

# **Food Quality Management and Control - FQMC**

**Notes for the course NFOK15011U, at the University of  
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# Chapter 1

## Information of the course

### 1.1 Course content

The course will introduce the concepts of food quality management and control from two different/complementary perspectives:

1: a detailed reading of the ISO 22000 standard, and insight into the use of this standard, including HACCP (Hazard Analysis and Critical Control Points), for the management of food safety.

2: monitoring of the food quality based on process monitoring tools such as Statistical Quality Control (SQC) and Lean Six Sigma to ensure a food product with minimal variation.

Producing food requires understanding of all process steps, and knowledge of the performance of each step is critical to estimate the variability of the final product. Knowing the variability makes it possible to find solutions for adjusting it, if it is not in accordance with the process step and/or end-product specifications. Thus, the idea of measuring, understanding, adjusting, monitoring and controlling variability throughout the production is a key topic of this course.

Quality in this course will be seen both in a wide context; i.e. as proof of product specification meaning that the variability of the food produced is known and below or within an acceptable limit to ensure customer satisfaction, as well as occasionally in a more narrow context; i.e. as food safety meaning that the amount of hazards is below a certain limit.

#### 1.1.1 Learning objectives

The main objective of this course is to provide the students with knowledge on international food safety management system standards and food quality monitoring and verification tools. After completing the course, the students should be able to:

#### Knowledge

Describe how food safety is achieved, using HACCP, according to international standards on food safety management (e.g. ISO 22000). Show overview of how the above mentioned food safety management system standards can be applied in the food industry. Describe how food production quality should be measured to ensure that process variation is under control. Describe how to gain insight into a process using quality by design to be able to optimize a process.

## **Skills**

Apply ISO 22000 for food safety management. Use SQC and sampling technologies to monitor and verify process and product specifications. Communicate problems and solutions within food safety management. Use monitoring systems (e.g. real-time measurements), Six Sigma and SQC like tools to get knowledge of and to monitor quality control points in a food production and also to understand how the measurement uncertainty of process steps will influence the uncertainty/variability of the food product parameters.

## **Competences**

Evaluate whether existing and/or new control strategies are appropriate in order to achieve safe and robust food products. Evaluate how the raw materials and production steps can be monitored to get an even better control of the final food product.

### **1.1.2 Teaching and learning methods**

Lectures, project work, and seminars. The lectures introduce theoretical and practical aspects of international systems on quality/food safety management and control. The project work and seminars will help the students to interpret and obtain an understanding of the above mentioned aspects.

### **1.1.3 Exam**

The exam will be an ITX exam with a duration of 4 hours. The exam consists of multiple choice questions (50% of the grade) and 1-2 essay questions (50% of the grade) where the students will be asked to analyze and solve a problem related to the course content. The exam will be based on the course literature and the lectures.

# Chapter 2

## Lecture Notes

### 2.1 05.09.24 - Measurements

#### 2.1.1 Agenda

The agenda of this lecture is:

- Monitoring a food process – why?
  - \* Variability of a process
  - \* Type of variations
- Characterization of a process by measuring
- Classification of process analyzers/sensors
- Correlations between measurements

### 2.2 05.09.24 - ISO 22000:2018 - A food safety management system standard

**Management** is the way in which an organization manages the inter-related parts of its business in order to achieve its objectives. There were given a link which can be used to get more information: <https://www.iso.org/management-system-standards.html> (5/9/2018)

**Standard** (= scheme), this describes the set of rules/requirements on which the system of an organization are based...

Here are some examples of Food Safety Management System Standards:

- BRC Global standard – Food
- IFS
- SQF
- ISO 22000
- FSSC 22000
- For more examples, see QM-textbook, pp. 7-12

### 2.2.1 Deming Circle

The Deming Circle, also known as the PDCA Cycle (Plan-Do-Check-Act), is a continuous improvement model developed by W. Edwards Deming. It consists of four key steps:

- **Plan** - Identify an opportunity and plan for change.
- **Do** - Implement the change on a small scale.
- **Check** - Use data to analyze the results of the change and determine whether it made a difference.
- **Act** - If the change was successful, implement it on a wider scale and continuously assess your results. If the change did not work, begin the cycle again.

The PDCA cycle promotes ongoing evaluation and refinement, leading to gradual, sustained improvement in processes or products. This is meant to be a continuous cycle, with each iteration building on the last and can be depicted in 2.1.

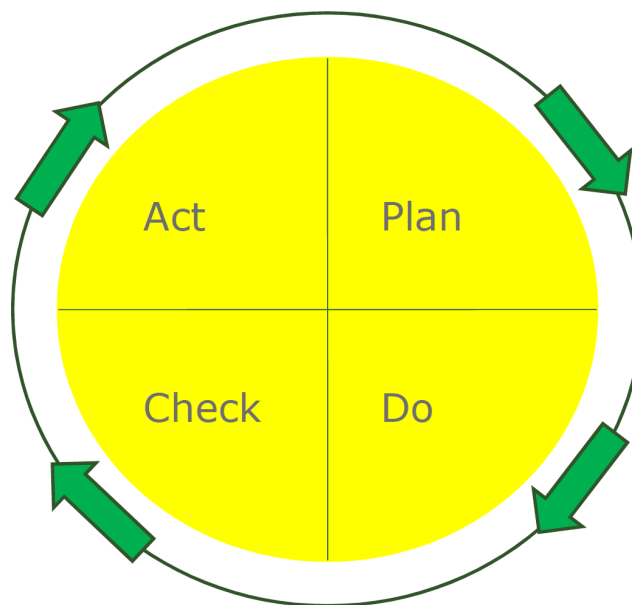


Figure 2.1: A picture of the circular thought behind the Deming Circle

A more thorough illustration of the four steps can be seen from the following

### 2.2.2 ISO 22000

Here are three keypoints of the ISO 22000:

- It combines the prerequisite and operational prerequisite programmes (i.e. GMP) and HACCP requirements of Codex Alimentarius and quality management requirements of ISO 9000
- It reduces confusion about Food Safety Management System Standard requirements, since it defines the elements of key standards required by leading retailer chains in a single standard and defines the Codex HACCP system as the "standard within the standard" to be used
- however, the standard is generic, i.e. organizations/companies have to think themselves!

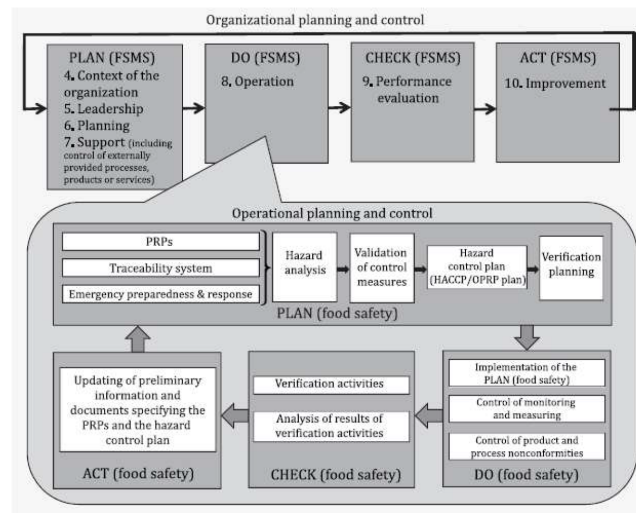


Figure 2.2: A thorough illustration of the Plan-Do-Check-Act cycle

There are 10 chapters in the ISO 22000 standard, chapter 4-10 are the main chapters. The first three chapters are the introduction and the scope of the standard. Thus chapters 4-10 are the main chapters of the requirements of the standard.

- Chapter 1: Scope
- Chapter 2: Normative references
- Chapter 3: Terms and definitions
- **Chapter 4: Context of the organization**
- **Chapter 5: Leadership**
- **Chapter 6: Planning**
- **Chapter 7: Support**
- **Chapter 8: Operation**
- **Chapter 9: Performance evaluation**
- **Chapter 10: Improvement**

## 2.3 05.09.24 - HACCP - step 9: monitoring procedures

HACCP stands for: (H)azard (A)nalysis and (C)ritical (C)ontrol (P)oints The intention behind this is:

- The internationally recognized procedure to ensure the production of safe foods
- Over the last 50 years, HACCP has evolved from
- 3 principles to
- 7 principles to
- 12 steps (incl. the 7 principles)
- Codex Alimentarius CAC/RCP 1-1969

The HACCP consist of 12 steps (Codex Alimentarius CAC/RCP 1-1969), 5 preliminary steps and 7 principles. The 12 steps are:

- 1 - Assemble HACCP team
- 2 - Describe product
- 3 - Identify intended use of the product
- 4 - Construct process flow diagram for the product
- 5 - Verification of process flow diagram
- 6 - Conduct a hazard analysis
- 7 - Determine critical control points (CCP's)
- 8 - Establish critical limits for each CCP
- 9 - Establish monitoring procedures for each CCP
- 10 - Establish corrective actions for each CCP
- 11 - Establish verification procedures for each CCP
- 12 - Establish record keeping and documentation procedures



# Chapter 3

## Groupe Work

### 3.1 Case Exercises

#### 3.1.1 Case 1 (Intro Case; Parma Ham A/S) - 03.09.24

##### Information

The information given for this case is as follows:

- Production capacity: 330.000 raw hams per year
- 70 well-educated staff members
- Production of Parma ham
- Has experienced huge problems with Salmonella and
- Staphylococcus aureus during the production of Parma ham
- Therefore, Parma Ham A/S has obtained an ISO 22000 certification

##### Company Policy

The information given for this case is as follows:

- Parma Ham A/S will produce high quality Parma ham safe for human consumption.
- The Food Safety Management System (FSMS), complying with the requirements given in “DS/EN ISO22000:2018”, shall ensure that legal requirements as to food safety are fulfilled at any time.
- The FSMS shall ensure that customer requirements as to food safety are fulfilled at any time.
- The presence of Salmonella and Staphylococcus aureus shall be reduced to an acceptable level at Parma Ham A/S.
- All staff members at Parma Ham A/S shall be aware of the food safety policy and the FSMS.

***Salmonella ssp.***

The information given for this case is as follows:

- Pathogenic Gram negative bacterium
- Naturally found in the intestinal tracts of mammals, birds, amphibians and reptiles but not in fish crustaceans or mollusks
- Causing salmonellosis
  - Nausea, vomiting, abdominal cramps and fever
  - Zoonotic infection
- The infective dose of Salmonella is thought to be extremely variable, relatively high for healthy individuals and very low for at-risk individuals, such as the elderly or medically compromised.
- Facultative anaerobe
- Minimum water activity for growth is 0.94
  - ( max. 8% salt in water phase)
- Able to survive in dried foods
- Min(/max) temperature for growth is 5 (46)°C
- Min(/max) pH for growth is 3.7 (9.5)
- The presence of Salmonella can be prevented by: heating food sufficiently to kill the bacteria, holding chilled food below 5°C, preventing post-cooking cross-contamination and prohibiting people who are ill or are carriers of Salmonella from working in food operations

***Staphylococcus aureus***

The information given for this case is as follows:

- Pathogenic Gram positive bacterium
- Humans and animals are the primary reservoirs for Staph. aureus. Staph. aureus can be found in the nose and throat and on the hair and skin of 50 percent of healthy individuals. However, the bacteria can be found in air, dust, sewage and surfaces of food-processing equipment. Staph. aureus can produce a toxin if allowed to grow in food. The toxin is not destroyed by the cooking or canning processes
- Staph. aureus food poisoning causes nausea, vomiting, abdominal cramping, watery or bloody diarrhea, and fever
- Facultative anaerobe
- Min(/max) temperature for growth is 7 (50)°C
- Min(/max) pH for growth is 4 (10)
- S. aureus has the ability to grow and produce toxins in food with very little available water ( $a_w$  0.86, 20 percent salt in water phase), which would prevent the growth of other pathogens.
- The presence of Staph. aureus can be prevented by: minimizing time/temperature abuse of food, especially after cooking, and requiring that food handlers engage in proper hygiene.

## Organizational Structure

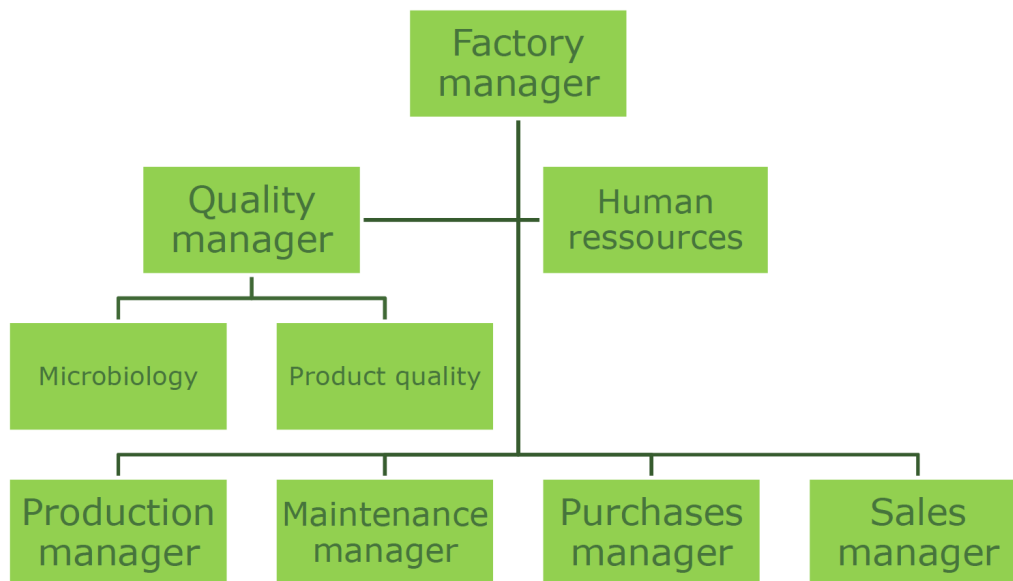


Figure 3.1: Organizational structure of Parma Ham A/S

## Responsibilities

The information given for the organizational structure and roles is as follows:

- The Factory Manager is responsible for:
  - The overall management of the factory, including the implementation of
  - The FSMS.
  - Shall ensure adequate resources for development and implementation of the Food Safety Management System and for continually improving its effectiveness
- The Quality Manager is the overall responsible for:
  - The Food Safety Management System
    - \* Development
    - \* Implementation
    - \* Maintenance
- The Production Manager is responsible for:
  - The production of the Parma ham and for inspection of raw materials
  - The production staff is divided into several sections, each with a section leaders
  - The section leaders are responsible for
  - Ensuring that all staff members have the necessary competencies
  - Ensuring that all staff members have the necessary food safety awareness
  - Education and training of staff members

Information continued:

- The Sales Manager is responsible for:
  - Customer focus
  - Investigating the requirements and expectations of customers
  - Investigating whether these requirements and expectations are fulfilled
- The Purchasing Manager is responsible for:
  - Supplier focus
  - Ensuring that purchased products conform to specified purchase requirements
  - Specified purchase requirements
    - \* Approval of products, procedures, processes and equipment
    - \* Qualification of personnel
    - \* QMS/FSMS
  - Supplier audits

**Chapter A**  
**Appendix**