Major incidents of foodborne illness

Aberdeen – Typhoid
1964 – Associated with cans of corned beef cooled in sewage 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

Contamination	The presence or introduction of a hazard. (EC Regulation No. 852/2004)
Control measures	Actions 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 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	The value of a monitored action which separates the acceptable from the unacceptable.
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 foodborne pathogenic bacteria is possible, i.e. 5°C to 63°C. Most rapid multiplication occurs between 20°C and 50°C.
Deviation	Failure to meet a critical limit.
Flow diagram (chart)	A systematic representation of the sequence of steps or operations involved with a particular food item or process, usually from receipt of raw ingredients to consumer.
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)
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 safety management	The policies, procedures, practices, 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.

Definitions

HACCP team	A group of people with appropriate expertise who develop and implement a HACCP system.
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.
Hazard analysis (Codex Alimentarius)	The process of collecting and evaluating information on hazards and conditions leading to their presence to decide which are significant for food safety and should therefore be addressed in the HACCP plan.
High-risk food	Ready-to-eat foods which, under favourable conditions, support the multiplication of pathogenic bacteria and are intended for consumption without treatment which would destroy such organisms.
Maintenance	Maintaining the supporting elements and resources to ensure the plan remains valid over time and doesn't become out of date.
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.
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 likelihood of occurrence and severity and evaluating the significance.
Safe food	Food which is free of contaminants and will not cause illness, harm or injury.
Target level	The predetermined value for the control measure, which will eliminate or control the hazard at a control point.
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 monitoring, to determine compliance with the HACCP plan. (Includes prerequisite programmes)

Origins of HACCP

Developed from the chemical processing industry HAZOPS (hazard and operability analysis)

1959 Pillsbury commissioned by NASA (Dr Howard Bauman)

1971 Presented publicly at a conference for food protection, Denver Colorado

1973 Training programme on HACCP developed by Pillsbury

1974 USA FDA required HACCP principles to be applied to low-acid foods

Internationally accepted as a food safety management system

1985 National Academy of Science (USA) recommended HACCP be used by food factories to ensure food safety

1988 ICMSF (International Commission for Microbiological Standards for Food) recommended

1990 Richmond report (UK) recommended the implementation of HACCP principles for all stages of food production to enhance food safety

1992 NACMCF (National Advisory Committee on Microbiological Criteria for Food) recommended HACCP

1993 Codex Alimentarius (FAO/WHO)recommended use of HACCP - developed guidelines for HACCP application - promoted as the most effective system of food safety assurance

1993 EC Directive 93/43

1995 Food Safety (General Food Hygiene) Regs

2000 Food Safety (General Food Hygiene) Butchers' Shops Amendment Regs.

2006 EC Regulation on the Hygiene of Foodstuffs

Current food poisoning trends (In England and Wales)

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).

- Salmonella isolates from humans
- Reported cases of food poisoning

(It is recommended that the statistics of reported cases are not used to indicate trends of food poisoning or as indications of food hygiene standards. They are primarily notifications of unconfirmed cases of suspect food poisoning, i.e. persons with gastroenteritis.

Furthermore, they will include a significant number of cases of campylobacter and viral illness, which are not foodborne).

Groups to provide reasons for continuing high levels of foodborne illness and food poisoning notifications.
What has changed in last 10 years?

More bacteria on or in food due to:

- **Intensive animal rearing**
- **Contaminated feed**
- **Concentration - slaughterhouses and transport**
- **NB Less salmonella in chicken/eggs, but more campylobacter**
- **Contaminated fruit/vegetables (salad)**
- **More public awareness**
- **More exotic food**
- **More holidays abroad**
- **More meals away from home**
- **Improved investigation techniques**
- **More susceptible people (especially aged and ill)**
- **New pathogens**
- **Reduced use of preservatives**
- **Changes in preparation techniques (more bulk purchases and family meal patterns)**

Food safety management

What is safe food?

(Managers want the customer to return, not the food)
Food which is free from contaminants and will not cause **harm**, injury or illness. **i.e it will not cause food poisoning**

How do we ensure the safety of food?

Food safety management

Legal and moral responsibility for every food business to implement a food safety management system **to minimise the risk of food poisoning.**

A food safety management system

The policies, procedures, practices, controls and documentation that ensure the food sold by a business is safe to eat and free from contaminants.

Examples of food safety management systems include:

- QA and end-product testing **(for manufacture)**;
- Assured safe catering;
- HACCP;
- Safer food, better business;
- Safe Catering (NI);
- CookSafe (Scotland);
- **good hygiene practice, effective supervision, generic controls and monitoring and periodic inspection.**

However, many systems were poorly implemented and had little effect on rising levels of foodborne illness.

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)

A food business

Any business in the course of which commercial operations, with regard to food or food sources, are carried out (whether for profit or not).

HACCP

HACCP (Hazard analysis critical control point)

A food safety management system which identifies, evaluates and controls hazards which are significant for food safety.

Requires:

- **A multi-disciplinary approach**
- **Full commitment and involvement of management and workforce**
- **Consistent/standardised production**
- **Detailed scientific knowledge**

HACCP should not be seen as an academic exercise or as mountains of monitoring records for enforcement officers to examine during annual inspections.

HACCP should be a set of food safety rules, scientifically validated, implemented by the manager and adhered to by staff. The staff should be able to demonstrate that they understand and implement those HACCP rules (including controls, monitoring and corrective action) for which they are responsible.

Science and technology and HACCP are continuously evolving.

Practices considered good today may be considered unacceptable tomorrow. The important thing to remember is that HACCP is a proactive food safety management system which is implemented to improve food safety and reduce the risk of foodborne illness and injury.

Our levels of knowledge, ability and understanding vary and it is essential that the HACCP system implemented in a food business can be understood and operated by the managers, supervisors and staff within the particular food business.

Results in continuous self-inspection

Documentation provides inspectors with current and past conditions i.e. providing more confidence in the ability of the operation to control food safety.

Implementing the principles of HACCP is a legal requirement for most food premises within the EU

The origins of HACCP

Commissioned by NASA **(National Aeronautics Space Administration US)** in 1959 to ensure safe food was provided for US astronauts.

First published in 1973 by Pillsbury.

Developed and promoted internationally by WHO, FAO, **(Food and Agriculture Organisation of the United Nations),** NACMCF **(National Advisory Committee on Microbiological Criteria for Foods - US) and** FSA **(Food Standards Agency).**

HACCP is an internationally recognised food safety management system.

Codex Alimentarius Commission (CAC) claim HACCP is the most effective system of food safety assurance.

The CAC is a committee established by the FAO of the United Nations and WHO (World Health Organisation) to develop internationally accepted food standards and guidelines.

Objectives - Protect the health of consumers
Promote fair trade practices
Facilitate international trade
Promote coordination of food standards

Representatives of government departments from all over the world. Regular meetings held.
(www.codexalimentarius.net)

Food safety management before HACCP

- **Ad hoc identification of hazards, implementing controls, monitoring and corrective actions (good manufacturing and good hygiene practice)**
- **Observation and supervision of whole process by managers (QA/QC used in manufacturing to control and monitor product safety)**
- **Science rarely used to determine safe storage, cooking and cooling times/temperatures in catering/retailing. (Usually based on legislation/codes of practice/custom and practice)**
- **Emphasis usually on cleanliness and "blanket hygiene" i.e. all hygiene problems accorded equal status (exceptions e.g. retorting in canneries). Too much attention focused on walls, floors and ceilings**
- **Only manufacturers implemented comprehensive systems for the control of chemical & physical contaminants**
- **The safety of products depended on tried and tested historical systems and standards**
- **Caterers/retailers usually relied on advice on safe systems from enforcement officers during enforcement visits**
- **Manufacturers relied on end-product testing (some large retailers - random sampling)**
- **All sectors relied on periodic internal inspection/audit. More formal systems likely in manufacture or large retail/catering business which employed auditors**

Disadvantages of end-product testing

- Control is reactive, action taken after a problem
- Considerable expertise to interpret results
- Testing may be slow
- Cost of sampling and analysis may be high
- Operation controlled by scientists in 'remote' laboratory
- Only applied to a proportion of food (limited samples)
- Does not relate to all potential hazards
- Limited number of staff directly involved in food safety

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

TEMPERATURE

Minimum temperature		**(Except Listeria and Yersinia 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		***(Staphylococcus aureus/Salmonella)***
Optimum pH		

a_w

Minimum		***(Staphylococcus aureus/Salmonella)***

NB Moulds grow at lower pH and a_w values

No reports of mycotoxin production below an a_w value of 0.80

Although the above factors prevent the multiplication of pathogens they remain viable for a long time and if present in large numbers have been known to cause food poisoning, for example, salmonella in apple juice

Please complete the chart below, answers to follow

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

TEMPERATURE

Minimum temperature	3°C/4°C	(Except Listeria and Yersinia 0°C - but very slow)
Maximum temperature	52°C	
Optimum temperature	28°C to 46°C	
Scientific danger zone	3°C to 52°C	
Legal danger zone	8°C to 63°C	

NB Vegetative forms of pathogenic bacteria will be destroyed at, for example, temperatures of 55°C for 2 hours

pH VALUE

Minimum pH	3.8	*(Staphylococcus aureus/Salmonella)*
Optimum pH	7.8	

a_w

Minimum	0.83	*(Staphylococcus aureus/Salmonella)*

NB Moulds grow at lower pH and a_w values

No reports of mycotoxin production below an a_w value of 0.80

Although the above factors prevent the multiplication of pathogens they remain viable for a long time and if present in large numbers have been known to cause food poisoning, for example, salmonella in apple juice

Important (UK) foodborne pathogens, sources, vehicles and growth characteristics

Bacteria	Source	Food vehicle	Growth temperature range (0°C) (optimum)	Growth pH (range) (optimum)	Minimum (a_W) level	D value*	Infective dose	Oxygen requirements	Max salt % Allowing growth
Bacillus cereus	Soils, dust, water, vegetation, and a variety of cereals, dried foods and spices	Meats, vegetable dishes, milk, cream pastries, soups and puddings, fried, boiled or cooked rice and other starchy foods (e.g. potatoes and pasta)	5 - 48 (28-35)	4.4 - 9.3 (7)	0.91	Spores 5 - 8 mins at 100°C	Medium	Facultative anaerobe	10%
Campylobacter jejuni	Soil, sewage, poultry, water, animals. cats, dogs, rodents and some wild birds	Raw milk, chicken, other meats and meat products	28 - 46 (42-45)	4.9 - 9.5 (7)	NK	1 min at 55°C	Low	Obligate microaerophilic	3.5%
Clostridium botulinum	Soil, intestinal tracts of fish and mammals	Low-acid canned foods, vegetables, meats, fish, smoked/fermented fish and other marine products	3 - 50 (30-37)	4.6 - 9.0 (7)	0.94	0.2 -1.0 secs at 100°C	Very low (toxin)	Anaerobic	5 - 10%
Clostridium perfringens	Soil, sediment (widespread), intestinal tracts of humans and animals, dust and insects	Beef, turkey, pork, chicken, cooked minced meat and other meat dishes, gravy, soups and sauces	10 - 52 (37-46)	5.0 - 8.9 (7)	0.93	Spores 1 - 20 mins at 100°C	Usually high	Anaerobic	6%
Escherichia coli (Enterovirulent types)	Intestinal tracts of humans and animals	Raw or rare meats and poultry, raw milk and milk products, unprocessed cheese, salads	3 - 46 (37)	4.4 - 9.5	0.95	6 secs at 65°C 2 secs at 71.7°C	Very low	Facultative anaerobe	8%

Important (UK) foodborne pathogens, sources, vehicles and growth characteristics

***The D value of an organism describes its heat sensitivity/resistance (stands for Decimal Reduction Time and is the time required at a specific temperature to kill 90% of the organisms present. As temperature increases, the D value decreases.**
[1] Minimum for enterotoxin production 14°C, maximum 45°C.
[2] Minimum pH for enterotoxin production.

Bacteria	Source	Food vehicle	Growth temperature range (0°C) (optimum)	Growth pH (range) (optimum)	Minimum (a_W) level	D value*	Infective dose	Oxygen requirements	Max salt % Allowing growth
Listeria monocytogenes	Soil, silage, water and other environmental sources, birds and mammals	Raw milk, soft cheese, coleslaw, ice-cream, raw vegetables, raw meat, raw and cooked poultry, raw and smoked fish and paté	–1.5 to 42 (30-37)	4.3 - 9.5 (7)	0.92	5 - 8 mins at 60°C 3 - 10 secs at 71.7°C (very variable)	Probably low for immuno-compromised	Anaerobic (Microaerophilic)	10%
Salmonella spp.	Water, sewage, soil, birds, insects, intestinal tracts of animals, especially poultry and swine, terrapins, rodents and eggs	Beef, turkey, pork, chicken eggs and egg products, meat salads, shellfish, raw milk, dried coconut, baked goods and dressings	7 - 47 (37)	3.8 - 9.0 (7)	0.95	10 -25 secs at 65.5°C 0.5 - 5 secs at 71.6°C	Medium (low in milk and some foods)	Facultative anaerobe	8%
Staphylococcus aureus	Hands, throats and noses of humans	Ham, turkey, chicken, pork, roast beef, eggs, salads (e.g. egg, chicken, potato, macaroni), bakery products, cream-filled pastries, luncheon meats, milk and dairy products	7 - 48[2] (37)	3.8 - 10.0 (7)	0.83[2]	12 - 120 secs at 65.5°C 4 secs at 71.7°C	Medium	Facultative anaerobe	18%
Vibrio parahaemolyticus	Estuarine and marine waters	raw, improperly cooked or cooked recontaminated fish, shellfish or crustacea	5 - 43 (30-37)	4.5 - 11.0 (8)	0.94	1 - 60 mins at 47°C	?Low	Facultative Anaerobic	8%
Yersinia enterocolitica	Soil, water, intestinal tracts of various animals (pigs, birds, dogs and cats)	Meat and meat products (particularly swine), vegetables, milk and milk products	0 - 44 (30)	4.6 - 9.0 (7)	0.94	6 secs at 48°C	?	Facultative anaerobe	10%

Try to complete the controls below, answers to follow

Causes 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)	

Causes of food poisoning (hazard)	Controls
Preparation too far in advance and storage at ambient temperature (multiplication)	• Food stored below 5°C or above 63°C • Prepare minimum amount of food • Time at ambient during preparation minimised • Staff training (personal hygiene) • Cleaning and disinfection of food contact surfaces prior to preparation
Inadequate cooling (multiplication)	• Food cooled from 60°C to 10°C within 1.5 hours - Blast chilling • Food cooled from 10°C to 5°C within 1.5 hours - Blast chilling • After cooling - food stored in a refrigerator below 5°C • Weight/thickness of joints of meat controlled • Cleaning and disinfection of food contact surfaces • Staff training
Inadequate reheating (survival)	• Reheat greater than 75°C at the coolest point
Contaminated processed/canned food (inherent contamination)	• Purchase all food from approved suppliers • Do not use damaged/old cans • Inspect canned contents prior to use • Staff training
Undercooking (survival)	• Centre temperature at least 75°C • Frozen poultry/joints thawed prior to cooking • Staff training
Inadequate thawing (survival during cooking)	• Ensure poultry/joints completely thawed (thawing cabinet) • Avoid cross-contamination • Knowledge of time to thaw specific weights to specific temperature • Staff training
Cross-contamination (contamination)	• Raw and high-risk food to be segregated at all stages from delivery • Separate food contact surfaces/equipment (colour coding) • Effective cleaning and disinfection • Staff training • High standards of personal hygiene • Effective pest control
Raw food consumed (inherent contamination)	• Hazardous raw food not to be consumed • Only use reputable suppliers • Suspect food not to be used (staff training)
Improper warm holding (multiplication)	• All food maintained above 63°C • Prepare minimum amount of food • Prevent contamination • Staff training
Infected food handlers (contamination)	• Pre-employment medical questionnaire/screening • Screening of staff • High standards of personal hygiene • Appropriate facilities provided • Staff training, especially reporting of illness and handwashing

Hazard ranking of pathogens

Severe hazards

Clostridium botulinum
Mycotoxins (from mould)
***Salmonella* Typhi and Paratyphi**
Brucella abortus
Vibrio cholerae
Hepatitis A and B
***Escherichia coli* O157**
Mycobacterium tuberculosis
Taenia saginata
Trichinella spiralis

Moderate hazards with potentially extensive spread (may be a severe hazard for susceptible populations e.g. listeria and pregnant women)

Salmonella spp.
Shigella spp.
Norovirus
Cryptosporidium
Listeria monocytogenes

Moderate hazards with limited spread

Campylobacter spp.
Clostridium perfringens
Staphylococcus aureus
Vibrio parahaemolyticus
Bacillus cereus
Giardia lamblia
Yersinia enterocolitica

Examples of chemical hazards

Natural toxins

Ciguatoxin (from marine dinoflagellates)
Diarrhetic shellfish poisoning
Haemagglutin (red kidney beans)
Hydrazine derivatives (toadstools)
Hydrogen cyanide (apricot kernals)
Mycotoxin, for example alflotoxin and patulin from mould
Paralytic shellfish poisoning
Pufferfish - gonads, liver and intestine
Solanin (green potatoes)
Scombrotoxin

Poisonous manufactured chemicals

Antibiotics
Benzene (from packaging)
Cleaning chemicals
Dioxins
Fertilisers
Fungicides
Growth hormones
Industrial waste oil
Pesticides
Polychlorinated biphenyls
Toxic metals and their compounds, including: aluminium, antimony, arsenic, cadmium, copper, cyanide, lead, mercury, tin and zinc
Weedkillers

In addition certain food additives are toxic if limits are exceeded, for example, monosodium glutamate, sodium nitrate and nitrite

NB also allergens
Crustacea
Eggs
Fish
Milk
Peanuts
Wheat

Try to complete the hazards and controls, answers to follow

Physical and chemical hazards and controls

Source	Hazards	Controls
Raw ingredients		
Building		
Equipment		
Notice boards		
Packaging materials		
Maintenance operatives		
Food handlers and visitors		
Cleaning activities		

Physical and chemical hazards and controls

Source	Hazards	Controls
Pests		
Pesticides		
Industrial chemicals		
Sabotage		
Food containers (jars and bottles used for filling, e.g. jam)		

Physical and chemical hazards 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 Glass policy
Equipment	Bolts/nuts Grease/oil Glass Wood	Metal detection/self-locking/maintenance Staff training (not above open food) Use perspex/glass policy Wood policy
Notice boards	Drawing pins	Not to be used. Perspex covered notice boards
Packaging materials	Staples String Wood/plastic (pallets & boxes) Containers Plastic Glass	Specify packaging eg 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 eg high pressure spraying near open food

Physical and chemical hazards and controls

Source	Hazards	Controls
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
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 (leaking refrigerants) Veterinary drugs/fertilisers Environmental contamination eg dioxins	Approved suppliers Segregation/leaks Staff training Note distribution/delivery vehicles
Sabotage	Needles Razor blades Toothpicks Glass	Tamper evident packaging Vigilance Thorough investigation of complaints (deterent effect)
Food containers (jars and bottles used for filling, e.g. jam)	Glass shards Chemical contamination	Approved supplier/correct glass 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 Effective/cleaning/rinsing/emptying

Hazards

A biological, chemical or physical agent in, or condition of, food with the potential to cause harm **(an adverse health effect) to the consumer. (Most biological hazards are microbiological).**

Microbiological hazard

The unacceptable contamination, the unacceptable multiplication, the unacceptable production or persistence of toxins and/or the unacceptable survival of pathogenic microorganisms in food. (Includes bacteria, viruses, parasites, protozoa and moulds.)

Microbiological **hazards result in** foodborne disease or food poisoning.
May be present in raw materials.
Cross-contamination **of high-risk food by pathogens.**
Multiplication/toxin production.
Survival **of pathogens/**spores/toxins **during cooking, preservation or processing.**

Chemical hazards result in food poisoning or chronic illness **such as cancer.**

Present in raw materials.
Contamination by cleaning agents.
by pesticides.
by weedkillers.
by allergens.
Excess additives
Poisonous foods **e.g. toadstools.**

Physical hazards **are foreign bodies in food which** may cause cuts to mouth, choking, broken teeth **or** internal injury**, for example, glass, nails or stones. May also include** burning **if food is too hot. Physical hazards may be** present in raw ingredients **or** introduced during production/preparation.

Failure to control food hazards

1964 -	**Aberdeen**	**Typhoid outbreak. Argentinian corned beef - cans cooled in polluted river water. *Salmonella* Typhi entered through seams. Cross-contamination to other meats during slicing (from slicing machine) 400+ cases**
1984 -	**Wakefield**	**Stanley Royd Hospital *Salmonella* Typhimurium 455 cases, 19 deaths. Cross-contamination between thawing frozen poultry and cooling beef from the oven thought to be the likely cause. Resulted in the end of Crown immunity for hospital kitchens from local authority enforcement action. Also resulted in major introduction of cook-chill operations in hospitals.**
1989 -	**Birmingham**	**27 cases and 1 death from *Clostridium botulinum* following the consumption of hazelnut yoghurt. Manufacturer previously produced fruit yoghurts. No effective hazard analysis when changing to hazelnut. Higher pH requires increased processing temperatures also changed from sugar to saccharin which increased the a_W, allowing the germination of spores.**
1996 -	**J Barr Wishaw Scotland**	**Wholesale Butcher . Several outbreaks of *E.coli* O157. 500+ cases, 21 deaths. Main problem was a failure to understand the risks involved when producing cooked meat. No HACCP in place. Cross-contamination a major hazard and possibly the failure to cook and reheat thoroughly. Some outbreaks involved cross-contamination of other cooked meats (similar to Aberdeen Typhoid outbreak)**

Failure to control food hazards

The adverse effects of food poisoning/food complaints on a food business

The resources **(time, personnel, money)** involved in investigation **and report writing.**

Brand damage.

The adverse publicity and potential loss of business.

Prosecution - fines, closure, **improvement notices and banning from operating a food business.**

Civil action resulting in compensation.

Overall loss of public confidence **in specific foods and the food industry e.g. eggs.**

Microbiological hazards

(Foodborne pathogens)

Bacteria

The main cause of food poisoning.

Viruses

Hepatitis A
Norovirus

Viral gastroenteritis

Quite common but usually relatively mild. Often spread by the faecal/oral route and from the environment. Usually low dose. Norovirus quite common but under-reported because of relatively mild illness for short period of time.

Protozoa

Cryptosporidium parvum
Giardia lamblia
(faecal/oral route, waterborne outbreaks)

Moulds (fungi)

Aspergillus spp. produce mycotoxins
Aflatoxin (nuts)
Patulin (apple juice)

Parasites

Taenia saginata **(beef)**
Trichina spiralis **(pork and horse flesh)**

Algae

Poisonous dinoflagellates which produce biotoxins causing paralytic and diarrhetic shellfish poisoning

Microbiological hazards

Sources of pathogens

People

- Hands
- Mouth
- Skin cuts and grazes
- Sewage
- Nose, sneezing
- Hair
- Intestines

Raw food/water/ice

- Red and white meat
- Raw vegetables (soil)
- Milk
- Eggs
- Shellfish (especially bivalves)
- Ready-to-eat fruit/salad vegetables
  - contaminated irrigation
  - poor hygiene of harvesters
  - contaminated in transport (manure transported one way, lettuces the other)

NB Suspected that the outbreak of Novovirus amongst British Troops in Afghanistan resulted from sewage contamination of their drinking water.

Soil/dust

- Cover food

Animals and birds

- No access to pets etc.

Insects

- Flies, cockroaches etc. (from feet, vomit, faeces etc.)

Rodents

- Rats, mice (from feet, urine, faeces, mouths etc.)

Refuse and waste food

- Do not allow waste to accumulate

NB Norovirus - inhalation of dust from desiccated vomit and faeces may occur.

Microbiological hazards

Spores

Resistant resting phase of certain bacteria, e.g. *Clostridium perfringens*, which protects them against adverse conditions, such as high temperatures, chemicals and dehydration.

- **Survive for many years**
- **Activated by cooking**
- **Germinate during cooling**
- **Unaffected by refrigeration or freezing**

Toxins

Poisons produced by pathogens. They may be produced in the food or in the body after the food has been eaten. Toxins are unaffected by refrigeration or freezing.

- **Exotoxins: Usually formed in food, e.g. *Staphylococcus aureus*. Many exotoxins are very heat-resistant and boiling for long periods may be required to ensure their destruction. Normal cooking may not destroy them. Eating foods containing toxins is likely to result in food poisoning. *C. perfringens* produces an exotoxin in the intestine when spores are formed.**

- **Endotoxins: Usually produced in the body, e.g. Salmonella. Once again if sufficient toxin is present we will end up with food poisoning.**

NB This OHP is optional depending on group knowledge.

Microbiological hazards

Factors affecting the multiplication of foodborne pathogens

Danger zone for bacterial growth

The temperature range within which the multiplication of most foodborne pathogenic bacteria is possible i.e. 5°C to 63°C. (Some pathogens grow outside this range, e.g. listeria and *Clostridium botulinum* (3·3°C) grow below 5°C; some pathogens may not start growing until at least 10°C, e.g. *Clostridium perfringens.* No foodborne pathogens multiply above 52°C.)

- Temperature **(5°C to 63°C optimum 20°C to 50°C)**
- Time **(as short as 10 minutes)**
- pH **(dislike extremes of pH e.g. acid food<4.5)**
- a_w **(available moisture) (usually sufficient in most foods)**
- Oxygen **presence or absence**
- Nutrients **(Food) (usually protein)**
- Preservatives **e.g. salt, nitrate**

Large numbers of bacteria usually required to cause food poisoning (pathogens low-dose).
Foodborne diseases including *E. coli* O157, hepatitis A, dysentery (shigella), typhoid and viral gastroenteritis have low infective doses and do not need to multiply in food, although *E. coli* O157 can do so.
Bacteria multiply by dividing into two. Binary fission. 10-20 minutes in optimum conditions 1000 to 1,000,000 in 1 hour 40 minutes (every 10 minutes).
Important UK foodborne pathogens - sources, vehicles, growth characteristics and infective doses.

Control measures

- Keep food out of the danger zone **below 5°C or above 63°C**
- Minimise time at room temperature
- Remove moisture **and keep dry foods free from moisture (dehydration)**
- Preservatives, e.g. salt and sugar **or acid** (vinegar)
- Fermentation **e.g. salami, yogurt and cheese**

Destroying bacteria

- Heat processing/cooking **- centre temperature 75°C (or equivalent time/temp)**
- **Stews etc. (usually around 100°C)**

- **Reheat to a minimum 75°C (82°C in Scotland)**
- **Pasteurization, sterilization, canning (121°C for 3 minutes)**
- **Disinfectants such as bleach**
- **Irradiation (spices) and U/V light (water/oysters)**

Destroying unfit, suspect or contaminated food.

In manufacturing, for example canning, a knowledge of the specific pathogen is essential to ensure effective control.
However, in catering a generic control is usually applied, for example, cook to a core temperature of 75°C.

Microbiological hazards

Discuss sources of important pathogens (generic or specific)

Consider:

If raw ingredients are a possible source of pathogens/toxins

If raw ingredients have been treated to destroy pathogens

Food vehicles of pathogens:

- Raw milk/dairy products**: *E. coli* O157, salmonella , campylobacter, *Staphylococcus aureus***
- Uncooked egg products**: salmonella**
- Cooked meat**: *E. coli* O157, salmonella and *Staphylococcus aureus***
- Rice**: *Bacillus cereus***
- Bivalves**: Norovirus**
- Salad vegetables/fruit**: *E. coli* O157, salmonella, norovirus, Hepatitis A and protozoa**
- Salmon/trout **(especially smoked/**vacuum packed**): *Clostridium botulinum***

Physical hazards (foreign bodies)

Physical hazards may make the food unsafe for consumption, and usually result in complaints.

Effects of physical hazards:

Choking)
Cuts/penetration) may require surgery to remove
Broken teeth)
Burning)
NB Long-term effect

Physical hazards which do not make the food unsafe need to be removed for quality reasons and to comply with the requirements of the food safety legislation, e.g. paper, small pieces of soft packaging material.

Sources of physical hazards

May be brought in with raw ingredients **or during transport (unloading and loading) e.g. wood from crates or pallets, especially if double stacked.**

BUILDINGS - (walls, ceilings, pipework, doors, windows) flaky paint, condensation, glass, rust etc.
EQUIPMENT - nuts, bolts, flaking paint, rust etc.
NOTICE BOARDS - drawing pins.
FOOD HANDLERS/VISITORS - jewellery, pen tops, buttons.
MAINTENANCE OPERATIVES - swarf, wire, pens, nuts, bolts, screws.
PACKAGING MATERIALS - wire, nails, screws, wood, glass.
PESTS - bodies, eggs and droppings.
PEST CONTROL ACTIVITIES - bait boxes, plastic, bait.
CLEANING ACTIVITIES - wood, plastic, bristles.
FOOD CONTAINERS
RESULT OF POST-PROCESS CONTAMINATION - sabotage.

Sources of chemical hazards

Present in raw materials

Pesticides/herbicides/fungicides/fertilizers (vegetables).
Heavy metals **e.g. lead, zinc, mercury,** (vegetables, fish).
Antibiotics/hormone residues(meat).
Allergens **e.g. peanuts, crustacea, eggs, sesame seeds, celery, mustard, fish, milk, soy and wheat (gluten)**
Natural toxins **e.g. rhubarb leaves, solanin (green potatoes)**
Industrial chemicals **e.g. dioxins in milk, PCBS (polychlorinated byphenyls)**
Radiation (Chernobyl)

Contamination during processing

Fumes **- paint, petrol**
Cleaning chemicals **- especially 'Cleaning in Place' caustic soda.**
Lubricants
Pesticides **- rat poisoning, insect sprays.**
Allergens **- processed food, sweets, cereals (cross-contamination). (Clear labelling is essential).**
Excess additives **- nitrates, sulphites, monosodium glutamate.**
Migration from packaging **- inks, plasticisers, adhesives.**
Sabotage
Chemical poisoning may be acute, chronic or carcinogenic.

May be difficult to control if we don't know the toxicity levels

MODULE 3

Prerequisite programmes

Outcomes

The delegate will know and understand how to:

- **define control measures**
- **explain the relationship between HACCP and prerequisite programmes**
- **provide examples of prerequisite programmes**
- **describe the importance of management commitment to implement HACCP and to provide leadership and resources**
- **explain the importance of approved suppliers and supplier assurance**

Food handlers control chart

Prerequisites - Personal hygiene

Hazards - Microbiological, chemical and physical

Sources and/or causes of hazards	Control measures	Monitoring	Corrective action
Contaminated hands, e.g. after going to the toilet or handling a sick person			
Food handler ill and/or diarrhoea and vomiting			
Boil/septic cut			
Cuts/abrasions			
Poor hygiene e.g. picking nose, sneezing over food, smoking etc.			
Contaminated protective clothing			
Jewellery			

Try to complete the 3 columns below, answers to follow

Food handlers control chart

Prerequisites - Personal hygiene
Hazards - Microbiological, chemical and physical

Sources and/or causes of hazards	Control measures	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 washbasins, liquid soap, warm running water, nailbrush, paper towels and handwashing 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 } GCA Provision of additional facilities
Food handler ill and/or 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)

Cleaning control chart

Prerequisites - Cleaning and disinfection

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

Sources and/or causes of hazards	Control measures	Monitoring	Corrective action
Cross-contamination from contaminated cleaning equipment and/or cleaning raw food areas before high-risk areas			
Failure to destroy pathogens			
Chemical contamination of food e.g. tainting with phenols			
Physical contamination of food from cleaning equipment e.g. bristles from brushes			

Have a go at this one, answers to follow

Cleaning control chart ANSWERS

Prerequisites - Cleaning and disinfection

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

Sources and/or causes of hazards	Control measures	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

Pest control chart

Prerequisites - Pests

Hazards - Bacteriological & physical contamination (from pests). Chemical from pesticides.

Sources and/or causes of hazards	Control measures	Monitoring	Corrective action
Contamination of food and food contact surfaces from pests Flies dropped out of EFKs onto food or food contact surfaces Contamination of food or food contact surfaces with pesticide			

Another one to complete, answers to follow

Pest control chart ANSWERS

Prerequisites - Pests

Hazards - Bacteriological & physical contamination (from pests). Chemical from pesticides.

Sources and/or causes of hazards	Control measures	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	Audit/inspection	Reposition EFKs (Destroy contaminated food)
Contamination of food or food contact surfaces with pesticide	Remove food etc. before treatment Clean surfaces after treatment Use reputable contractor	Inspection/observation	Discard/destroy contaminated food Issue new instructions Replace contractor

Waste management control chart

Prerequisites - Waste management

Hazards - Bacteriological and physical contamination

Sources and/or causes of hazards	Control measures	Monitoring	Corrective action
Overflowing waste receptacles attracting pests Uncovered external waste containers attracting pests Decomposing/maggot infested waste External waste storage containers wrongly sited			

Last one to complete, answers to follow

Waste management control chart ANSWERS

Prerequisites - Waste management

Hazards - Bacteriological and physical contamination

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

Prerequisites programmes

(Include GHP/GMP/employee training)

Prerequisite programmes are the good hygiene practices a business must have in place before implementing the HACCP plan.

Prerequisite programmes ensure the HACCP plan concentrates on the most significant hazards. The effectiveness of prerequisite programmes is determined by carrying out internal audits.

Prerequisites

Management commitment

Adequate resources **and suitable facilities**

Approved suppliers (**discuss** supplier assurance **e.g. auditing, customer reference, history, specifications/sampling, brand, documentation, other customers used.)**

Premises and equipment well designed, constructed and maintained.

Unidirectional product flow.

Potable water/ice supplies

Prerequisites programmes

(Include GHP/GMP/employee training)

High standards of personal hygiene. **(Suitable facilities). Health and exclusion policy. Visitor policy/contractor policy**
Staff trained **commensurate with their work activities**
Effective **planned** cleaning and disinfection **(schedules)**. **Suitable facilities**
Equipment calibration
Preventive maintenance
Stock rotation
Integrated pest management
Effective waste management
Labelling, traceability and recall procedures

NB Quite often where outbreaks of food poisoning have been linked to HACCP certified food operations, the breakdown has been associated with inadequate prerequisite programmes.

Control measures

Actions required to exclude or eliminate a food safety hazard or reduce it to an acceptable level.

MODULE 4

Legal requirements and HACCP principles

Outcomes

The delegate will know and understand how to:

- **define hazard analysis**
- **explain how the obligation to produce safe food has been incorporated into national and trade agreements**
- **explain how the EU Hygiene Directive 93/43 has been incorporated into UK Food Safety Legislation (will be replaced by EC Regulation No 852/2004 on the Hygiene of Foodstuffs from 01/01/06)**
- **explain the role of Industry Guides to Good Hygiene Practice**
- **describe the elements of food safety management systems based on hazard analysis**
- **state the 7 principles of HACCP as defined by Codex Alimentarius**
- **explain the benefits of Food Safety Management Systems based on the principles of HACCP**
- **explain the roles of employees and managers regarding food safety and HACCP**
- **provide examples of useful HACCP reference sources and relevant legislation**

Legal requirement for hazard analysis

The Food Safety (General Food Hygiene) Regulations, 1995

Regulation 4(3) - A proprietor of a food business shall ensure that the preparation, processing, manufacturing, packaging, storing, transportation, distribution, handling and offering for sale or supply of food are carried out hygienically. (In particular, the proprietor must ensure that the appropriate requirements of Schedule are complied with.)

The proprietor shall identify any step in the activities of the food business which is critical to ensuring food safety and ensure that adequate safety procedures are identified, implemented, maintained and reviewed on the basis of the following principles:

- Analysis of the potential food hazards.
- Identify the points where the hazards may occur.
- Decide which of the points are critical to food safety.
- Implement effective control and monitoring at CCPs.
- Review the system periodically and whenever significant change occurs.

NB Although the two missing HACCP principles (verification and documentation) are not legal requirements many people consider them to be important for a well run business.

REGULATION (EC) No 852/2004 ON THE HYGIENE OF FOODSTUFFS
Date of application 1 January 2006
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.

7 HACCP principles (Codex Alimentarius)

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.

Legal requirement for HACCP

Hazard analysis

The process of collecting and evaluating information on hazards and conditions leading to their presence to decide which are significant for food safety and should therefore be addressed in the HACCP plan. (Codex Alimentarius)

EU directive 93/43 ➔ Food Safety (General Food Hygiene) Regs 1995
Codes of Practice - guidance for enforcement officers
Industry Guides to Good Hygiene Practice - advice on compliance

NB Vertical directives **relate to a specific food industry e.g.** red meat **or poultry.** Horizontal directives **apply to** all food premises**. The current strategy from the EU is to use horizontal directives as far as practicable.**

Food Safety Act 1990 - due diligence defence

Discuss how HACCP is a vital part of a due diligence defence, especially accurate and relevant documentation and records.

The section	Compliance	Compliance
All reasonable precautions	**An effective control system**	**HACCP**
Due diligence	**Implementation of the control system**	**Effective implementation of HACCP**

Legal requirement for hazard analysis

The Food Safety (General Food Hygiene) Regulations, 1995

Regulation 4(3) - A proprietor of a food business shall ensure that the preparation, processing, manufacturing, packaging, storing, transportation, distribution, handling and offering for sale or supply of food are carried out hygienically. (In particular, the proprietor must ensure that the appropriate requirements of Schedule are complied with.)

The proprietor shall identify any step in the activities of the food business which is critical to ensuring food safety and ensure that adequate safety procedures are **identified**, implemented, **maintained and reviewed on the basis of the following principles:**

- Analysis of food hazards.
- Identify the points where the hazards may occur.
- Decide which of the points are critical to food safety.
- Implement effective control and monitoring at CCPs.
- Review the system periodically **and whenever significant change occurs.**

REGULATION (EC) No 852/2004 ON THE HYGIENE OF FOODSTUFFS

Earliest date of application 1 January 2006
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 verification 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.**

Butchers' licensing

The Food Safety (General Food Hygiene) (Butchers' Shops) Amendment Regulations 2000

Butchers' shops selling raw and ready-to-eat food must be licensed

Conditions applicable:

Must comply with food safety regulations

All food handlers must be trained **in food safety**

Must have at least one trained supervisor who can manage the HACCP system

Effective HACCP, including verification and documentation, must be in place

The Food Safety (General Food Hygiene) (Butchers' Shops) Amendment (Scotland) Regulations 2000

Licence condition - all supervisors trained to Intermediate standard and HACCP system (inc verification and documentation) UNLESS there is complete segregation of all raw meat and unwrapped ready-to-eat food.

Principles of HACCP must be implemented to enable managers to avail themselves of a due-diligence defence.

The Meat (Hazard Analysis and Critical Control Point) Regulations 2002

Regulations apply to operators of licensed fresh meat and poultry meat:
Slaughterhouses
Culling plants
Cold stores
Repackaging centres
Rewrapping centres

All operators must apply the 7 HACCP principles

The Seven Principles of HACCP
(as defined by Codex Alimentarius)

Principle 1
Conduct a hazard analysis

Principle 2
Determine the critical control points (CCPs)

Principle 3
Establish critical limits

Principle 4
Establish a system to monitor control of the CCPs

Principle 5
Establish the corrective action to be taken when **monitoring indicates that** a particular CCP is not under control

Principle 6
Establish procedures for verification to confirm that the HACCP system is working effectively

Principle 7
Establish documentation concerning all procedures and records appropriate to these principles and their application

Benefits of HACCP

- **HACCP is a** structured and systematic **approach to identify and control food safety hazards and produce safe food** (control on the premises)
- Reduces the risk of food safety incidents **(food complaints/food poisoning)**
- HACCP demonstrates compliance with the law (also due-diligence defence)
- More cost-effective **as it** targets resources to the control of critical points and reduces waste, reprocessing **and** recalls
- Generates a food safety culture/increased confidence **that all processes are properly controlled on the premises** (customers and enforcers)
- Proactive not reactive **(remedial action taken prior to serious problems arising)**
- More effective as it is part of the process
- Protects brand image

Benefits of HACCP

- Safety can be introduced in product development
- All staff involved - **can be used as a** training exercise
- Satisfies customer requirements (retail **purchasing from manufacturers)**
- Internationally recognised **(CODEX)**
- Demonstrates management commitment **to food safety**
- Control parameters relatively easy to monitor
- More effective than end-product testing **(used in manufacture)**
- More effective than ad hoc systems of control and monitoring of all hazards **(catering and retailing)**
- More effective than periodic inspection **(all food businesses)**

Role of employees and managers

Individual food handlers have a responsibility for food safety.

All food handlers have an involvement with HACCP.

Managers MUST:

- Have commitment **to implement and maintain HACCP systems**
- Ensure a HACCP study is carried out and resources are available to ensure the HACCP system is implemented and remains effective **(people, time, facilities)**
- Train staff in food safety/**HACCP principles and implementation skills**

Employees MUST:

- Ensure they follow all food safety instructions
- Report when food safety may have been compromised
- Comply with food safety law

NB Role of HACCP team members.

Training of all food handlers in relevant aspects of HACCP is essential for the effective implementation of HACCP. Specific training will be required to support the HACCP plan. Working instructions and procedures should be developed for food handlers in relation to their activities, especially at each critical control point.

MODULE 5

Preparing for implementation

Outcomes

The delegate will know and understand how to:

- **explain the main elements of a HACCP policy**
- **explain the steps involved in the implementation of HACCP based on Codex Alimentarius**
- **explain the need for an experienced and knowledgeable HACCP team and their responsibilities**
- **identify sources of information available to the HACCP team**
- **explain the significance of the terms of reference for a HACCP study, including its scope and definition of food safety objectives and methodology**
- **describe the product/recipe/process**
- **explain the importance of identifying intended/likely customers**
- **describe the generic grouping of products**

Codex implementation of HACCP (HO20)

Describe the product/recipe/process (2) (HO21)

Stages in the implementation of HACCP (The HACCP study)

1 Assemble and train the HACCP team.
(define the terms of reference and the scope)

2 Describe the product/recipe/process.

3 Identify the 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.
(Hazard analysis)

7 Determine critical control points using the decision tree.

8 Determine critical limits, target levels and tolerances for each critical control point.

9 Establish monitoring system for each CCP.

10 Establish actions to be taken when a CCP is moving out of control, and the corrective actions to be taken if a deviation occurs

11 Establish verification procedures (includes validation and review)

12 Establish record keeping and documentation.

Example of Product Description Form

Product description

Product type : Product name: Important characteristics (a_W, pH, preservatives): How is it intended to be used: Packaging: Labelling instructions: Shelf life: Intended consumers: Distribution: Potential hazards: Legal requirements:	

Approval:_____Date:_____

Product description

Product type :	Cooked, sliced ham
Product name:	Porkies Delight
Important characteristics (a_W, pH, preservatives):	Salt 2.5% to 3.00% Sodium nitrite 100ppm
How is it intended to be used:	Ready-to-eat, sliced
Packaging:	Vacuum packed
Labelling instructions:	Store below 5°C, use-by date
Shelf life:	25 days if stored below 5°C
Intended consumers:	All categories, via retail/wholesale
Distribution:	Refrigerated vehicles
Potential hazards:	Contamination (microbiological, physical, chemical) Multiplication (if not stored under refrigeration) Survival (due to inadequate processing)
Legal requirements:	Storage below 8°C and labelling requirements

Approval:_____Date:_____

The twelve logical sequence steps for the implementation of HACCP (The HACCP study)

Successful implementation of HACCP must be built on good hygiene practice and depends on:

Culture of the organization
Management commitment
Effective management/supervision (including leadership of the HACCP team)
Adequate resources (budget and time)
Adequate training
Access to scientific information
Access to necessary expertise

HACCP implementation must be carefully planned

Full implementation - throughout all departments/products.

Gradual implementation -department/product at a time.

1. Assemble the HACCP team **(multidisciplinary expertise - external expertise may be required, especially for smaller businesses).** Training **will probably be required. The** terms of reference **(which product or groups of products/process) and** the scope of the HACCP study **(which hazards) should be determined.**

2. Describe the product/recipe/process. **Relevant safety information will include composition, a_W, and pH. Processes such as heat-treatment, freezing, brining, and irradiation. Packaging, shelf life, storage conditions and method of distribution.**

3. Identify intended use of the product **i.e. how will the end user/consumer use the product, e.g. microwave reheating. Awareness of potential abuse, likely time out of temperature control. Will the product be consumed by vulnerable groups e.g. babies, immunocompromised or the elderly?**

The twelve logical sequence steps for the implementation of HACCP (The HACCP study) *cont*

4. Construct a flow diagram. (It's also usual to describe the process). **The flow diagram must cover all steps in the operation.**

5. On-site validation of the flow diagram. **- 'walk the line'**

6. Identify all potential hazards/risk/severity **associated with each step, conduct a hazard analysis and consider any** measures to control **identified** hazards **(Principle 1).**

7. Determine critical control points using the decision tree (Principle 2).

External expertise may be required to support the HACCP team. However, a HACCP plan produced solely by an external consultant may not result in the essential sense of ownership by managers and operatives.

Implementation of HACCP (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 corrective actions to be taken if **a deviation occurs i.e.** a CCP is out of control. (Principle 5)
11 Establish verification procedures **(includes validation and review)**. (Principle 6)
12 Establish documentation and record keeping. (Principle 7)

HACCP plan

The formal documentation relating to product safety, including:
Information on which safety decisions were based: hazards, controls, CCPs, monitoring and corrective action
Critical limits and targets
Flow diagram(s)
HACCP control charts

HACCP should be unique to the specific food operation

Organizations requiring HACCP

Customers)
Enforcement officers) Potential for
Accrediting bodies) contradiction
Third parties) and confusion

Inspectors should be open-minded... the objective is "safe food"

Requirements for inspectors

Knowledgeable in HACCP
Skilled inspector
Technically qualified
Industry experience

You can't overlay HACCP on an unstable system

Assemble and train the HACCP team

The HACCP team is a group of people with appropriate expertise who develop and implement the HACCP system. Size of team proportionate **to size, risk and complexity of the business.**

Multidisciplinary **- who?**

Adequate resources**/time and commitment is essential**
Identify team leader and note-taker

Team expertise required for HACCP

Knowledge of hazards, risks and controls
HACCP/hazard analysis techniques (hazard identification, CCP determination, monitoring, verification including sampling)
The technology of process
Food microbiology
Engineering/equipment **used in the** process
Product characteristics **(a_W, pH, composition, preservative)**
The practical aspects of the operation/process (including consumer target group and abuse potential)
Quality assurance
Packaging/distribution
Maintenance of records/documentation
Competency to inspect/audit

Team responsibilities

Research/information
Undertake baseline audit
Undertake and record HACCP study
Communication
Training especially in relation to CCPs
Verification
Auditing
Review deviations

The role of each team member should be clearly defined

Sources of information

HACCP team members

Consultants and laboratories

Research organizations (universities)

Public analysts

National food poisoning statistics

Seminars

Codes of practice

Enforcement officers

Food Standards Agency

Health Protection Agency

Trade associations

In-house experts

Mathematical modelling

Customers/suppliers

Customer complaints

Television/radio

Textbooks
Magazines
Libraries
Internet
} **Scientific literature**

Terms of reference

Which hazards?

(Micro)biological
Physical
Chemical **(Allergens)**

Decide on the scope

Which operation or process?
Which products?
Which steps including start and finish?

Describe the product/recipe/process

Potential hazards and risks
Raw ingredients - (approved supplier)
Suitability for bacterial multiplication
Composition/preservative (pH, a_W, toxicity)
Methods of processing/cooking, storage and distribution
Intended shelf life
Packaging and labelling instructions
Legal requirements/standards
Allergies e.g. nuts
Intended storage temperatures
Will the product be reheated?
Is the reheating essential to destroy microorganisms?
Will the food be eaten immediately after reheating?
What potential hazards will the food be exposed to?
i.e. abuse potential **e.g. during transport or by consumer**

Identify the intended use/likely customers (where the product will be sold)

Intended consumers/use (vulnerability) (Baby food)
Elderly/young/pregnant - *Listeria monocytogenes*
Institutional feeding, hospitals, homes for the elderly, immune deficiency (ill persons) and drug abusers.
Allergen sensitive people.

Generic grouping of food products

Particularly important for catering and retailing

Large variety of products

Limited scientific information

Generic

1) HACCP based on each step from delivery through to service, **i.e. steps controlled not product, e.g. refrigerator maintained at 5°C (Single flow diagram)**

2) HACCP of all products subject to similar process, for example

- perishable raw food which is cooked and served hot;
- **high-risk food which is served cold;**
- **high-risk food (frozen or chilled) which is reheated and served hot;**
- **perishable raw food which is cooked for hot holding and then served hot;**
- **perishable raw food which is cooked, cooled and reheated for hot service;**
- **perishable raw food which is cooked, cooled and served cold;**
- **frozen raw food which is thawed, cooked and served hot or cold; and**
- **ambient temperature low-risk foods which are cooked and served hot or cold.**
  (Several flow diagrams)

3) All products prepared in a similar way grouped, e.g. all items of bread, meat pies, cakes etc.

MODULE 6

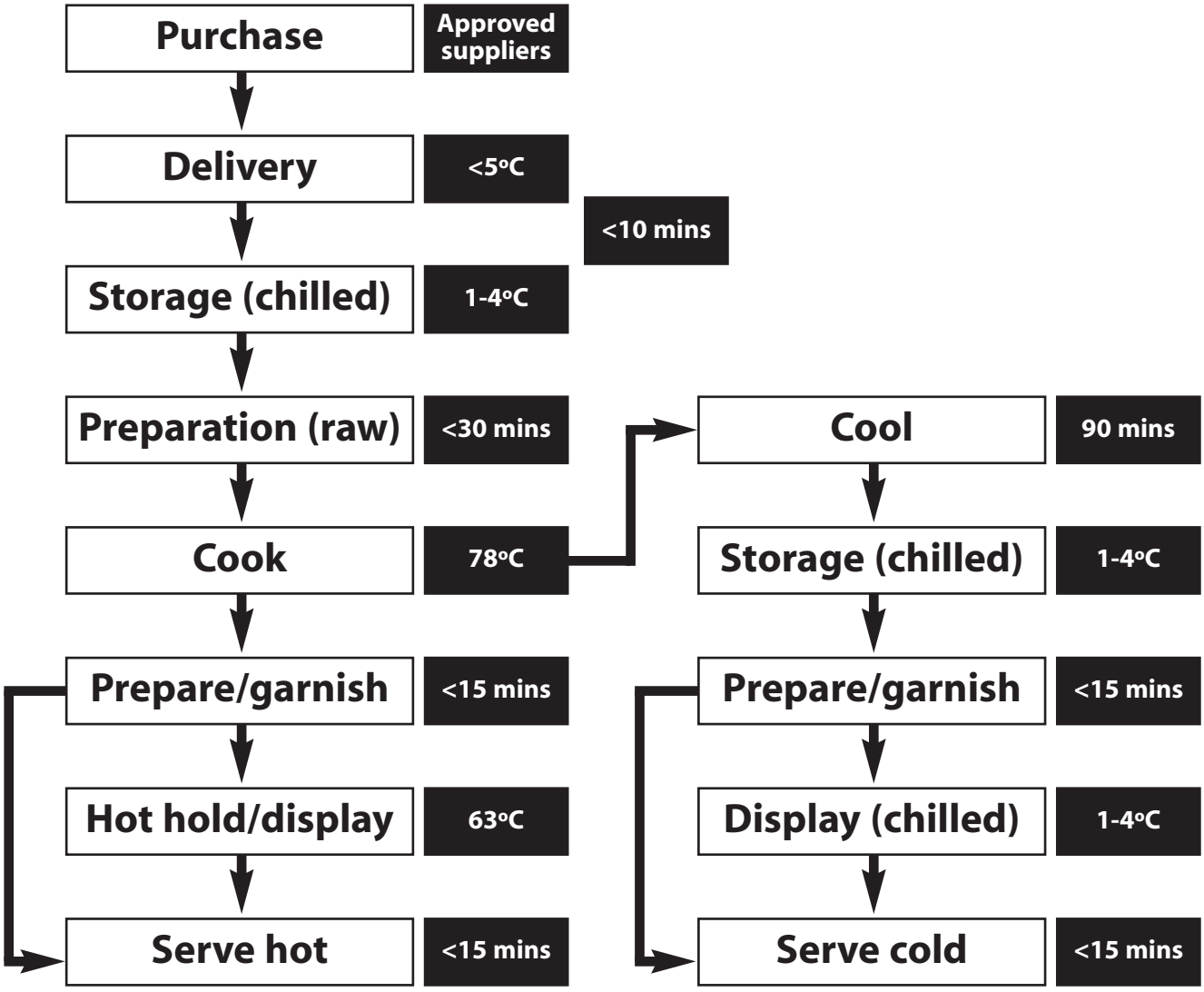
Flow diagrams

Course outcomes

The delegate will know and understand how to:

- **define a flow diagram**
- **explain how to construct a flow diagram**
- **describe the importance of validating the flow diagram**

Process led flow diagram for perishable raw food, cooked and served hot or cold



Process description:
Chicken and black pepper

Ten, 2 kg frozen chickens and dry black pepper are purchased from approved suppliers. The frozen chicken is removed to the large freezers within 10 minutes of unloading. The freezer operates at -18°C. Each chicken is date marked and used within 6 months of purchase. The freezer is alarmed which is activated if the temperature rises above -15°C for longer than 30 minutes. All freezers are maintained at 6 monthly intervals.

The black pepper is unloaded into the dry store and stored off the floor on slatted alloy shelves. A pest control contract is in operation and audits are undertaken every 3 months.

The frozen chickens are thawed overnight in batches of 10 in a temperature controlled room at 15°C. After thawing they are refrigerated below 5°C and stored for a maximum of 24 hours until required for cooking.

Cooking takes place in a preheated fan assisted oven at gas mark 4 (180°C) for 2 hours. A disinfected, calibrated probe thermometer is used to ensure the chickens have achieved a minimum temperature of 75°C. The temperature of the deep thigh muscle is used as the coolest point.

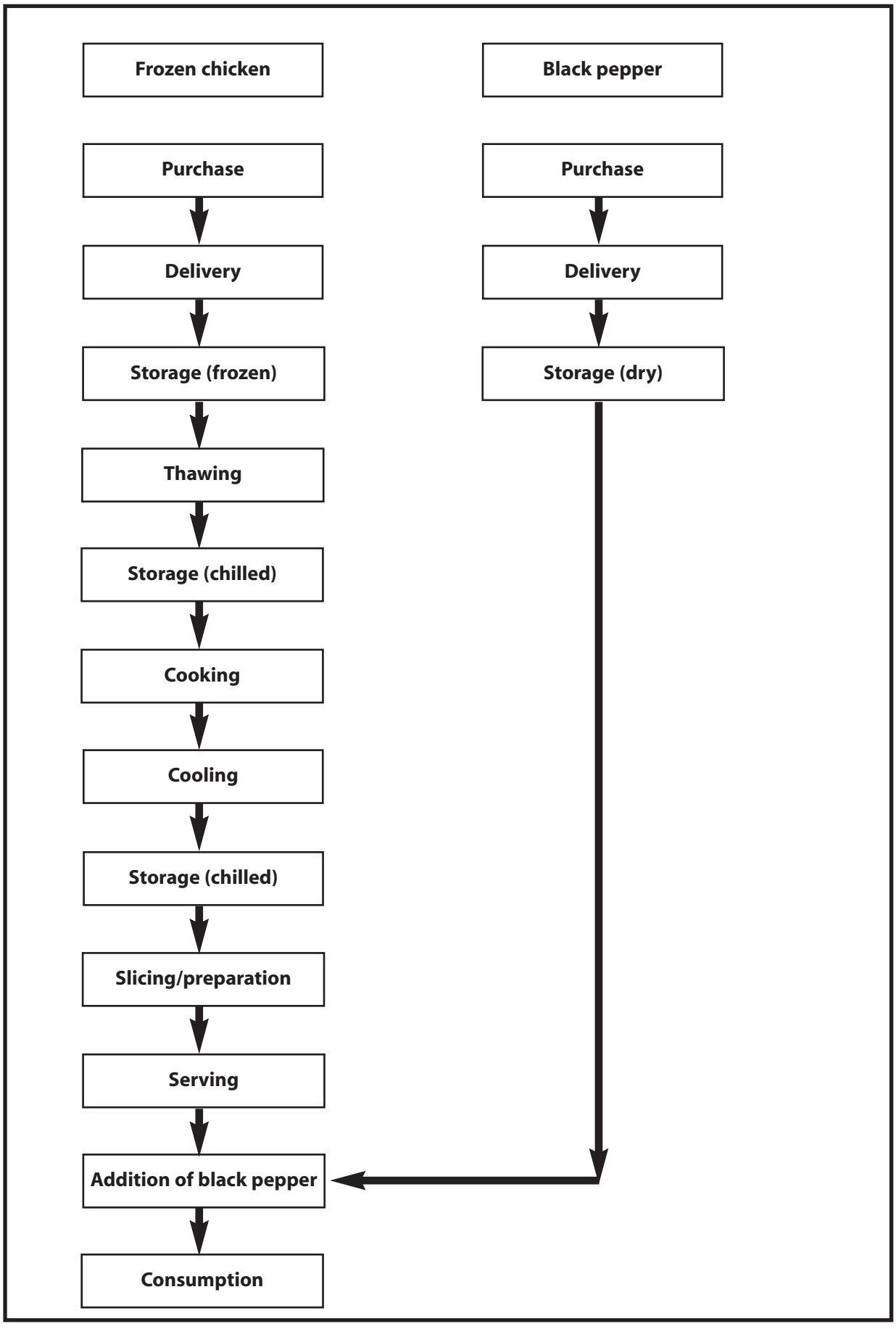
The chickens are cooled rapidly, using a fan which blows air over the chickens which are loosely covered in tin foil. Chickens are cooled to 7°C within 6 hours and then stored in the refrigerator at below 5°C.

The chickens are stored for a maximum of two days until required for serving. They are sliced and served within fifteen minutes of removal from the refrigerator. After serving, black pepper is added at the request of a customer immediately prior to consumption.

The group are asked to consider probable hazards at each process step from purchase to consumption. Controls, targets, critical control points, critical limits, monitoring and frequency, corrective action and responsibility are to be identified at the relevant times of the course for each step. At the end of the course each group should have completed the HACCP control chart for the sliced cooked chicken and black pepper.

The critical control points should be identified by the groups using the identification of CCPs chart.

Flow diagram for chicken and black pepper



Construct a flow diagram

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 ingredients to consumer. **May include:Times/temperatures of processing/cooking/cooling/chilling and storage.**

It may also be useful to produce a floor plan and layout which includes:

Equipment used etc.
Personnel routes
Product routes
Waste routes
Monitoring points

} **potential cross-contamination from delivery to service**

(Toilets, cloakrooms and handwashing facilities should be highlighted)

The flow diagram and floor plan form an essential part of the HACCP documentation

Walking-the-line

On-site validation of flow diagram and food room layout (at various times of production) to ensure that what you assume happens does happen

MODULE 7

Hazard analysis

Principle 1: Conduct a hazard analysis

Outcomes

The delegate will know and understand how to:

- **define risk and risk assessment**
- **describe how to conduct hazard analysis**
- **assess the risk that a hazard may occur**
- **assess the severity of a hazard**

Factors to consider when undertaking hazard analysis

Raw ingredients

Are they likely to contain pathogens, toxins, chemical or physical hazards?
Likelihood of low-dose pathogens in ready-to-eat food, especially fruit/salad vegetables? Have they been treated to destroy pathogens?

Physical characteristics and composition of ingredients/product

Include: pH, a_W, level of preservatives, type of acid
Can pathogens multiply and/or survive and produce toxins?
Safety record of similar products

Processing/preparation

Is there a process step to destroy pathogens, spores and/or toxins?
Is contamination after processing likely?

Microbiology of food product

Is the food likely to contain pathogens, toxins or spores?
Could a change in the microbiological characteristics of food affect its safety?

Premises design (prerequisite)

Equipment design (prerequisite)

Packaging

Will the packaging protect the food from contamination?
Could chemicals leach from the packaging?
Does the packaging include essential safety information e.g. relating to allergens or storage temperature and shelf life?

Cleaning and disinfection (prerequisite)

Personal hygiene/training (prerequisite)

Storage between packaging and consumption

Could poor storage result in contamination or temperature abuse that could lead to unsafe food?

Distribution

Could contamination or multiplication occur?

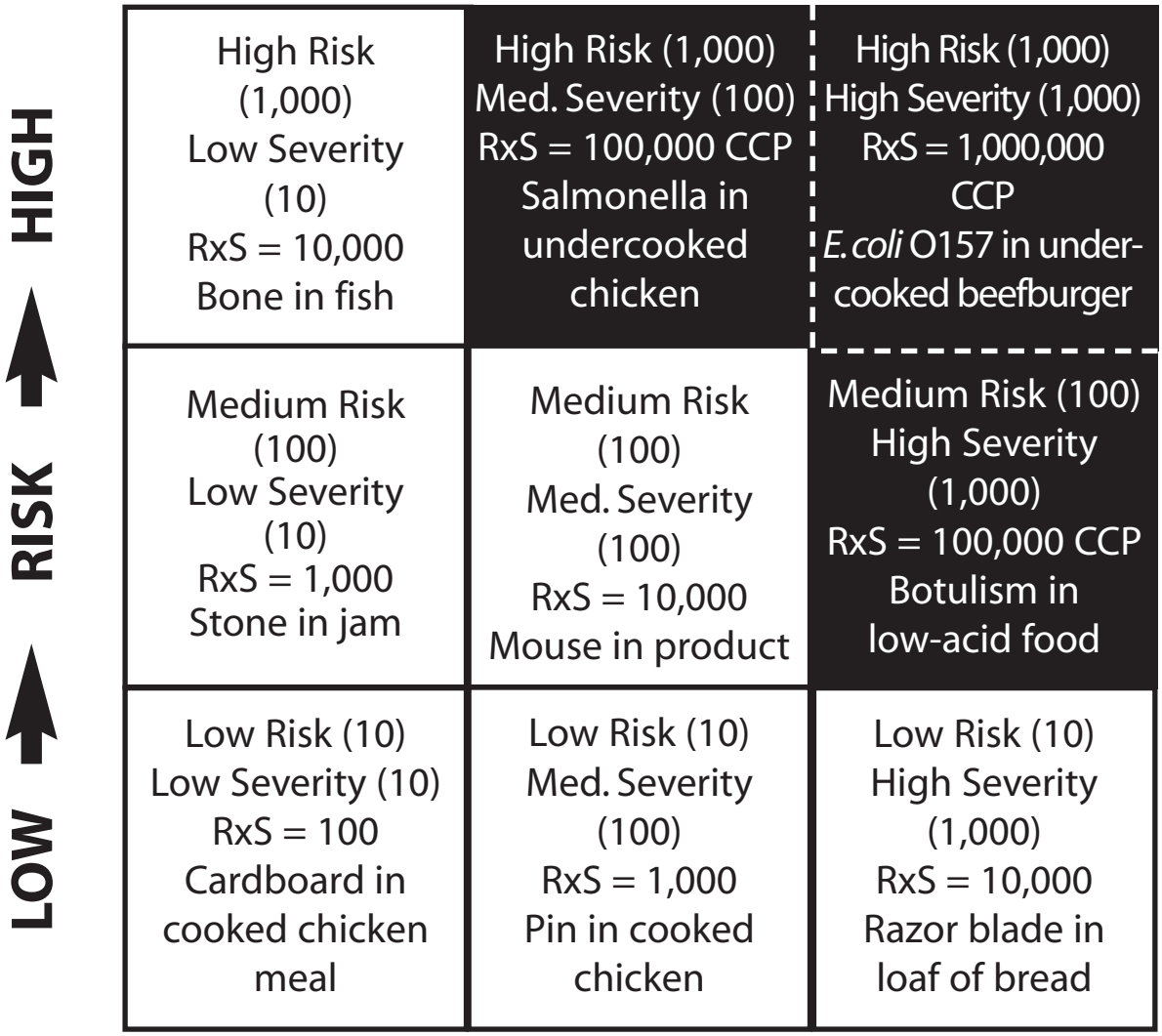
Intended use

Is the food intended to be reheated by the consumer?
Is there likely to be food left over, stored and reheated?
Potential consumer abuse

Intended consumer

Is the food likely to be consumed by someone from a vulnerable group, e.g. the infirm, elderly, immunocompromised or pregnant women?

Risk assessment matrix



Used to assess significant hazards or to ensure critical control points are critical

Hazard analysis

CODEX states that:
Hazard analysis involves evaluating information on the hazards and conditions leading to their presence to decide which are significant to food safety **and therefore should be addressed by the HACCP plan. This will involve assessing the likelihood of the hazards (the risk) and the severity of their adverse effects on health.**

Using the flow diagram, all the potential hazards at each step should be listed and hazard analysis carried out on each hazard.

Identify hazards at each step

- Presence of contaminants **(including allergens)**
- Multiplication or survival **of pathogens**
- **Production of** toxins
- **Germination of** spores

PREPARATION

COOKING

SERVING

Factors to consider when undertaking hazard analysis

Raw ingredients

Are they likely to contain pathogens, toxins, chemical or physical hazards?
Likelihood of low-dose pathogens in ready-to-eat food, especially fruit/salad vegetables? Have they been treated to destroy pathogens?

Physical characteristics and composition of ingredients/product

Include: pH, a_W, level of preservatives, type of acid
Can pathogens multiply and/or survive and produce toxins?
Safety record of similar products

Hazard analysis *cont*

Processing/preparation

- **Is there a process step to destroy pathogens, spores and/or toxins?**
- **Is contamination after processing likely?**

Microbiology of food product

- **Is the food likely to contain pathogens, toxins or spores?**
- **Could a change in the microbiological characteristics of food affect its safety?**

Premises design (prerequisite)

Equipment design (prerequisite)

Packaging

- **Will the packaging protect the food from contamination?**
- **Could chemicals leach from the packaging?**
- **Does the packaging include essential safety information e.g. relating to allergens or storage temperature and shelf life?**

Cleaning and disinfection (prerequisite)

Personal hygiene/training (prerequisite)

Storage between packaging and consumption

- **Could poor storage result in contamination or temperature abuse that could lead to unsafe food?**

Distribution

- **Could contamination or multiplication occur?**

Intended use

- **Is the food intended to be reheated by the consumer?**
- **Is there likely to be food left over, stored and reheated?**
- **Potential consumer abuse**

Intended consumer

- **Is the food likely to be consumed by someone from a vulnerable group,**
  e.g. the infirm, elderly, immunocompromised or pregnant women?

Deciding which hazards are significant

Risk

The likelihood that a hazard will occur.

Risk assessment

The process of identifying hazards, assessing likelihood of occurrence and severity, and evaluating the significance **(low, medium or high risk).**

This involves considering all the relevant available scientific information to make an informed decision based on experience
Requires detailed knowledge of:

- **Product characteristics**
- **The process**
- **Hazards associated with the product/process**

Other information that may be of interest:

- Complaint history/experience
- Epidemiological information **(care - as current statistics of little value. Very little relevant and accurate information is available. However, website searches for USA and Canada are more productive)**

Likelihood of occurrence (sampling results) current statistics

Research may be essential

Is the contaminant likely to be in the raw material?
Could it survive the process?
Could it increase?

Severity

The magnitude of the hazard or the seriousness of the possible consequences.
Seriousness of symptoms (acute)
Likely permanent effects on health (chronic)

Mortality rate) Especially vulnerable groups
Morbidity rate)

Safety concerns must be separated from quality concerns

Scientific information required includes:

- What are the potential hazards/risks?
- What temperature/time is needed to destroy any microbiological hazards **that may be present (including toxins)?**
- What cooling times **are required (risk of spores)?**
- What concentration of preservative **is required to prevent growth of microorganisms?**
- What pH and what a_w **are required to prevent growth of microorganisms?**
- What are the risks of contamination/multiplication after processing?
- What risks are there associated with packaging?
- What are distribution risks?
- What is the shelf life **based on specific storage/distribution temperatures?**

Following people may require HACCP:

Customers) **Contradiction/confusion**
Third party) **Different CCPs for different**
Accrediting bodies) **customers**
Enforcers)

MODULE 8

Control measures

Outcomes

The delegate will know and understand how to:

- **define control measures**
- **describe the parameters to which controls can be applied**
- **suggest measures which effectively control hazards, including generic control measures**

Control measures

Control measure
Any action or activity that can be used to prevent or eliminate a food safety hazard or reduce it to an acceptable level, **i.e. preventing things going wrong.**

More than one control measure may be required to control a specific hazard and more than one hazard may be controlled by a specific control measure.

Controls can be applied to:

- Temperature **e.g. refrigerator or cooking**
- Time **especially time at ambient**
- pH **- pathogens won't normally multiply below a pH of 4·0. Acids such as vinegar and lemon juice are used to reduce the pH**
- **Fermentation - involves using acid-producing bacteria to lower the pH e.g. yoghurts and salami**
- a_W **- water activity. Most pathogenic bacteria will not multiply if the a_W is below 0·89. Salt and sugar can be used to reduce the a_W**
- The shape, size or weight. **For example, smaller and thinner joints will cool more quickly**
- Additives **- preservative such as nitrates**
- Visual assessment **- e.g. colour change**
- Chemical analysis

Generic controls

In catering generic controls are more likely to be applied successfully.
Generic controls may be applied to many products and by many businesses.

keep sources of contamination out of food premises.

(c) Approved suppliers (prerequisite)

(c) (m) (s) Staff vigilance and training (prerequisite)

Training of staff

Planned programme essential - based on legal requirements, and hazards, controls, monitoring and corrective action for which they are responsible.

All staff to be trained. Priority for supervisors, managers and high-risk food handlers. Induction, good hygiene practice/hazards, competency, refresher.

(c) (s) Cleaning and disinfection (prerequisite)

(c) Pest management (prerequisite)

(c) Good personal hygiene (prerequisite)

(c) Waste management (prerequisite)

The class may be able to provide examples of generic controls, state which are prerequisites and which type of hazard is controlled i.e. microbiological, physical and chemical.

Generic controls continued

(m) Stock rotation (prerequisite)

(c) Colour coding (prerequisite)

(c) Good design (prerequisite)

(c) (m) (s) Effective maintenance **of premises and equipment** (prerequisite)

(c) Well constructed (prerequisite)

(c) Protect/cover

Generic controls continued

(c) Segregation of raw and ready-to-eat foods (prerequisite)

(m) Salt/sugar/acid

(m) Adjust pH

(m) Keep dry

(m) Size, weight and shape of joints

(m) Time management
(minimum time at ambient)

(m) Storage temperatures
(-18°C, <5°C or >63°C)

(s) Cooking/processing

Physical contamination controls

(c) Inspection belts

(c) Glass policy

(c) Wood policy

(c) Metal detection/**magnets**

(c) X-rays

} **Manufacture**

In catering, most potential physical and chemical controls are dealt with by prerequisite programmes (personal hygiene/training, cleaning and effective pest control), vigilance, working in an orderly and tidy way, (clean-as-you go), and effective supervision.

The use of branded products and approved suppliers are the most effective controls to prevent purchasing raw ingredients which contain physical or chemical contaminants.

Food containers (especially glass jars/bottles)

- **Use approved supplier - appropriate type and thickness of glass**
- **Care in transport, unloading and storage**
- **Bottle/jars passing on conveyor belt to filler should be inverted and blasted with compressed air or water jets**
- **Protect open jars after 'cleaning' prior to filling**
- **All steps should be routinely monitored**
- **Procedure in place to deal with breakage - especially during filling**
- **Line should be stopped. Empty jars/bottles should be checked - inverted/compressed air/waterspray**
- **Product which may have been contaminated - put on hold**
- **Filler - checked by maintenance/manufacturer**
- **Area thoroughly cleaned**
- **Recall may be necessary if contaminated product has left site**
- **Report by engineer on action to take to prevent recurrence**
- **HACCP plan should be reviewed (staff training)**

Chemical contamination controls

(c) Don’t store food in chemical containers

(c) Separation of chemicals from food

(c) Don’t store chemicals in unmarked **or food** containers

(c) Rinsing following chemical cleaning

Remember - many of these controls are part of the prerequisite programmes. This enables the HACCP plan to concentrate on the more significant hazards.

MODULE 9

Critical control points

Principle 2: Determine the critical control points

Outcomes

The delegate will know and understand how to:

- **define critical control point**
- **identify critical control points, especially by using decision trees such as the codex decision tree**

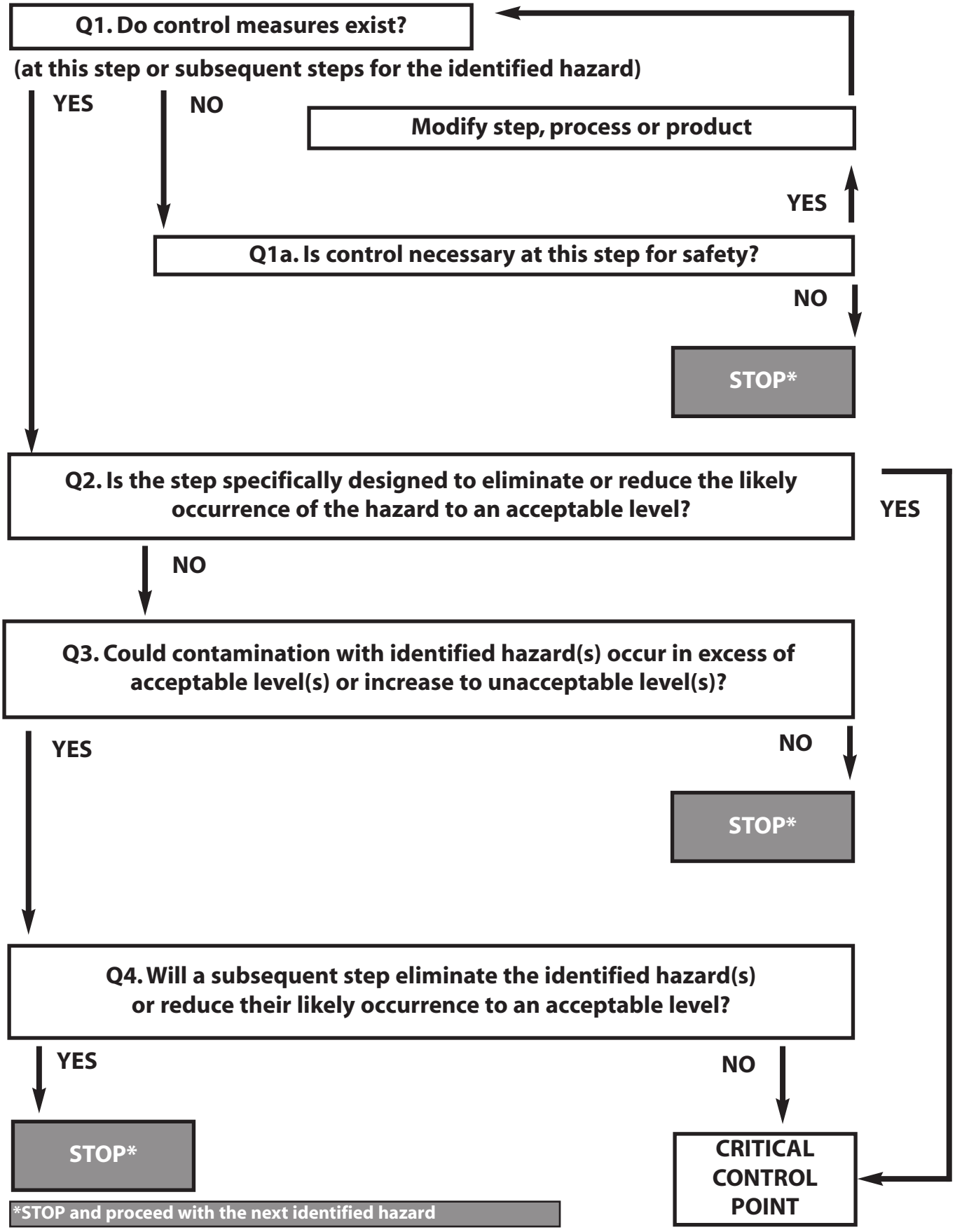
Definitions (2) (HO6)

Codex CCP decision tree (HO27)

Identification of CCPs (2) (HO28)

Group exercise - complete 4th column of HACCP control chart (CCPs) (HO24)

Codex CCP Decision tree



Identification of CCPs - Chicken and black pepper

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? Q3: Could contamination occur at unacceptable levels or could it increase to unacceptable levels? Q4: Will a subsequent step eliminate or reduce the hazard to an acceptable level?

PROCESS STEP	HAZARDS	CONTROL MEASURES	DECISION TREE QUESTIONS Y OR N AS APPROPRIATE					CCP Y/N/P*
			Q1	Q1A	Q2	Q3*	Q4	
Purchase of frozen chicken	Contamination with pathogens	Approved supplier	Y	-	N	Y	Y	N(P)
Delivery	Multiplication of pathogens	Unload quickly	Y	-	N	N	-	N
Storage (frozen)	Multiplication of pathogens	Temperature/time control	Y	-	N	N	-	N
Thawing (preparation)	Survival of pathogens during cooking due to inadequate thawing	Controlled thawing (time/temp)	Y	-	N	Y	Y	N
Storage (chilled)	Multiplication of vegetative pathogens	Temperature/time control	Y	-	N	Y	Y	N
Cooking	Survival of pathogens	Cook thoroughly	Y	-	Y	-	-	Y
● Cooling	Multiplication/spore germination	Cool rapidly	Y	-	N	Y	N	Y
Storage (chilled)	Multiplication of pathogens	Temperature/time control	Y	-	N	Y	N	Y
Slicing/preparation	Contamination by pathogens	Clean and disinfect equipment	Y	-	N	Y	N	Y(P)
✙ Serving	Multiplication of pathogens	Serve immediately	Y	-	N	N	-	N
Add black pepper	Germination of spores	Apply just before eating	Y	-	N	N	-	N

*** Q3 has been interpreted as "is it likely" not "is it theoretically possible".**

● If a rapid cooling stage is specifically introduced, e.g. blast chilling Q2 could be answered "YES".

✙ The time is too short to allow the multiplication of pathogens prior to consumption. If the hazard at serving was "contamination with pathogens", this could be considered a CCP because of low-dose pathogens such as campylobacter or norovirus.

Critical control point

A step in the process at which control can be applied and is essential to prevent or eliminate a food safety hazard or reduce it to an acceptable level.

(Control points which are not critical will still require the application of GHP (good hygiene practice) or GMP (good manufacturing practice) but, for example, monitoring may be less frequent.

Identification of CCPs

Knowledge of team members
Scientific information
Trade information
Decision tree

Determination of CCPs is based on risk and severity and whether or not control measures exist.

Codex HACCP (designed for manufacture)
requires the identification of the minimum number of critical control points.
This ensures resources are concentrated at these points so ensuring a more focused and cost effective food safety management system.

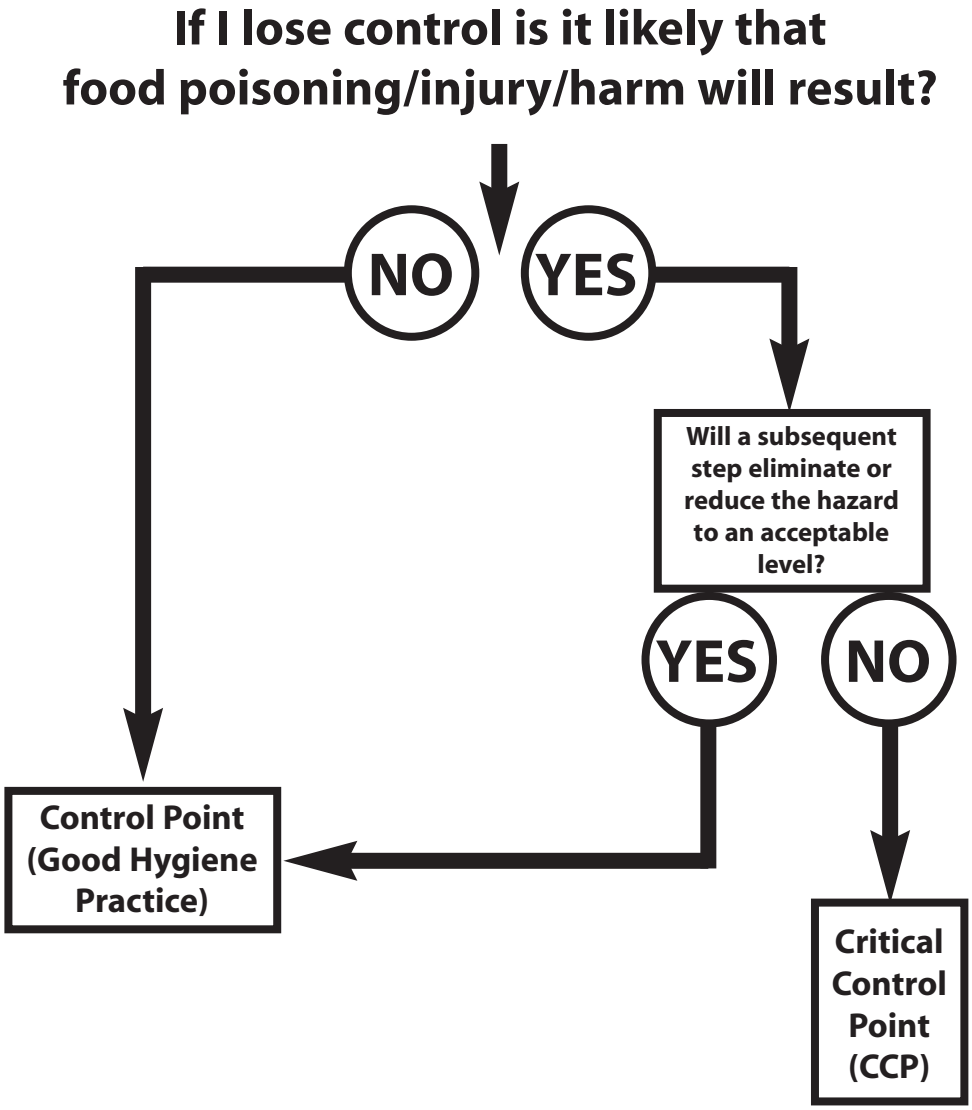
Examples of CCPs include cooking and rapid cooling, when this is undertaken to eliminate a hazard or reduce it to a safe level. Product formation may be a CCP e.g. adding acid to reduce pH or sugar to reduce a_W. Temperature, pH and salt concentrations are critical for the growth of starter cultures used in fermented products.

Refrigerated storage of high-risk food may be considered a CCP although refrigerated storage below 5°C may be considered as part of good hygiene practice i.e. part of prerequisites.

Cooling rate for high-risk foods may be critical but in yoghurt pH is the control, not time.

Simplified decision tree

Especially useful for catering and retailing.



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 accetable 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?

Identification of CCPs

Groups to complete the handout "Identification of CCPs" using chicken and black pepper or an example provided by the tutor.

Q3 'Could contamination with identified hazards ..... etc." should be considered as 'is it likely that contamination... etc.' NOT is it theoretically possible that contamination.... etc'

Frozen storage: The answer to Q3 is no because the chicken would have to thaw and rise in temperature above 8°C for a considerable period of time to enable multiplication of pathogens. If chicken was found thawed and in water it would be discarded.

Thawing: If the chicken is not completely thawed, for example, allowing insufficient time, the presence of ice would mean that some pathogens would survive the normal cooking time. However, because cooking is controlled by temperature, i.e. 78°C not time, then we can rely on the cooking step to destroy any surviving pathogens.

Cooling: If cooling involves leaving the chicken for a few hours before refrigeration then, arguably this step is not 'specifically designed to eliminate or reduce the likely occurrence of a hazard to an acceptable level'. However, if blast chilling was used, specifically to prevent the germination of spores, then the answer to 'Q2' could be 'yes'.

Storage (chilled): The storage between cooking and consumption is not introduced to eliminate... etc. a hazard. It is the refrigeration/cold temperature not the 'storage step' that controls the hazard, therefore the answer to 'Q2' is 'NO'.

Serving: The time between removal from the refrigerator and consumption is too short to allow the multiplication of pathogens and serving is therefore not a CCP. If there is significant delay then, arguably, you are introducing another step i.e. storage prior to serving. This step would

be a CCP and the control measure would be 'temperature control'.

NB If we had documented evidence of a foodborne illness resulting from, for example, multiplication during service then this knowledge would enable us to reclassify serving as a critical control point.

MODULE 10

Critical limits, target levels and tolerances

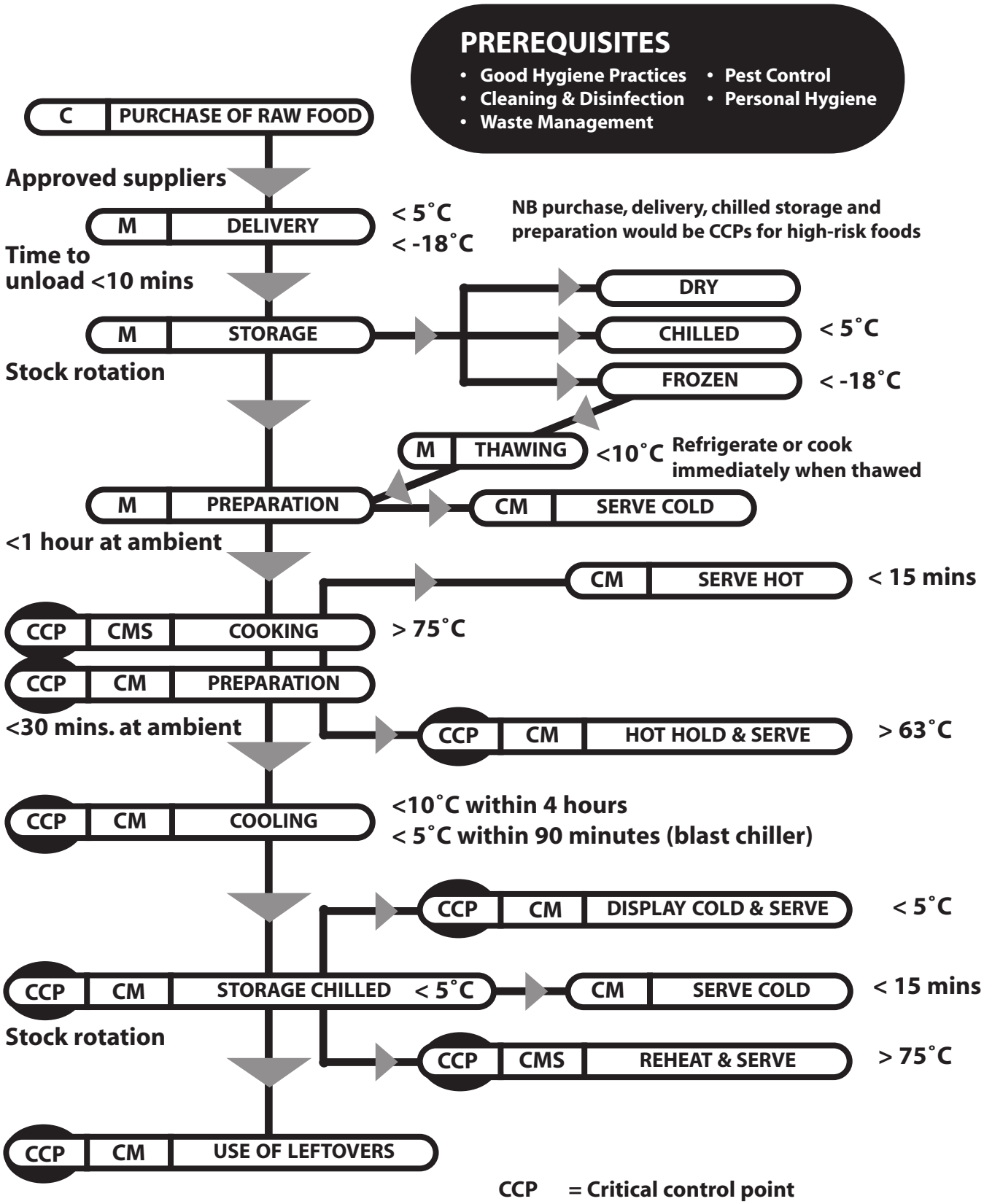
Principle 3: Establish critical limits

Outcomes

The delegate will know and understand how to:

- **define critical limit, target level, tolerance and deviation**
- **establish critical limits and target levels for CCPs**
- **provide examples of critical limits and target levels**

Generic flow diagram for catering



Check temperatures with a disinfected electronic probe thermometer

CCP = Critical control point

Generic hazards
C = Contamination
M = Multiplication
S = Survival

Critical limits

Critical limit

The value of a monitored action which separates the acceptable from the unacceptable

Deviation

Failure to meet a critical limit **(corrective action such as destruction or reprocessing of the product will be required).**

Target level

The predetermined value for the control measure, which will eliminate or control the hazard at a control point. **Target levels** act as a buffer zone and **prevent a deviation by providing a tolerance**

Tolerance

The specified degree of latitude for a control measure which, if exceeded, requires immediate corrective action.

Establishing critical limits

Using scientific literature, mathematical modelling, challenge testing, experimentation, expert opinion or regulatory standards and guidelines

Criteria used:

Time, temperature, humidity, a_W, pH, titratable acidity, preservatives, salt concentration, available chlorine, viscosity (or combination) Must be supported by sound scientific evidence - not dogma
Chemical limits - specify maximum levels allowable, e.g. pesticides
Physical limits, for example, absence of glass.
Microbiological limits - usually too slow and product will be sold before results are available. NB ATP and resazurin test.

Critical limits must be measurable - (does not need to be continuous but of sufficient frequency to ensure control)
observation/test to demonstrate the CCP is under control. May involve more than one factor e.g. time and temperature (of product and oven).

Critical limits

	Critical limit	Target	Tolerance	Action Level
Refrigerator	8°C	5°C	3°C	(7°C)
Cooking Temp	75°C	78°C	3°C	(76°C)

If the target level is exceeded action must be taken to prevent loss of control. Action may therefore be taken at 7°C and 76°C respectively to ensure the critical limit is not breached.

If the critical limit (or tolerance) is breached immediate corrective action is necessary to bring the process under control. The product may need to be destroyed or quarantined pending further testing. (In the case of cooking if desired temperature not achieved further cooking usually suffices).

NB variables
e.g. Accuracy of thermometer, ±1°C
Therefore, target levels for refrigerator 4°C, critical limit 7°C and for cooking 79°C and 76°C

MODULE 11

Monitoring

Principle 4: Establish a monitoring system

Outcomes

The delegate will know and understand how to:

- **define monitoring**
- **explain the need for monitoring**
- **explain methods of monitoring CCPs**
- **explain the requirements of monitoring systems**
- **explain the knowledge, training and competency of staff with regard to monitoring**

Definitions (2) (HO6)

Group exercise - applying HACCP to preparing cooked meat (EX30) (optional)

Group exercise - complete 6th column of HACCP control chart (monitoring) (HO24)

Exercise

Applying HACCP to a potentially unsafe system of preparing cooked meat for a buffet

At 8.30 am in the morning the chef collects 12 large joints of meat from a walk-in refrigerator.

Using a large trolley he takes the joints to his large 2 metre stainless steel preparation table sited approximately 50 metres away.

He spends all morning preparing the meat for the buffet and at 12.30 he loads the prepared meat onto a protected display.

Any meat not required for the buffet is returned to the walk-in refrigerator.

After two hours on display at ambient temperature any leftover displayed buffet meat is discarded.

You are required to recommend a safe system of work based on HACCP principles and to deal specifically with identifying the main hazards, controls and effective monitoring.

Exercise

Applying HACCP to a potentially unsafe system of preparing cooked meat for a buffet

A solution

Recognising that the main hazard is likely to be the multiplication of pathogenic bacteria you could suggest that each of the joints should be dealt with separately. You could specify the maximum time allowed for the preparation of each joint which ensures that the temperature of the meat does not exceed 8°C for longer than 1 hour. A disinfected probe thermometer may be used to monitor the effectiveness of the system and all measurements recorded.

Unfortunately the amount of additional walking and monitoring involved means that the chef has inadequate time to complete the job. This means this "safe" system is unlikely to be adhered to at all times and an unnecessary food safety risk arises.

A better solution would be to reduce the 2 metre table to one metre, so he only has room for one joint at a time, and to provide a refrigerator under or adjacent to the table. This will mean that the meat can be collected from the walk-in chiller and placed in the mis-en-place refrigerator. Only one joint at a time will be taken from the refrigerator. After slicing and preparation there is no room on the table so it has to be put back in the refrigerator and another joint selected.

The system itself involves very little additional work other than monitoring the temperature of the mis-en-place refrigerator. This could be done automatically, with an alarm fitted to warn of unacceptable temperatures.

The solution recommended has ensured that the easy way of working is the safe way. Imposing onerous controls and monitoring on a system which is difficult or requires significantly more work is much less likely to be successful. A breakdown is particularly likely if the operation is under pressure, e.g. because of shortage of staff.

The buffet display is dealt with as previously but is safer as the meat is at refrigeration temperature when first displayed. A refrigerated display would be preferable but as the display is only for two hours the meat could be returned to the refrigerator for other use (NOT displayed again)

Monitoring

Monitoring

The planned observations and measurements of control parameters to confirm the process is under control and critical limits are not exceeded.

Monitoring is required to:

Confirm that a CCP is under control
Ensure target levels are not breached. **This enables action to be taken when a trend towards a loss of control is identified**
Identify deviations **and trigger corrective actions**
Provide records:

- For verification
- **To identify reasons for** complaints
- For due diligence

Monitoring must permit rapid detection and correction

Monitoring may be manual or automatic, continuous or at set frequencies

Frequency of monitoring must be relevant to the process and the product throughout. The corrective action to be taken will also determine frequency.

Continuous on-line (automatic) is preferable e.g. thermographs.

Must ensure samples are statistically representative
Accuracy essential - staff trained to use equipment
Equipment must be calibrated as recommended by the manufacturer.

Monitoring records must be checked by a supervisor/manager - may be daily, weekly or monthly.

Types of monitoring

Usually physical or chemical

Audits
Visual inspection (premises, vehicle, practices)
Measuring e.g. temperature, pH, a_W, **times** etc.
Competency checks
Organoleptic **(smell, observation and touch)**
Checking documentation/records

Audits

Premises, procedures, practices
Cleaning system/equipment
Electric fly killers

Checking records

Goods receipt book
Customer complaints
Temperature control/cooking
Date codes/stock rotation
Training/sickness
Cleaning schedules
Sampling/test results
Pest control book
Calibration of instruments
Maintenance/servicing
Inspection/audit forms

Monitoring of trends e.g. gradual increase in fridge temperatures or increasing bacterial loading are most useful to enable action to be taken to prevent a deviation.

Staff must be competent to deal with all potential problems and the action they are authorised to take.

Calibration of thermometers

Certification that equipment e.g.thermometers are accurate. Carried out against certified equipment, traceable to nationally recognised standards.

On-site calibration - using boiling water (100^{o}C) and water/crushed ice (0^{o}C) may be undertaken weekly/monthly - for thermocouples and thermistors.

Monitoring systems

Should state:

What - **the critical limits, the target levels and tolerances.**

How - **details of how the monitoring should be undertaken (equipment and calibration should be specified). Written procedures useful**

Where - **where the monitoring should be undertaken (at the CCP or as close as possible to the CCP)**

Monitoring may be:
on line, e.g. time/temperature
off line, e.g. salt or pH

Who - **is responsible for the monitoring (include training requirements) and, if necessary, checking that monitoring has been carried out satisfactorily.**

When - **when the monitoring should be undertaken including continuous or batch.The monitoring interval must be frequent enough to ensure that the hazard is controlled - without requiring significant destruction of product.**

Microbiological testing

In some cases may be required for manufacturing. Furthermore as rapid techniques are developed - will be a more useful tool. However, the number of samples required to reliably detect low levels of pathogens is unacceptably high and not cost-effective.

Not practical for catering/retailing - for monitoring under usual circumstances.

Microbiological testing by laboratories is useful for verification purposes.

Staff must be trained to monitor critical control points and should have:

- Knowledge of HACCP
- Knowledge of importance of critical control points and monitoring
- Knowledge of frequency of monitoring
- Knowledge of target levels/critical limits
- Competency to monitor and record
- Competency to take corrective action

Module 12

Corrective actions

Principle 5: Establish the corrective action to be taken when monitoring indicates that a particular CCP is not under control

Outcomes

The delegate will know and understand how to:

- **define corrective deviation and action**
- **explain the need for corrective action when a critical limit is breached**
- **explain the formulation and implementation of corrective action**
- **explain how to deal with product subject to deviation**
- **explain the need for traceability and recall**

HACCP Control Chart

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PROCESS STEP	HAZARDS AND SOURCES CAUSES OF	CONTROL MEASURES	CCP Y/N/P	CRITICAL LIMIT	MONITORING (INCLUDE FREQUENCY)	CORRECTIVE ACTION AND RESPONSIBILITY (product and action to bring the CCP under control)*
Purchase of:						
Frozen, raw chicken	Contaminated product	Approved supplier Specific delivery temperatures Select least hazardous ingredients e.g. fresh chicken or cooked chicken	P		Annual audit (QC) References from satisfied customers Obtain relevant documentation e.g. HACCP plan	Issue written instructions on new requirements (S) Revisit supplier (QC) Issue a written warning (S) Change supplier (M)
Black pepper	Contaminated product (microbiological (spores) physical and chemical) NB Salmonella	Approved supplier Select least hazardous ingredients e.g. irradiated	P		Sampling Absence of customer complaints Historical check on deliveries	

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Delivery of:						
Frozen chicken	Multiplication of pathogens because of the delivery of thawed product	Unload and place in freezer within 10 minutes	N		Check condition of deliveries (each time) (F) Check temperature. (F) Check time to unload (F) Monthly audits (M)	Reject unsatisfactory deliveries (above –15°C) or out-of-specification (S)
	Unsatisfactory delivery vehicle	Specify delivery requirements, especially temperature control	P		Check delivery vehicle (F)	
	Food outside date code	Six month maximum shelf life at –18°C			Check date code (F)	Out-of-date (food handler to reject and advise supervisor)
Black pepper	Delivery of contaminated product(physical or chemical)	Specification	N			

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Storage of: Black pepper	Germination of spores and multiplication of bacteria	Keep dry and well ventilated	P		Monthly audits (M)	Repair store (S) Discard contaminated product (S)
	Contamination by pests	Integrated pest management	P		Visual observation by food handler using the store (daily) 2 monthly audit by pest control operator	Call in pest control operator (S)

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Storage of: **Frozen chicken**	**Storage at temperatures which result in spoilage, mould growth or multiplication of food poisoning bacteria**	**Store at correct temperature (-18°C)** **Alarmed units**	**N**		**Check and record temperature of freezer daily :target -18°C (F)** **Check temp. records weekly (S)** **Advise appropriate supervisor of any problem (F)**	**Chicken below –12°C, return to –18°C. (F)** **Frozen chicken above –12°C. complete thawing, cook and serve. (S)** **Remove and destroy thawed chicken. (S)** **Call in maintenance engineer/replace freezer. (S)**

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Thawing of: Chicken	Failure to thaw	Controlled thawing between 10°C and 15°C for 12 hours or a thawing cabinet	N+	Absence of ice	Check pliable, free of ice and check temperature before cooking (each chicken) (F)	Continue thawing (F)
	Multiplication of salmonella because of thawed food left at ambient temperature	Place in refrigerator or cook immediately after thawing	N			

+This is not a critical control point if you are using a calibrated digital thermometer to ensure the critical cooking temperature of 75°C has been achieved. However, if you are relying on a time only to control cooking it would be a critical control point as the normal cooking time would not be adequate to ensure safe centre temperatures have been achieved, if the chicken had not completely thawed.

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Storage of: Thawed chicken	Multiplication of food poisoning bacteria because of storage at high temperature (above 8°C)	Storage at correct temperature Target <5°C Alarmed units	N		Check regularly and record temperature 2 x daily (F) Monthly audit(M)	Adjust thermostat (S) Call in maintenance (S) Move chicken to another refrigerator (F) Use immediately (S) Destroy (S)
		Apply date code (24 hours)	N		Check date code(F)	Remove and destroy out-of-date chicken

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Cooking of: Chicken	Survival of pathogens	Thorough cooking >78°C Juices of meat to run clear Ensure frozen poultry completely thawed	Y	75°C	Check temperature of chicken in coldest part of oven with calibrated disinfected thermometers (every batch) (F) Visual check of cooked chicken (F) Monthly audit (M)	Continue cooking until core temperature of 78°C achieved (F) Extend future cooking times (QC) Carry out cooking trials to obtain more information (QC) Call in maintenance because of defective oven (S)

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Cooling of: Chicken	Germination of spores and multiplication of food poisoning bacteria	Cool rapidly from 60°C to 21°C in <2 hours and from 21°C to 7°C in <4 hours(FDA of USA Standard)	Y	2.5 hours to cool below 21°C and 5 hours to cool below 7°C	Check and record time and temperature of cooling of each batch with a disinfected probe thermometer(F) Monthly audit(M)	Quarantine chickens in refrigerator for consideration by (QC) Reduce size or weight of bird (M) Carry out cooling trials to obtain more information (QC) Purchase a blast chiller (M)
	Contamination	Cool chickens in designated area protected from contamination	P			

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Storage of:						
Cooked chicken	Multiplication of food poisoning bacteria because of storage at high temperature (above 8°C)	Storage at correct temperature Target <5°C Alarmed units	Y	8°C (2hours)	Check regularly and record temperature 2 x daily (F) Monthly audit(M)	Adjust thermostat (S) Call in maintenance (S) Move chicken to another refrigerator (F) Use immediately (S) Destroy (S)
		Apply date code (24 hours)	Y	48 hours	Check date code(F)	Remove and destroy out-of-date chicken (S)
	Contamination	Segregation from raw food	P?	Absence of contact with raw product	Check when using refrigerator(F)	Remove and destroy contaminated food (S)

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Slicing of: Chilled cooked chicken	Contamination	Good personal hygiene/training Clean and disinfect knife and food-contact surfaces Colour coding Disposable wiping cloth Separate from raw	P		Proficiency testing (6 monthly) (S) Check cleaning schedule (daily)(F) Swabbing surfaces and equipment (weekly)(QC) Monthly audit(M)	Discard contaminated product(S) Retraining/instruction More effective supervision
	Multiplication of salmonella if left at ambient for too long	Chicken to be sliced within 30 mins of cooling Only one chicken to be sliced at a time	Y	8°C (1 hour)	Check and record times and temperatures(F)	Provide a temperature controlled slicing room (M)

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Serving of:						
Chicken	**Multiplication of pathogens because of prolonged time at ambient**	**Keep chicken refrigerated until required for immediate serving Serve within 15 minutes of removal from refrigerator**	**N+**		**Check time daily (S) Monthly audits(M)**	**Issue new instructions (M) Retraining Improve supervision**
	Contamination from equipment/ waiters	**High standards of personal hygiene and training All utensils and crockery cleaned and disinfected**	**P**			**Reject and destroy contaminated product (S) Retrain/new instructions Improved supervision**
Apply black pepper	**Germination of spores**	**Add just before consumption**	**N**			

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+ Serving is not considered a CCP, as regards multiplication, as there is insufficient time between removal from the refrigerator and consumption. If there was a significant delay this would in effect be introducing another step prior to serving. This would be a CCP and the control would be 'temperature control'.

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Purchase of raw materials (choice of supplier)	Food product is likely to be contaminated with pathogens, toxins, spoilage organisms, chemicals or foreign bodies	Select least hazardous ingredients Only use reputable suppliers (approved suppliers' list) Specification for product safety, including delivery temperatures	P		Audit suppliers' premises (record details) annually (QC) Obtain documentation to demonstrate they follow good hygiene practice, e.g. food safety policy, HACCP documentation, report from third party auditor, completed hygiene questionnaire (QC) Obtain references from other satisfied customers (QC) Absence of customer complaints (on-going) (QC) Sampling of product (retain records) (QC) Historical check of deliveries (QC)	Revisit/inspect supplier (QC) Review product specification (QC) Avoid/replace unsatisfactory suppliers (M) Provide written instructions of expected standards and/or reaffirming specification (QC) Send warning letter stating consequences of failure to meet standards (M)

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Delivery of raw materials (high-risk foods, dry foods, frozen foods, raw foods which may contain pathogens, raw foods which are unlikely to contain pathogens)	Delivery of contaminated food e.g. raw and high-risk food delivered together	Raw and high-risk food completely separate Specify delivery requirements including packaging requirements	P	**Absence of contamination**	Check each delivery against approved supplier list (F)	Reject contaminated/unfit food e.g. blown cans, badly damaged packaging, evidence of pests, evidence of thawing of frozen foods (F)
	Delivery of food from unapproved sources				Check condition of each delivery, including packaging (F)	Rejects must be reported to appropriate managers for further action e.g. re-order, new instructions to supplier or changing supplier
	Open food exposed to dust, birds, physical contaminants				Visual appearance/fitness of food and absence of pests, etc. (F)	
	Damaged packaging				Check condition, cleanliness of each delivery vehicle, and driver (F)	
	Unsatisfactory delivery vehicle/driver				Monthly audit (S)	
	Contamination resulting from deboxing/unpacking	Separate deboxing area				
	Food outside its 'use-by' date				Check date codes (F)	Reject out-of-date food (F)
	High-risk food >8°C	Target temp <5°C	Y	**8°C**	Check/record temp of high-risk and frozen food (as per spec) (F),	Reject deliveries of high-risk food above specified temperatures e.g. above 8°C or above -15°C if frozen (S)
	Frozen food which is thawing	Target temp -18°C			Record time of deliveries and time into storage (F)	
	The growth of food poisoning bacteria/toxin production due to prolonged delays after unloading	Minimise time for unloading			Check temp/time records (S)	
					Report any problems to appropriate supervisor (F)	
		Staff training			Competency testing (S)	Reinstruct/retrain (S)

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Storage (chilled)	Contamination of high-risk food from raw food, chemicals or foreign bodies	Ensure satisfactory packaging, wrapping, protection, containers Separate raw and high-risk foods	P	**Absence of contamination**	Check correct storage of high-risk and raw foods when chiller is used (F) Check packaging daily (F) Monthly hygiene audit (S) Check food complaint records weekly (S)	Remove/destroy unsatisfactory, contaminated food (S)
	Food outside its use-by date	Stock rotation, date codes			Check date codes daily and record observations (F)	Reject out-of-date food (F) Remove/destroy out-of-date food (S)
	Multiplication of food poisoning bacteria/toxin production due to storage above 5℃ Multiplication of food spoilage organisms due to prolonged storage	Store at correct temperature (target temp <5℃) Alarmed units	Y	**8℃ for 2 hours**	Check temperature of food in chiller throughout day,. Record (F)	Adjust thermostat/call in maintenance operator (S) Arrange for additional chiller/chiller capacity (M) Use food immediately (S)
	Storage of food in open cans				Check temperature/date code records weekly (S) Report any problems to appropriate supervisor (F)	Repair/replace equipment (M)
		Staff training			Competency testing (on-going) (S)	Reinstruct/retrain staff (S)

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Storage (frozen)	Contamination of high-risk food	Separate high-risk/raw food	P		Check for satisfactory packaging/storage (F) Monthly hygiene audit (S) Check food complaint records monthly (S)	Remove and destroy contaminated food (S)
	Storage at temperatures which result in spoilage, mould growth or multiplication of food poisoning bacteria Bacterial growth in thawed foods	Store at correct temperature (-18°C) Alarmed units	N		Check and record temperature of freezer daily (F) Check temperature records weekly (S) Advise appropriate supervisor of any problem (F)	Food between -5°C and -12°C, complete thawing, cook and serve (S) Remove and destroy high-risk thawed food (S) Call in maintenance engineer/replace freezer (S)
		Staff training			Competency testing (on-going) (S)	Reinstruct/retrain staff (S)

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Preparation (contamination hazards)	Contamination of high-risk food from raw food (direct or indirect)	Effective design, unidirectional workflow, separation of raw and high-risk preparation areas	P	**Absence of contamination**	Monthly hygiene audit (S)	Re-design premises (M)
	Contamination from contaminated work surfaces/utensils	Separate utensils and equipment for raw and high-risk foods (colour coding)			Weekly bacteriological swabbing of surfaces (ATP) (S)	Change raw materials e.g. use cooked chicken instead of raw (QC)
	Contamination from wiping cloths	Different staff for raw and high-risk foods				Remove and destroy contaminated or potentially unsafe food (S)
	Contamination from pests, especially flying insects					
	Multiplication of food poisoning bacteria/toxin production due to prolonged time at ambient	Minimise time food is at room temperature (Target: maximum above 8ºC 30 mins)	Y	**1 hour above 8°C**	Check times at ambient temperatures - record information (F)	Use immediately or destroy any high-risk food above 8°C for 2 hours
	Contamination from chemicals, e.g. fly spray	Prepare minimum amount of food			Check records weekly (S)	
	Contamination from foreign bodies, e.g. boxes unpacked adjacent to preparation areas				Report any problems to appropriate supervisor (F)	
	Flaking paint on walls and ceiling	Satisfactory surfaces and equipment				
	Rusty, pitted defective equipment/utensils					
		Staff training			Periodic competency testing of food handlers (S)	Issue new instructions or retrain food handlers (S)

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HACCP Control Chart

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PROCESS STEP	HAZARDS AND SOURCES CAUSES OF	CONTROL MEASURES	CCP Y/N/P	CRITICAL LIMIT	MONITORING (INCLUDE FREQUENCY and TARGETS)	CORRECTIVE ACTION AND RESPONSIBILITY (product and action to bring the CCP under control)*
Storage (dry)	Contamination from pests, foreign bodies or 'dirty' foods such as root vegetables	Pest control, pest-proof containers, good housekeeping, store off floor (target - absence of pests)	P		Check for signs of pests, dampness, damaged packaging, rusty cans, out-of-date stock throughout the week. Record observations (F)	Employ reputable pest control contractor (M)
	Damaged/rusty cans	Care with deboxing/opening to avoid foreign body contamination			Check records monthly (S)	Discard infested or contaminated food (S)
	Growth of food spoilage bacteria/moulds, especially if damp/humid conditions	Keep dry/well ventilated			Monthly hygiene audit (S)	Building maintenance to remove dampness/improve ventilation (M)
	Spoilage resulting from failure to rotate stock	Stock rotation			Report any problems to appropriate supervisor (F)	
	Greening/sprouting of potatoes (solanin)	Store out of light				
	Storage with/adjacent to chemicals	Separate storage for cleaning chemicals etc.				
		Staff training			Competency testing (S)	Reinstruct/retrain (S)

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.
S=Supervisor F=Food handler M=Manager QC=Quality control
Staff training relates specifically to awareness and detection of hazards, their control and monitoring etc.

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Preparation (thawing of raw food)	Contamination of high-risk food from thawing raw food, especially poultry	Ensure thawing of raw meat is carried out entirely separate from high-risk food Clean and disinfect surfaces after thawing	N+		Audit system monthly (S)	Destroy any contaminated high-risk food (S)
	Inadequate time for thawing, resulting in undercooking and survival of bacteria Multiplication of food poisoning bacteria because of thawed food left at ambient temperatures	Follow manufacturer's instructions Use appropriate system to ensure the food, especially joints of meat and poultry, is completely thawed, for example, thawing cabinet, cold room (10°C to 15°C) Allow sufficient time for thawing When completely thawed place in refrigerator or cook immediately			Check each batch of poultry is thawed - legs and wings pliable, cavity ice free (F) Use a temperature probe (F) Report any problems to appropriate supervisor (F)	Continue thawing until complete (F) Purchase a thawing cabinet (M)
		Training of food handlers			Competency testing of food handlers (S)	Issue new instructions or retrain food handlers (S)

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+Provided a core temperature of at least 75°C is achieved during cooking, thawing is not a critical control point. However, if cooking is based on a time and temperature then thawing may be a critical control point. In this case "complete thawing" would be the critical limit.

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Cooking (processing)	Contamination introduced e.g. from tasting	Use a clean spoon for tasting	P		Monthly audit (S)	
	Multiplication of food poisoning bacteria because of the prolonged time in danger zone Survival of food poisoning bacteria due to inadequate cooking/processing	Ensure food is cooked for the appropriate time and temperature. Juices from joints of meat should run clear (Target temp 78ºC) Poultry - cook stuffing separately Ensure frozen joints/poultry are completely thawed The base of pans should not exceed the heat source Simmering/bubbling of stews and sauces after stirring Keep lids on	Y	75°C	Using a disinfected probe thermometer - check the centre temperature of each batch has achieved a target of 78°C and record (F) Visual check each batch of food (F) Check cooking/processing records weekly (S) Report any problems to appropriate supervisor (F)	Continue cooking until centre temperature of at least 75ºC achieved. Reject unsafe product when it is not possible to continue (S) Maintenance/replacement of equipment (M) Allow longer time for cooking in the future (QC) Carry out cooking trials to obtain more information (QC)
	Chemical contamination from unsatisfactory equipment	Use food grade cooking equipment e.g. stainless steel				Replace cooking equipment
		Staff training			On-going competency testing (S)	Issue new instructions to food handlers (S)

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Cooling	Contamination from food poisoning bacteria, foreign bodies, chemicals or insects, especially flying insects Multiplication of food poisoning bacteria not destroyed during cooking Germination of spores	Keep food covered and completely separate from raw food Portion/slice joints with a disinfected knife Cool food rapidly, (60°C to 21°C <2 hrs 21°C to 7°C <4 hrs) preferably with a blast chiller (<10°C within 2 hours) Minimise weight and thickness of joints Decant sauces/stews into shallow containers Use iced water Place in the chiller as soon as possible (should not raise the temperature within the chiller) Cover food and use a fan to promote air movement (raise food off surface) Spray bagged foods with cold water Rice, vegetables, pasta & potatoes can be cooled with running cold water Refrigerate below 5°C when cool Staff training	P Y	**Absence of contamination** **+ 60°C to 21°C >2.5 hrs 21°C to 7°C >5 hrs**	Monthly audits (S) Check and record centre temperatures of each batch with a disinfected probe thermometer (F) Check time/temperature records daily (S) Report any problems to appropriate supervisor (F) Competency testing (S)	Reject unsatisfactory or contaminated product (S) Purchase a blast chiller (M) Reduce size or weight of product (QC) Carry out cooling trials to obtain more information (QC) Purchase pre-cooked cold meat (QC) Reinstruct/retrain (S)

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.

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Staff training relates specifically to awareness and detection of hazards, their control and monitoring etc.

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Chilled or hot display	Contamination from equipment/utensils or raw food	Keep food covered/protected	P	**Absence of contamination**	Monthly hygiene audits (S)	Reject contaminated product (F)
	Contamination from servers/waiters	Prevent customer contamination				Destroy contaminated product (S)
		Provide sneeze screens				
		Total separation of raw and high-risk food service				
	Multiplication of food poisoning bacteria/toxin production because of prolonged time at ambient	Keep food below 5°C or above 63°C	Y	**8°C for 4 hours 63°C for 2 hours**	Check and record the temperature of refrigerated display cabinets throughout the day 5°C (F)	Adjust temperature with thermostat (F)
		Sell within shelf life				Call in maintenance engineer (S)
		Minimise time that buffets are at ambient. Destroy leftovers			Check and record the temperature of hot displays as appropriate :65°C (F)	Replace equipment/utensils (M)
		Equipment maintenance			Check temperature records (S)	Remove/destroy cold high-risk food that has been above 8°C for longer than 4 hours (S)
					Report any problems to appropriate supervisor (F)	Remove and destroy hot food that has been below 63°C for longer than 2 hours (S)
						Change system to avoid service delays (QC)
		Staff training			Competency testing	Reinstruct/retrain staff (S)

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Staff training relates specifically to awareness and detection of hazards, their control and monitoring etc.

Corrective action

Deviation - failure to meet a critical limit

Corrective action

The action to be taken when a critical limit is breached, **i.e. a deviation occurs e.g. food temperature in fridge exceeds 8°C for 4 hours.** Remedial action, **based on target levels,** should be taken before **a deviation occurs i.e. before** the critical limit is breached.

The action taken must bring the CCP under control and deal with any affected product **e.g. call in engineer** - **destroy high-risk food.**
Records of deviations and corrective action must be maintained

In practice target levels are usually monitored so that a CCP can be brought back under control before there is a need to destroy food. For example, target temperature is set at 5°C, on monitoring the temperature it is found to be 6°C so the thermostat is adjusted to reduce the temperature to 5°C.

Examples

Chicken centre temperature after cooking 73°C. Critical limit is 75°C, target level is 78°C, therefore a deviation has occurred. Operator, places chicken back in oven until temperature of 78°C is achieved. All actions are recorded.

Investigate - why was there a deviation?
1. Inadequate thawing
2. Error in time taken out of oven
3. Size of bird larger than previously cooked
4. Faulty oven

During the bean canning process the retort suffers a loss of steam pressure. The operator adds an additional processing time as required by written deviation procedures.
On completion of canning the batch of canned beans are quarantined pending QC assessment of written records and temperature charts. Bacteriological sampling may be undertaken before release.

Procedures for corrective actions should specify:

- What action is to be taken
- Who is responsible for the action **- clear chain of command**
- Who should be notified
- Whether production/sales should be stopped
- Treatment of affected product **(including quarantine, testing, reprocessing and recall)**
- Who can authorise production/sale to restart

After rectification of a deviation monitoring may need to be more frequent until control is assured

Product subject to deviation

Corrective action should specify the treatment of affected product (quarantine, testing, reprocessing, disposal and recall)

Continue process (e.g. extend cooking time)

Change shelf life (e.g. use immediately)

Release after examination/sampling/testing

Use for different purpose

Release

Destroy

Traceability and recall (retail and manufacture)

All products to be :

- Clearly labelled
  Clear identification of batches **is also essential (retail and manufacture).**
  Identification of batches containing specific ingredients

- Traceable
  Traceability of products is essential, including capability for recall.

Examples of major recalls
John West Salmon - all cans from suspect batches with possible *C. botulinum*.

John Barr (*E. coli* O157)- attempted to prevent consumption of contaminated cooked meat. (May have been frozen by consumers).

Recalls - use trade/enforcement officers/media - public announcements (TV, radio, newspapers)

May be seen as good hygiene practice and therefore be considered as a prerequisite

NB Latest EU legislation re traceability.

MODULE 13

Verification

Principle 6: Establish verification procedures to confirm that the HACCP system is working effectively

Outcomes

The delegate will know and understand how to:

- **define verification, validation, review and maintenance**
- **explain the need to verify the HACCP system**
- **explain what is involved with verification of the HACCP system**
- **explain the type of audits**
- **explain the need to validate elements of the HACCP plan to ensure they are effective**
- **explain the need to review the HACCP system, whenever significant changes occur or significant food safety problems/complaints occur**
- **explain the need to update and maintain the HACCP plan**

Verification

Stage 1 (validation)

Obtaining evidence that elements of the HACCP plan are effective, especially the critical control points and critical limits. **This may require external expertise.**

Stage 2

Ensure that the HACCP system in total is satisfactory. (HACCP plan and prerequisites)

Verification

The application of methods, procedures and tests, and other evaluations, in addition to monitoring, to determine compliance with the HACCP plan.

Verification techniques include inspection/auditing, by a technically competent person. Data and complaint analysis (look for trends) microbiological monitoring(end-product testing and/or production). Observe monitoring person.

Check all documentation and records.

Example

Monitoring of milk pasteurization - time/temp checked on thermograph.

Verification could involve bacteriological sampling and also validating the accuracy of the thermographs used to maintain temperatures of pasteurization

Stage 3 (Review)

A reassessment of the HACCP system to ensure its continued validity.

Frequency of verification

Should occur at a frequency to ensure the HACCP plan is being followed continuously i.e. safe food produced

All verification documentation should be recorded.

Verification techniques

May require external expertise

Audit against the HACCP plan to **ensure correct implementation and control of hazards. (involve food handlers) Inspection/audit skills required (preferable to use non-HACCP team member)**

Use of random testing/sampling **(including microbiological**

Challenge testing

Re-examine all scientific data **relating to hazards and risks**

Focus on critical areas (e.g. what causes food poisoning)

Confirm that all CCPs are under control

Data and complaint analysis

Research/awareness of new technology, science and developments especially in relation to epidemiological information

Audit (types)

First party - internal
Second party - customers
Third party - independent experts
Fourth party - enforcement agencies

In the UK verification of small catering/retail business may have to be undertaken by enforcement officers.

When to review the HACCP system

A review should be undertaken:

- At regular intervals (at least annually)
- If new scientific data emerges **(new technology/epidemiological information)**
- When a justified complaint or confirmed illness occurs
- When the raw materials or recipe changes
- When equipment or the process is changed
- Storage conditions or product use changes
- Packaging or distribution is changed
- Following modification of the HACCP plan

Review documentation must be recorded

NB Changes in the food operation or HACCP plan may require additional training of food handlers to ensure competence

Annual reviews

Useful to identify new products/processes or menu items that have not been included in the HACCP system.

Similarly, changes to equipment or suppliers

Reviews should identify weaknesses in the system and eliminate unnecessary or ineffective controls

Maintenance of the HACCP system

Maintaining the supporting elements and resources to ensure the plan remains valid over time and doesn't become out of date.

Maintain

- The HACCP team
- The sources of information
- The HACCP documentation

Module 14

Documentation

Principle 7: Establish documentation concerning all procedures and records appropriate to these principles and their application

Outcomes

The delegate will know and understand how to:

- **explain the need for documentation of HACCP systems**
- **explain the need for keeping documentation up to date and removing obsolete instructions**
- **describe the type of documentation required to support the HACCP plan**
- **demonstrate the ability to prepare and complete monitoring records for CCPs and prerequisite programmes**
- **explain how to establish records for controlling procedures**
- **explain how to store completed records**

Documentation

Accurate records are essential to the application of the HACCP system.

Must be appropriate for the size and nature of the business.

Documentation is required for:

- Company policy
- Verification/internal audits
- To investigate complaints/illness
- Due diligence
- Legal compliance
- External auditors/EHOs

A management system to ensure up-to-date and effective documentation is essential.

Utilize the simplest effective record-keeping system that integrates with the operation

Obsolete instructions/documentation must always be withdrawn.

Documentation to support the HACCP study

(Obtained during the operation of the plan)

- The HACCP plan
- Floor plan
- Prerequisite programmes
- Audit reports of suppliers **(where practicable)**
- Monitoring records of deliveries/specifications
- CCP monitoring activities **(and non CCPs**) **(temperature/time/weight/chemical/bacteriological e.g. Rezasurin)**
- Deviations and corrective actions
- **Inspection**/audit reports
- Customer complaints/**investigation results**
- Prerequisite programmes' monitoring activities
- All monitoring records should be signed and dated **(countersigned if appropriate)**

Records from prerequisite programmes include:

- **Approved supplier list**
- **Stock rotation/date code**
- **Staff health/exclusion/personal hygiene records**
- **Cleaning schedules**
- **Training programme/training records**
- **Pest control (pest control book)**
- **Equipment maintenance/servicing**
- **Labelling**
- **Calibration of instruments**
- **Recall and traceability**

Employees involved in monitoring can assist in ensuring records and record-keeping procedures are simple and effective

The HACCP plan:

- Details of the HACCP team and responsibilities
- Scope and terms of reference
- A description of the process, product **and intended use**
- Flow diagrams **including CCPs**
- Consumers
- All information relating to the hazard analysis and CCP determination **(HACCP control charts)**
- Critical limits and targets **(evidence for justification)**
- Deviations and corrective action procedures **including reject, recall and traceablility**
- Monitoring and record-keeping procedures
- A record of the reasons for critical decisions and modifications to the system
- Validation, verification and review procedures

Failure in the implementation of HACCP

- Poor hygiene practices (prerequisites)
- Lack of management commitment
- Externally imposed
- Lack of resources, **especially time (for implementation, monitoring, verification and review)**
- Too complex **(unnecessary jargon)**
  not understood
- Lack of knowledge/training
- Poor records/too much paperwork
- System sits in manager's office **(HACCP should be brought into food rooms and critical control points clearly identified)**
- Too many critical control points identified
  - **Not science based**
  - **Straying into quality not safety**
  - **Failure to reduce monitoring, emphasis on controls that are not critical**
  - Unreliable critical limits

Try the following questions, answers follow

Section 1 Optional Questions

1. Which of the following is a legal requirement?

- ☐ a) Identifying steps in the activities which are critical to food safety.
- ☐ b) Identifying members of a HACCP team.
- ☐ c) Identifying critical control points using a decision tree.
- ☐ d) Ensuring all high-risk food handlers have a HACCP qualification.

2. One of the main principles of HACCP is to:

- ☐ a) Define the terms of reference of a HACCP study.
- ☐ b) Establish corrective actions.
- ☐ c) Record the temperature of refrigerators 3 times per day.
- ☐ d) Verify that the flow diagram is accurate.

3. What should be included within the scope of a HACCP study?

- ☐ a) The labelling requirements of products.
- ☐ b) The type and number of monitoring documents.
- ☐ c) The number of people in the HACCP team.
- ☐ d) The type of hazards that may affect the product.

4. What is a decision tree used for?

- ☐ a) To determine the pH of a product.
- ☐ b) To identify hazards that may be present.
- ☐ c) To identify critical control points within a process.
- ☐ d) To identify critical limits.

5. Which of the following may be described as a control measure?

- ☐ a) Checking the temperature of food with a probe thermometer.
- ☐ b) Cooking a raw chicken to a safe temperature.
- ☐ c) Recording accurate temperatures in a log book.
- ☐ d) Analysing a process to ascertain likely hazards.

6. A review of the HACCP plan should be undertaken:

- ☐ a) At least six times per year.
- ☐ b) Following a food poisoning incident.
- ☐ c) If a new laboratory has been selected.
- ☐ d) When a new managing director is appointed.

7. Which of the following is an example of a corrective action?

- ☐ a) Checking the temperature of food with a probe thermometer.
- ☐ b) Verification of the flow diagram.
- ☐ c) Calibrating the digital thermometer.
- ☐ d) Detaining a suspect product for further testing.

8. Verification of the HACCP system should involve:

- ☐ a) Obtaining evidence that the critical limits are being complied with.
- ☐ b) Monitoring the refrigerator temperatures.
- ☐ c) Ensuring that the ovens are regularly maintained.
- ☐ d) Providing extensive training for the HACCP team members.

Section 1

9. Monitoring records kept to support the HACCP system are useful to?

- ☐ a) Ensure the quality of the food is satisfactory
- ☐ b) Determine the control measures required.
- ☐ c) Provide training for HACCP team members.
- ☐ d) Support a due diligence defence.

10. Which of the following is a routine monitoring procedure in HACCP?

- ☐ a) Identify the hazards in the raw ingredients.
- ☐ b) Arranging for bacteriological testing of finished product.
- ☐ c) Measuring the temperature of food in a refrigerator.
- ☐ d) Assessing the knowledge of the high-risk food handlers.

11. What is the purpose of Industry Guides to Good Hygiene Practice?

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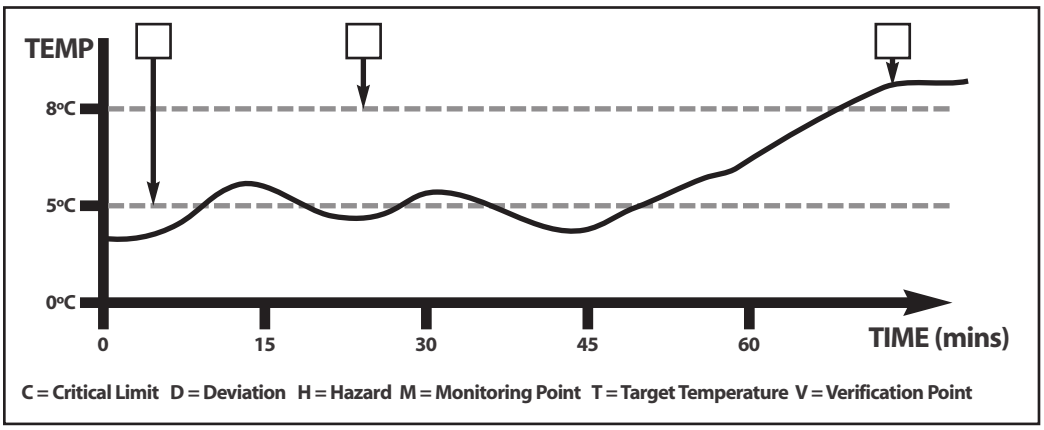
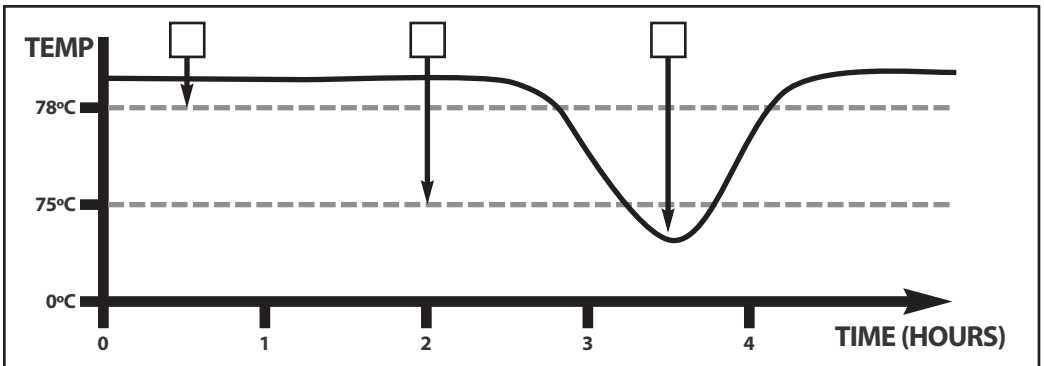
12. The following graph shows the temperature of food in a refrigerator. After 45 minutes the door is left open. The maximum safe temperature is 8°C. Place a letter in each box, from the list provided, to describe the specific line or point.



C = Critical Limit D = Deviation H = Hazard M = Monitoring Point T = Target Temperature V = Verification Point

13. The following graph shows the temperature of chickens removed from the oven after cooking. The temperature of the chicken removed after 3.5 hours is 73°C. Place a letter in each box, from the list provided, to describe the specific line or point.



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Section 1 ANSWERS

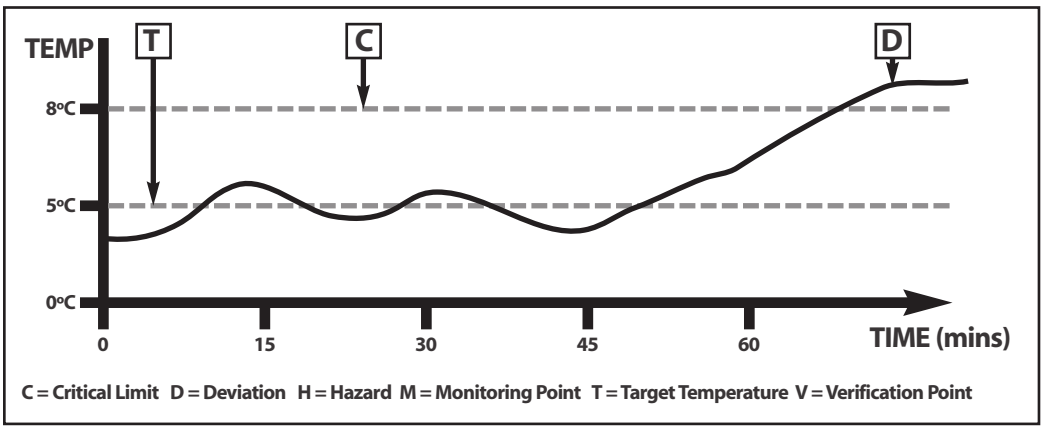
Intermediate HACCP

Section 1:

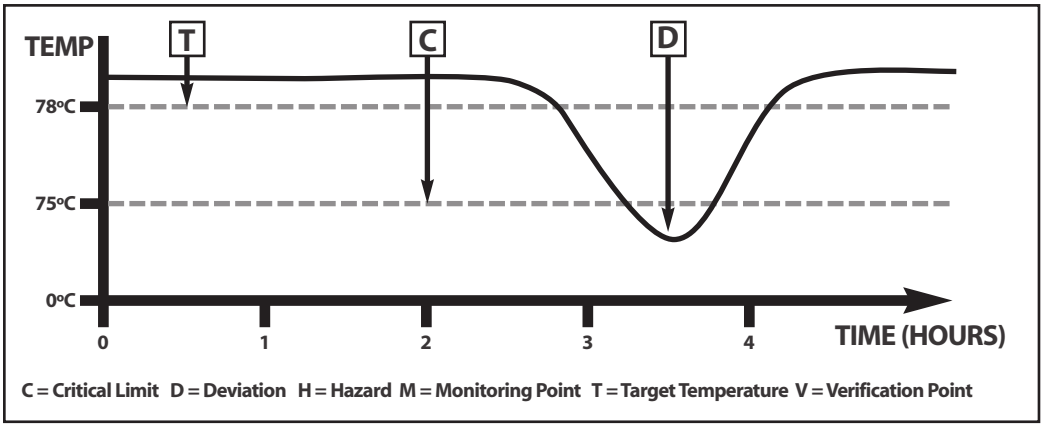
Question 1 **Answer: a**
Question 2 **Answer: b**
Question 3 **Answer: d**
Question 4 **Answer: c**
Question 5 **Answer: b**
Question 6 **Answer: b**
Question 7 **Answer: d**
Question 8 **Answer: a**
Question 9 **Answer: d**
Question 10 **Answer: c**

Question 11 **Answer: To provide a food business guidance on how to comply with legislation.**

Question 12 **Answer:**



Question 13 **Answer:**



Try this optional question, answer to follow

Section 2 Q:1

INTRODUCTION: You are assisting the HACCP team study food preparation in a small restaurant. The scope of the HACCP study is microbiological contamination, multiplication and survival, including toxins and spores, from delivery to service. You should assume the premises comply fully with legal requirements.

PREPARATION: 20kg bags of dried rice are delivered weekly to a small restaurant. The bags are rejected if there is any indication of pest damage. After unloading the bags are emptied into clean bins in the dry storage area. 5kg bags of frozen peas are delivered and stored at –18ºC. Deliveries above –15ºC are rejected. Black pepper is delivered as whole corns, moved to the dry store and ground as required. Tap water is added to the rice in large pans which is then boiled. Frozen peas are added to the rice which is brought back to the boil. Some rice is plated and served immediately and some rice is held in a bain marie above 63ºC until required for service. Ground black pepper is added to plated meals as required. Some rice is cooled using tap water at 10ºC, it is then placed under refrigeration below 5ºC. The following day the rice is placed in a chilled display below 5ºC and served to customers as part of a salad.

Construct a process flow diagram from the information provided for the preparation and service of boiled rice, peas and black pepper.

Q:1 Answer

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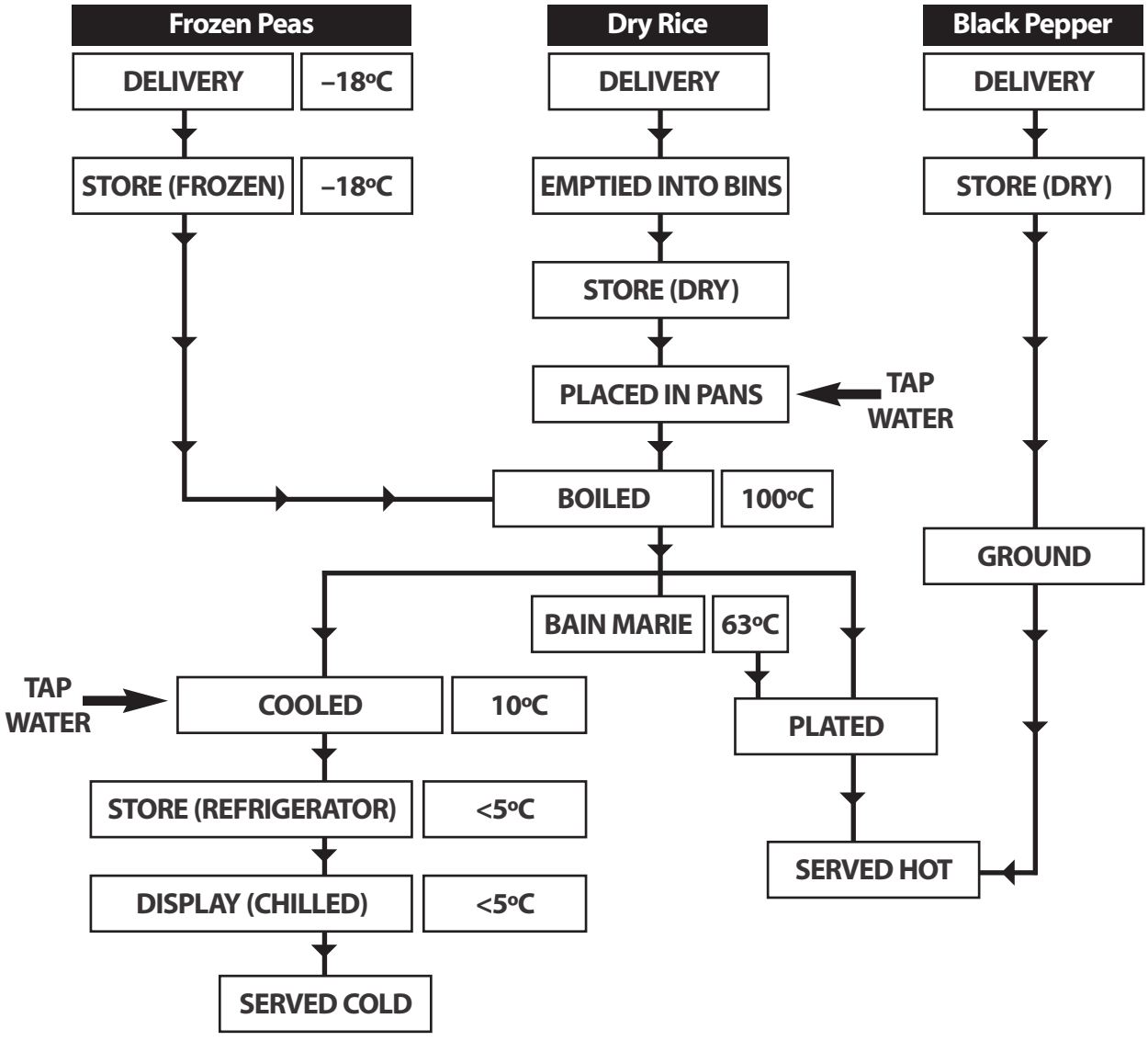

Q:2

Bearing in mind the scope of the study identify a hazard and a source or cause of the hazard at each of the following steps.

Process Step	Hazard & Source/Cause
Cooking	
Cooling	
Hot Holding	

Q:3

Suggest one control measure for each of the following process steps.

Process Step	Hazard & Source/Cause	Control Measure
Refrigerated storage after cooling	Multiplication of bacteria due to the large amount of rice placed in the refrigerator	
Chilled display	Multiplication of *B. cereus* due to temperature of chilled display being at 20°C	

Q:4

Apply the Codex Decision Tree to the following process steps. There may be alternative control measures but answers should only relate to the example provided.

Process Step	Hazard & Source/Cause	Control Measures	Decision Tree Questions (Put Yes or No as appropriate)					CCP? (Y/N)
			1	1a	2	3	4	
Cooking of rice	Survival of vegetative *B. cereus*	Boil at 100°C						
Hot service of rice immediately after cooking	Multiplication of *B. cereus*	Serve within 15 mins of cooking						
Chilled display of cold rice	Multiplication of *B. cereus*	Store rice below 5°C						

Q:2 Answer

Bearing in mind the scope of the study identify a hazard and a source or cause of the hazard at each of the following steps.

Process Step	Hazard & Source/Cause
Cooking	Survival of vegetative *B. cereus* due to inadequate cooking (time and temperature combination)
Cooling	Long slow cooling enabling the germination of spores and the multiplication and toxin production of vegetative *B. cereus*
Hot Holding	Multiplication and toxin production of vegetative *B. cereus* due to temperature dropping to around 40°C

Q:3 Answer

Suggest one control measure for each of the following process steps.

Process Step	Hazard & Source/Cause	Control Measure
Refrigerated storage after cooling	Multiplication of bacteria due to the large amount of rice placed in the refrigerator	Use small batches (less than 2.5 cm). Cool rapidly <10°C before storing in the refrigerator
Chilled display	Multiplication of *B. cereus* due to temperature of chilled display being at 20°C	Chilled display to operate at 5°C or below

Q:4 Answer

Apply the Codex Decision Tree to the following process steps. There may be alternative control measures but answers should only relate to the example provided.

Process Step	Hazard & Source/Cause	Control Measures	Decision Tree Questions (Put Yes or No as appropriate)					CCP? (Y/N)
			1	1a	2	3	4	
Cooking of rice	Survival of vegetative *B. cereus*	Boil at 100°C	Y	–	Y	–	–	Y
Hot service of rice immediately after cooking	Multiplication of *B. cereus*	Serve within 15 mins of cooking	Y	–	N	N*	–	N
Chilled display of cold rice	Multiplication of *B. cereus*	Store rice below 5°C	Y	–	N	Y	N	Y

*The answer to Q3 is 'NO' if 'could' is interpreted as 'is it likely' (using experience, science and epidemiological information). However, the answer to Q3 would be 'YES' if 'could' was interpreted as 'is it theoretically possible'.

Q:5

For each control measure that you have identified in Q:3 detail one suitable monitoring procedure.

Process Step	Monitoring*
Refrigerated storage after cooling	
Chilled display	

* WHAT/WHEN/WHO

Q:6

In a small factory involved with the production of jam several complaints were received from customers regarding glass contamination. Earlier in the week engineers had dealt with a spate of broken glass jars during filling with jam and sealing of jars. They weren't sure whether the jars were suspect or the filling and capping line was faulty. However, they made some adjustment to the line and no further problems occurred.

Do you agree with the actions taken?

Suggest an appropriate course of action including notes on the action that should have been taken at the time of the breakage and how problems of this type could be prevented in the future.

Q:5 Answer

For each control measure that you have identified in Q:3 detail one suitable monitoring procedure.

Process Step	Monitoring*
Refrigerated storage after cooling	Food handler to check and record the temperature of each batch of rice with a clean, disinfected probe thermometer prior to refrigeration OR to check each batch to ensure the thickness does not exceed 2.5cm and daily checking of temperature control records of refrigerator by supervisor.
Chilled display	Food handler to check and record the temperature of the chilled display at least 3 times per day and daily checking of the temperature control records by the supervisor.

* WHAT/WHEN/WHO

Q:6 Answer

In a small factory involved with the production of jam several complaints were received from customers regarding glass contamination. Earlier in the week engineers had dealt with a spate of broken glass jars during filling with jam and sealing of jars. They weren't sure whether the jars were suspect or the filling and capping line was faulty. However, they made some adjustment to the line and no further problems occurred.

Do you agree with the actions taken? I DO NOT AGREE WITH THE ACTION TAKEN

Suggest an appropriate course of action including notes on the action that should have been taken at the time of the breakage and how problems of this type could be prevented in the future.

At time of broken glass jars -

- Follow the glass policy regarding broken glass
- Stop production
- Reject all empty or filled jars exposed to potential risk of contamination
- Inform competent authority
- Look for any broken glass
- Thoroughly clean up using separate cleaning equipment/brushes etc.
- Consider recall if suspect jars with broken glass have been sent out

Preventing future problems -

- Re-examine the glass policy
- Training of staff/engineer regarding dealing with glass breakage
- Send glass jars for sampling
- Call in jar supplier/filler manufacturer
- Increase checking/observation/maintenance of filler
- Monitor trends in consumer complaints
- Consider changing glass supplier
- Check system for cleaning empty jars prior to filling
- Review HACCP