampling
- Monitoring of inspections
- Annexes



National guides to good practice

(Regulation EC No. 852/2004)

Developed by food business sectors in consultation with competent authorities and consumer groups (must have regard to Codex Alimentarius).

- **Practical guides on legislation**
- **Authorized officers must have regard to content**
- **Help to achieve consistency**
- **May be used in Court to illustrate good practice**
- **Food businesses may opt to comply in other ways**

Notes



Food Safety Act 1990

As a result of the Food Hygiene (England) Regulations 2006
- The Food Safety Act 1990 is now primarily concerned with food standards/quality.

The main offences are:

- **S7 - To render food injurious to health - must be had to the cumulative effect.**
- **S9 - Authorized officers may seize or detain food which fails to comply with the food safety requirements or is likely to cause food poisoning or a foodborne disease. A Justice of the Peace may condemn the food if requested.**
- **S14 - To sell food to the prejudice of the purchaser which is not of the nature (different kind or variety) or substance (not containing proper ingredients) or quality (inferior, for example, stale bread) demanded by the purchaser.**
- **S21 - Due-diligence defence (*See also Food Hygiene (England) Regulations 2006*)**
- **S29 & 30 - Empowers authorized officer to purchase or take samples of food for analysis.**
- **S32 - Empowers authorized officer, on production of authority, to enter any food premises at all reasonable hours. (24 hour notice required if private dwelling house).**
- **S33 - Obstruction**
- **S35 - Penalties - in indictment unlimited fine and/or up to 2 years' imprisonment.**

On summary conviction up to £20,000 and/or up to 6 months' imprisonment

NB Reg 4a of the General Food Regulations 2004 (No 3279)
It is an offence to place food on the market if it is unsafe (injurious to health or unfit for human consumption), i.e. a contravention of Article 14 of the Regulation (EC) 178/2002 (Effectively replaces S8 of Food Safety Act 1990)



Investigating food complaints

- Complainant interviewed by authorised officer (genuine or not) statement taken
- Seller notified and invited to see complaint (may caution)
- Inspection of food premises/practices in relation to complaint
- Due diligence defence considered
- Complaint sent for laboratory analysis (continuity of evidence essential)
- Once officer believes a prosecution is likely proprietor of business interviewed under caution

Notes



Food Labelling Regulations 1996



Require most food sold for human consumption to be labelled with:

- Name of the food
- List of ingredients
- "Best-before" date
on low-risk foods with longer shelf-life e.g. dry foods and frozen foods. Quality issue. Not an offence to sell food after date but there will be no due diligence defence if the food is found to be unfit
- "Use-by" date
on high-risk, perishable food. Requires refrigeration. Offence to sell food after date (or alter). Food safety issue
- **Any** special storage conditions or conditions of use
- Name and address of:
Manufacturer or packer or seller
- **Ensure any date marking on outer cartons is transferred to individual foods when necessary**

Food Labelling (Amendment) (England) (No2) Regulations 2004

Require the labelling of food which contain the following allergens:

- Cereals containing gluten
- Crustaceans
- Eggs
- Fish
- Peanuts
- Soybeans
- Nuts
- Celery
- Mustard
- Sesame seeds
- Sulphur dioxide and sulphites

Enforcement

Food Standards Agency (FSA) - **overall responsibility**
Food authorities (local authorities) **have the responsibility to enforce food safety legislation using** authorized officers **at local level.**

Environmental health practitioners (EHPs)

Powers

- **to inspect food sold or intended for sale for human consumption**
- of entry (at any reasonable time)
- to provide advice (**informal letter - recommendations**)
- to provide training
- **to serve notice (hygiene improvement/emergency prohibition)**
- **to close premises**
- to seize or detain food **which fails to comply with food safety requirements**
- **to instigate prosecution**
- seize **or detain** records (**not destroy**) for use as **evidence**
- **to purchase or take samples of food/ingredients for analysis**

Their duties include:

- **Routine inspection of food premises**
- **Investigation of food poisoning outbreaks**
- **Investigation of food complaints**
- **Providing training and lecturing on food hygiene courses**
- **Facilitating food incidents/hazards/alerts**
- **Dealing with planning and licensing applications**
- **Dealing with registration of food premises**
- **'Home Authority' procedures for national company, usually if HQ within their area**
- **Local business forums etc.**

Trading standards officers

Concerned with composition, labelling, weight/volume **and certain aspects of food safety** e.g. adulteration

NB. Authorized officers do not fine, prosecute or condemn food (courts fine, authorities prosecute and JPs condemn).



The inspection of a food premises by an EHP



The purpose of the inspection

- **To** establish whether food is being handled **and produced** hygienically
- To establish if food is safe to eat
- **To identify foreseeable incidences of** food poisoning
- **To determine the** scope of the business (**e.g. wholesale**)
- Assess effectiveness of HACCP, **especially in relation to critical control points. Identify hazards and effectiveness of controls. Adequate records/documentation.**
- To check standards have been achieved (legal and industry guides)
- To identify training needs of staff (competency)
- To provide advice/make recommendations
- To respond to a complaint
- Revisit
- To continually improve food hygiene standards
- To ensure the business complies with the law
- **To consider appropriate enforcement action (proportionate to risk)**

Inspection of food premises (2) (Food Law Code of Practice/Food Law Practice Guidance)

Notes



Prior to inspection officer must take into account

- Premises' history
- Time **of inspection**
- Equipment **required**
- Protective clothing **required**
- Additional expertise **required**

Frequency of inspection

Refer to inspection programme. This should take into consideration:

- Type of premises
- Nature of food
- Degree of handling
- Size of business
- Type of customer
- Current level of compliance
- Confidence in management
- History of compliance
- Control systems in place

Ask delegates to write down the five most important things they have learnt.

