

Hazard Analysis Critical Control Point

HACCP IN FOOD PRODUCTION

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HACCP is a safety system designed to protect foods as they flow through a facility

- Preventive, not reactive
- A management tool used to protect the food supply against biological, chemical and physical hazards
- Originally developed for NASA space flights (1960's)
- Recognized internationally as an effective system of food production controls.

Biological Hazards

- Biological hazards are yeast, mold, bacteria, viruses, protozoa and parasitic worms
- Bacteria: causes most cases of food borne illness
- Viruses: focus on personal hygiene
- Parasites: need a host to survive
- Fungi: spoilage microorganism

Bacterial hazards cause food infection and food intoxication



Nonsporeforming Bacteria

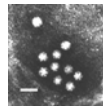
- *Campylobacter* spp.
- Pathogenic *Escherichia coli* (e.g., *E. coli* O157:H7)
- *L. monocytogenes*
- *Salmonella* spp. (e.g., *S. typhimurium*, *S. enteritidis*)
- *Shigella* spp. (e.g., *S. dysenteriae*)
- Pathogenic *Staphylococcus aureus* (e.g., coagulase positive *S. aureus*)
- *Vibrio* spp. (e.g., *V. cholerae*, *V. parahaemolyticus*, *V. vulnificus*,)
- *Y. enterocolitica*
- *E. sakazakii*

C. botulinum

- Proteolytic
- Nonproteolytic
- *C. perfringens*
- *B. cereus*

Biological Hazards: Viruses


- Very small particles that cannot be seen with a light microscope
- Do not need food, water or air to survive
- Some survive cooking and freezing
- Infect living cells and are species specific
- Reproduce inside a living cell but do not reproduce in food
- Survive in human intestines, water or food for months
- Transmission usually by fecal-oral route (poor personnel hygiene)




Biological Hazards: Parasites

- Parasites are organisms that need a host to survive
- Only about 100 types are known to infect people through food contamination
- Role of fecal material in transmission of parasites
 - Grow naturally in some foods
 - Can be transmitted to humans
 - May be killed by proper cooking or freezing

Biological Hazards



Ceißeltierchen *Giardia* verursacht Durchfall




Entamoeba histolytica


Giardia lamblia

Biological Hazards: **Worms**

- Roundworms (nematodes)
 - *Anisakis simplex*
 - *Ascaris lumbricoides*
 - *Pseudoterranova dicepiens*
 - *Trichinella spiralis*
- Tapeworms (cestodes)
 - *Diphyllobothrium latum*
 - *Taenia solium*, *T. saginata*
- Flukes (trematodes)



Spulwurm in Kalbs oder Hund



Fischbandwurm
Einspeisung mit Eisen gefüllt

Biological Hazards


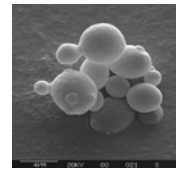
Fungi

- Spoil Food and can cause illness
- Grow best in sweet, acidic foods with low water activity

● **Mycotoxins** (e.g., aflatoxin)

● **Shellfish toxins**

- Paralytic shellfish poisoning (PSP)
- Diarrhetic shellfish poisoning (DSP)
- Neurotoxic shellfish poisoning (NSP)
- Amnesic shellfish poisoning (ASP)/Domoic Acid

Physical Hazard

- Any potentially harmful extraneous matter not normally found in food such as Glass, Wood, Stones, Metal or Plastic

To reduce the risk

- Examine contents of cans and cases
- Check can opener for metal shavings, nicks in the blade
- Evaluate products during preparation
- Report Foreign Matter incidents

Chemical Hazard

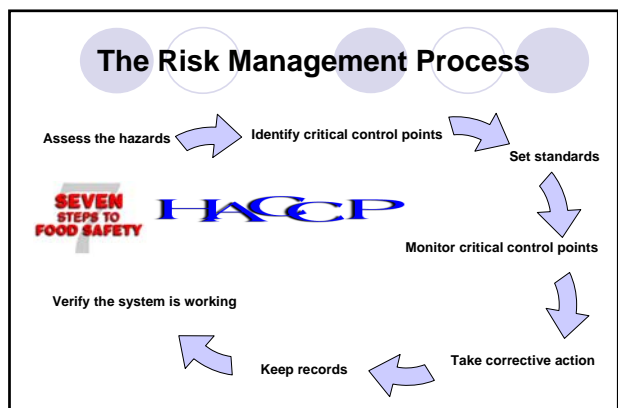
Intentionally added chemicals

Unintentionally or incidentally added chemicals

- Agricultural chemicals
- Toxic elements and compounds
- Secondary direct and indirect

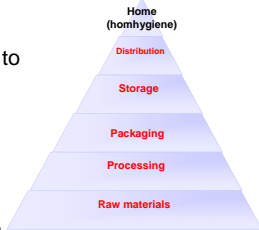
To reduce the risk

- Store chemicals away from food storage
- Store foods in proper containers
- Read labels



Assess the Hazards

- List all potential hazards associated with each step, conduct a hazard analysis, and consider any measures to control identified hazards
- Chart the flow of food (Receive, Store, Prepare, Cook, Cool, Reheat, Hot Hold, Serve)
- All potentially significant hazards must be considered



The Risk Management Process

Assess the hazards → Identify critical control points

- HAZARD IDENTIFICATION: BIOLOGICAL HAZARDS
- HAZARD IDENTIFICATION: CHEMICAL HAZARDS
- HAZARD IDENTIFICATION: PHYSICAL HAZARDS

- Pathogen growth in the finished product can be prevented by control at the formulation or ingredient-addition step (e.g., pH adjustment or addition of preservatives)
- Pathogen growth can be controlled by refrigerated storage or chilling or Pathogens can be killed during cooking
- Parasites can be killed by freezing (e.g., *Anisakis* in fish destined for raw consumption)
- A chemical hazard can be prevented by control at the formulation or ingredient-addition step
- Metal fragments can be detected by a metal detector and eliminated by removing the contaminated product from the processing line

The Risk Management Process

Assess the hazards → Identify critical control points → Set standards

- A critical limit is a maximum and/or minimum value to which a biological, chemical or physical parameter must be controlled at a CCP to prevent, eliminate or reduce to an acceptable level the occurrence of a food safety hazard.
- Critical limits are standards that are employed at each control point.
- Critical limits may be based upon factors such as: temperature, time, physical dimensions, humidity, moisture level, water activity, or pH.
- Critical limits must be scientifically based.

The Risk Management Process

Assess the hazards → Identify critical control points → Set standards

Monitoring frequency can be **continuous** or **noncontinuous**

What...How.... Who

Monitor critical control points

The Risk Management Process

Assess the hazards → Identify critical control points → Set standards

Specific corrective actions must be developed for each CCP in the HACCP system in order to deal with deviations when they occur.

Monitor critical control points

Take corrective action

Corrective Action

- Isolating and holding product for safety evaluation
- Diverting the affected product or ingredients to another line where deviation would not be considered critical
- Reprocessing
- Destroying product
- To correct and eliminate the cause of the deviation and restore process control
 - Bring CCP back under control
 - Determine cause of deviation to prevent future recurrence
- To identify the product that was produced during the process deviation and determine its disposition
- Record actions that have been taken.

Continue to Cook

Reheat

Discard

Deviation

Temperature of milk at pasteurizer drops below critical limit

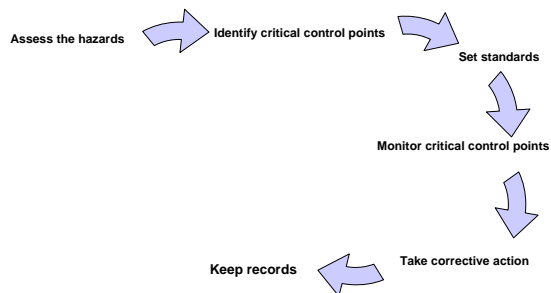
Corrective Action

- Milk flow is diverted until temperature recovers.
- Diverted product is repasteurized.
- Check the operation of the heating/cooling units to determine the reason for the temperature deviation that caused the flow diversion.
- Repair if necessary, re-establish control and resume production

Product (e.g., hot-smoked fish) does not reach required internal temperature for the required time

Recook or destroy product

The Risk Management Process



Record Keeping

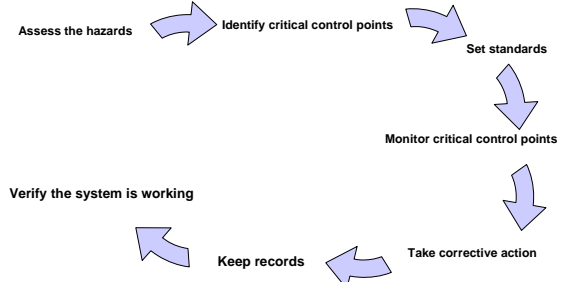
Documents program, procedures, measurements, & actions.

- Inspection reports
- Equipment calibration & time/temp logs
- Training records (helps to identify future training needs)
- Sops (standard operating procedure)
- SSOP (sanitation standard operating procedure)

Record Keeping

- All HACCP monitoring records should be on forms that contain the following information:
 - Form title
 - Firm name and location
 - Time and date
 - Product information (including product type, package size, processing line and product code where applicable)
 - Actual observations or measurement
 - Critical limits
 - Operator's signature or initials
 - Reviewer's signature or initials, and date of review

The Risk Management Process



Verification

- Verification provides a level of confidence that the HACCP plan is based on solid scientific principles and is adequate to control the hazards associated with the product and process, and is being followed
- Elements of verification: Validation, CCP verification activities, HACCP system verification und Regulatory agencies

Validation

- The element of verification focused on collecting and evaluating scientific and technical information to determine if the HACCP plan, when properly implemented, will effectively control the hazards
- Who validates the HACCP plan?
 - HACCP team
 - Individual qualified by training or experience
- What does validation involve?
 - A scientific and technical review of the rationale behind each part of the HACCP plan from hazard analysis through each CCP verification strategy

Calibrations are Performed:

- On equipment and instruments used in monitoring or verification
- At a frequency to ensure accuracy of measurements
- By checking accuracy against a recognized standard at or near the condition that the instrument or equipment will be used
- Checking:
 - Date of calibration
 - Methods used
 - Test results

Verification Records

- Modifications of the HACCP Plan
- Audits of supplier compliance with guarantees or certifications
- Calibration records
- Microbiological tests
 - challenge tests, environmental tests, in-line tests, finished product tests
- In-house, on-site inspections
- Equipment evaluation tests

The WHO golden rules for safe food preparation

1. Choose foods processed for safety
2. Cook food thoroughly
3. Eat cooked foods immediately
4. Store cooked foods carefully
5. Reheat cooked food thoroughly
6. Avoid contact between raw foods and cooked foods
7. Wash hands repeatedly
8. Keep all kitchen surfaces clean
9. Protect foods from insects, rodents, and other animals
10. Use safe water

GOOD PERSONAL HYGIENE



What you can not see can cause foodborne illness.

The image shows two microscopic views of bacteria, one appearing as a cluster of small, round cells and the other as a larger, more complex structure. Above the images is a small inset showing a pair of hands being washed.

How to reduce the risk of Biological contamination

- Cook and hold foods at proper temperatures
- Keep potentially hazardous foods out of the **temperature danger zone**
- Pass potentially hazardous foods through the danger zone as **quickly as possible**
- Pass potentially hazardous foods through the danger zone as few times as possible
- Practice proper **handwashing** and good **personal hygiene**

The diagram shows a thermometer with a red line indicating the 'Temperature Danger Zone' between 41°F (5°C) and 140°F (60°C). It includes instructions: 'Keep hot food hot (above 140°F / 60°C)', 'Heat or chill food quickly', and 'Keep cold food cold (below 41°F / 5°C)'. A green, multi-lobed germ is illustrated above and below the diagram.

According to International Association of Food Production hot foods must be cooled from 140°F to 70°F (60°C to 21°C) within 2 hours and from 70°F to 41°F (21°C to 5°C) within an additional 4 hours.

The diagrams show a thermometer with a red line at 140°F (60°C) and another at 41°F (5°C). A red 'X' is over the 140°F mark, and a green checkmark is over the 41°F mark. Text: 'Refrigeration/Cold Holding Cold foods must be held at 41°F (5°C) or below.'

Do not allow foods to stay in the temperature danger zone. Keep cold foods cold and hot foods hot.

The diagrams show a thermometer with a red line at 140°F (60°C) and another at 165°F. A red 'X' is over the 140°F mark, and a green checkmark is over the 165°F mark. Text: 'Hot foods Cooked to an internal temperature of at least 165°F Served and held at 140°F (60°C) and above'

avoid cross contamination

- Cross-contamination is the transfer of a harmful substance from one food to another food by vehicles such as **human hands, contact surfaces** or directly from a **raw food** to a **ready-to-eat food**.
- Improper **storage** practices
- **Human hands (food workers, consumers)**
- Food and/or ingredient contamination
- Contact surfaces of equipment, utensils, and wiping cloths
- Contamination from **Air**
- Contamination from ice (**water**)

The icon shows a knife and a fork crossed, with a red circle and a diagonal slash over them, indicating that these items should not be used for cross-contamination.

Handwashing

- Inadequate handwashing
- Untrimmed fingernails
- Soiled clothing
- Eating, drinking, or using tobacco

Wash hands after:

- Using restroom
- Touching your hair or face
- Eating or smoking
- Completing a task and before using new gloves
- After touching any source of contamination

The illustration shows a pair of hands being washed with soap and water, with bubbles around the fingers.

Using Gloves

- Use gloves to avoid bare-hand contact with food during preparation and production
- Wear gloves while serving food
- Change gloves:
 - When moving from task to task
 - After touching your hair or face
 - After touching any source of contamination

The photo shows a food service counter with various items on it. The sign below it says 'No Bare Hand Contact Do not touch ready-to-eat foods with bare hands.' The sign features a red circle with a slash over a hand touching a piece of food.

Do not work with food and beverage if you are ill or experiencing gastrointestinal symptoms.

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Critical steps

- Protecting stored food
- Thawing
- Cooking
- Microwave cooking
- Cooling foods rapidly
- Defrosting Safely
- During Prep and Service

Hygiene monitoring

•Reduce risk of food pathogens
•Demand from Customers
•Improve shelf-life

Hygiene monitoring

Cleaning monitoring

Contact Plates

For the detection and enumeration of microorganisms on environmental surfaces, manufacturing plants, and equipment.

Envirocheck® Contact Plates TVC
Envirocheck® Contact Plates Y + M

Hygiene monitoring

Cleaning monitoring

Contact Slides

For the microbiological hygiene control of surfaces and liquids in production lines and equipment. Both sides of a flexible paddle are coated with culture medium.

Envirocheck® Contact TVC Total Viable Counts
Envirocheck® Contact DC Disinfection Control
Envirocheck® Contact C Coliforms / *E. coli*
Envirocheck® Contact E Enterobacteriaceae
Envirocheck® Contact YM Yeast and Moulds

Hygiene monitoring

Cleaning monitoring

Limitations of microbiological hygiene control with Contact Plates/Slides

- Does not detect food residues
- Does not detect (recover) all microorganisms
- Detects microorganisms after 1- 7 days

Hygiene monitoring
Cleaning monitoring

Rapid Testing

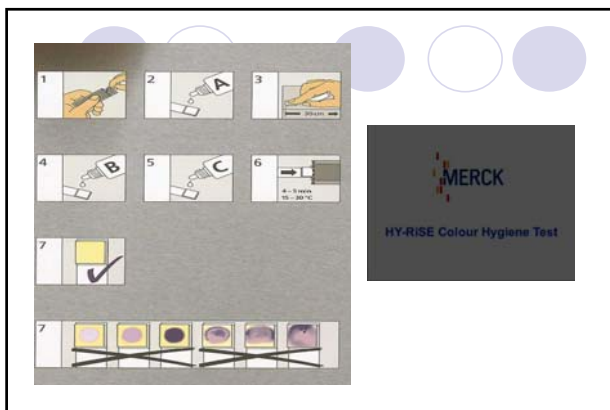
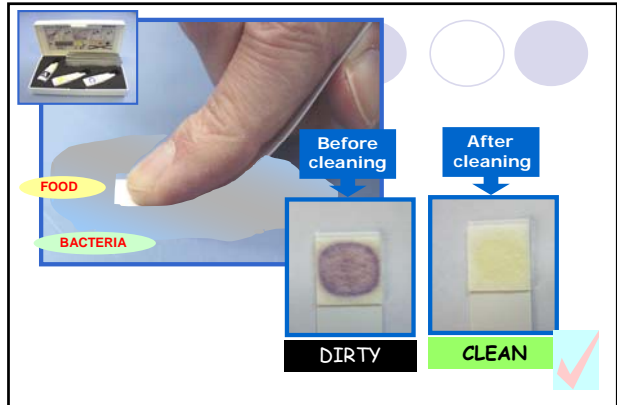


HY-Lite®



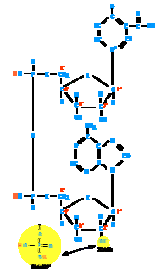
HY-Rise®

To be of practical value to the manufacturer, a sanitation monitoring system must give results fast enough to allow necessary corrective action before restart of production.



HY-RiSE® NAD colour test strip

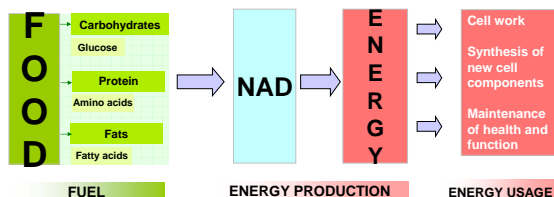
- Visual test (no reader)
- Qualitative test
- Simple to perform
- Results in 5 minutes
- Reagents stable at room temperature
- More sensitive to microorganisms than similar colorimetric tests for sugar or protein
- Suitable for confirmation of cleaning operations in Hotels / Restaurants / Catering / Retail



Hygiene monitoring
Cleaning monitoring

What is Nicotinamide Adenine Dinucleotide ?

In living cells, NAD is essential for biological reactions that produce energy from the breakdown of food.



HY-LITE® „For the rapid detection of total ATP“

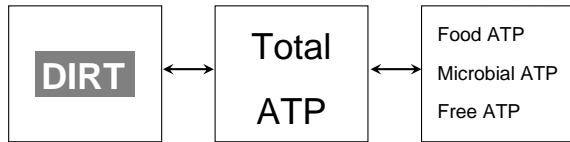


HY-LITE® 2 Luminometer with built-in printer, TREND 2 Software and HY-LITE® Pens

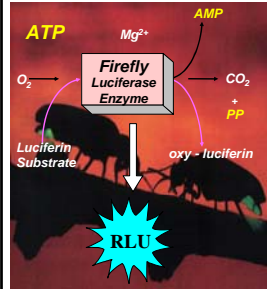
- All living things, plants and animals, require a continual supply of energy in order to function.
- Adenosine triphosphate (ATP) is a substance found in all animal and vegetable matter, including food and food debris, in addition to bacteria, fungi and other microorganisms.

Hygiene monitoring
Cleaning monitoring

Why measuring „total ATP“ ?



Hygiene monitoring
Cleaning monitoring



- The HY-LITE® 2 system is a luminometer, counting photons out of the bioluminescence light reaction.
- Display of light intensity (from bioluminescence) in Relative Light Units (RLU).
- Relative Light Units are directly proportional to ATP

Hygiene monitoring
Cleaning monitoring

HY-LITE® liquid test



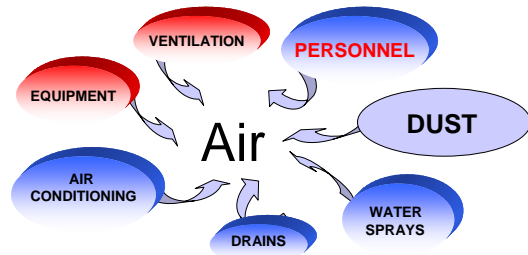
HY-LITE® surface test



The HY-LITE® pen:2 formats
Surface test pen with rinse tube and swab
Liquid test pen for CIP rinse water samples

Hygiene monitoring
Air monitoring

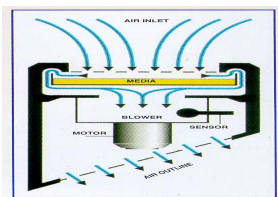
Microbial air sampler to count microbes in a defined volume of air



Hygiene monitoring
Air monitoring

MAS 100® Air-Sampler's principle

Based on the Impactor Principle described by ANDERSEN (1958) by which particles (loaded with organisms) are "caught" out of an aspirated air volume directly onto the surface of an agar-plate



after incubation the colonies are counted and expressed as colony forming units (cfu) per m³

THANK YOU FOR YOUR
ATTENTION

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