Difference between sampling during production process or for validation
Food Safety
Knowledge about the hazard or risk and ways of minimising the risk

What are the hazards in cheese and dairy products?
Food Safety
Knowledge about the hazard or risk and ways of minimising the risk

What are the hazards in cheese and dairy products?

- **Physical Hazards**: Example: Fragments of glass
- **Microbiological Hazards**: Example: *Listeria monocytogenes*
- **Chemical Hazards**: Example: Antibiotics
Self Monitoring Measures
play an essential role in the delivery of the food safety management system

How to control the hazards in cheese and dairy products?

- Staff training
  - Hazard identification
  - GHPs
  - HACCP-based Plans

- Hazard identification for milk products
  - Good Hygiene Practices (GHPs)
  - Good Manufacturing Practice (GMP)

- HACCP-based Plans for each product and process

- Product testing

- Non-Conformity management

- Traceability

Testing during the process and Environmental testing
Self Monitoring Measures
play an essential role in the delivery of the food safety management system

How to control the hazards in cheese and dairy products?

Food Safety Management System

- Staff training
  - On:
    - Hazard identification
    - GHPs
    - HACCP-based Plans
    - or Technical (not covered by the guide)

- Hazard identification for milk products
  - Good Hygiene Practices (GHPs)
  - Good Manufacturing Practice (GMP)

- Product testing

- Non-Conformity management

- Traceability
Self Monitoring Measures
The food safety management system should set out self-monitoring measures appropriate to each stage of the production process.

Food Safety Management System

- Self-monitoring measures appropriate to each stage of the production process
- Hazard identification for milk products
- Good Hygiene Practices (GHPs)
- Staff training
- Good Manufacturing Practice (GMP)
- Staff training

Examples
- Listeria monocytogenes
- Regular inspection and maintenance of the milking machine
- Training of milking staff
- Acidification of a product
- How to use starter cultures correctly
- How to measure acidity
Self Monitoring Measures
The food safety management system should set out self-monitoring measures appropriate to each stage of the production process.

Food Safety Management System

- Self-monitoring measures appropriate to each stage of the production process
- HACCP-based plans
- Testing during the process and Environmental testing
- Monitoring of smear water
- Staff training
- Analysis during the production process to control the production process
- Product testing with n=1
- Product testing with n=5
- Verification and validation of the food safety management system
Means of Analysis

Difference between „testing during the process“, „environmental testing“ and „product testing for validation“

How to control the hazards in cheese and dairy products?

Producers can only assure food safety by the use of a food safety management system. Reliance on end-product testing alone is not sufficient and ineffective.

• **Self monitoring:** Analysis during the production process to control the production process

• **Verification:** Verification and validation of the food safety management system
# Preventive Actions (some examples)

Knowledge about the hazard or risk and ways of minimising the risk

<table>
<thead>
<tr>
<th>Process step</th>
<th>Facultative measures to prevent</th>
<th>Listeria monocytogenes</th>
<th>Salmonella</th>
<th>Staphylococcus aureus</th>
<th>Escherichia coli</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk production</td>
<td>Choosing well cleanable and maintainable milking equipment</td>
<td>Prevent poor type or condition of milking equipment</td>
<td></td>
<td>Prevent poor type or condition of milking equipment</td>
<td>Prevent poor type or condition of milking equipment</td>
</tr>
<tr>
<td>Periodic milking machine maintenance</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Staff training on process hygiene</td>
<td>Proper milking procedures, hygiene in milk production, milking order</td>
<td>Identification of clinical signs of salmonellosis like diarrhoea, Use of manure from other farms with great caution</td>
<td>Proper milking procedures, hygiene in milk production, milking order</td>
<td>Identification of E. coli mastitis</td>
<td></td>
</tr>
<tr>
<td>Cattle testing prior to purchase</td>
<td>Carriers of Salmonella may excrete the bacteria in their stools</td>
<td>Carriers of staphylococci aureus may excrete the bacteria in the milk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regularly milk testing for somatic cell counts</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regularly bulk milk testing</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Employee training on personal hygiene</td>
<td>Salmonella may cause diarrhea, carriers of Salmonella may excrete the bacteria in their stools</td>
<td>Covering wounds, use of masks in case of a bad cold</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stool sample of each employee</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop cleaning and disinfecting plan</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Validation of cleaning and disinfection procedures</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

**Degrees of probability:**
*high, medium, low*
How to control a hazard?

Application of self monitoring measures to control *Listeria monocytogenes*

Example: How to control *Listeria monocytogenes*

- **Training of milking staff**
  e.g. Proper milking procedures, hygiene in milk production, milking order

- **Regular inspection and maintenance of the milking machine**
  e.g. Prevent poor type or condition of milking equipment

- **Training of staff**
  e.g. Clothing and footwear exchange before entering production and ripening rooms

- **Acidification Monitoring**
  e.g. Identification of inactive starter cultures

- **Monitoring of smear water**
  e.g. Early detection of surface contamination with L.M. (Bottleneck management)

- **Testing during the process**
  e.g. Product testing to predict product stability with n=1

- **Verification of FSMS**
  e.g. Product testing of a new product with n=5

- **Record keeping system which enables tracing back and forward**

- **Suspension of distribution and product withdrawal or recall**
How to control a hazard?

Application of self monitoring measures to control *Listeria monocytogenes*

**Staff training**
- On: Hazard identification

**Good Hygiene Practices (GHPs)**
- HACCP-based plans for each product and process
- Good Manufacturing Practice (GMP)
- Hazard identification for milk products
- Product testing
  - Testing during the process
  - Environmental testing

**Non-Conformity management**
- Traceability
- Suspension of distribution and product withdrawal or recall

**Conclusions:**

A sampling plan for product testing is NOT a Food Safety Management System (FSMS)

An effective FSMS is based on various self monitoring measures

- **Training of milking staff**
  e.g. Proper milking procedures, hygiene in milk production, milking order
- **Regular inspection and maintenance of the milking machine**
  e.g. Prevent poor type or condition of milking equipment
- **Training of staff**
  e.g. Clothing and footwear exchange before entering production and ripening rooms
- **Acidification Monitoring**
  e.g. Identification of inactive starter cultures
- **Monitoring of smear water**
  e.g. Early detection of surface contamination with L.M. (Bottleneck management)
- **Testing during the process**
  e.g. Product testing to predict product stability with n=1
- **Verification of FSMS**
  e.g. Product testing of a new product with n=5
- **Record keeping system which enables tracing back and forward**
How to create a sampling plan?

Important considerations when creating a sampling plan

The assurance of food safety cannot be based on end-product testing but microbiological testing can be part of an FSMS. A sampling plan helps to structure the sampling procedure.

- **Purpose for collecting a sample**
  The first step to create a sampling plan is to define the purpose for collecting a sample. Does the producer want to demonstrate the efficiency of the FSMS, to determine the adherence to Good Manufacturing Practices or the utility of ingredients for a particular purpose (e.g. raw milk soft cheese) or to predict product stability. According to the purpose the producer will assess a sampling plan for testing during the process, environmental testing or end-product testing.

- **Effectiveness of sampling**
  To achieve a reasonable certainty it can make sense to favour testing during the process or environmental testing. End-product testing is an ineffective way of detecting low level contamination. (e.g. when rind washing, analysis of smear water for presence of L.M. can be more effective at detecting a sporadic, low-level of contamination than end-product testing)

- **Bottleneck Management**
  Every hazard has its most important sources of contamination. It can be more effective to develop and put in place target-oriented process monitoring steps than unspecific end-product-testing (e.g. analysis of stool samples of the employees for presence of Salmonella can be more effective at detecting a sporadic contamination than end-product testing.)

Following the considerations above it’s the producers task to fill the sampling plans framework (see sampling options on the following slides 13 and 14) with useful criteria appropriate to his situation. How a sampling plan can be made step by step is shown in tool 9.3 and 9.4.
### I. TESTING DURING THE PROCESS - Raw milk (Number of samples per batch: n=1)

<table>
<thead>
<tr>
<th>Organism</th>
<th>Time of the investigation</th>
<th>Standard value</th>
<th>What is checked</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Escherichia coli</em></td>
<td>Bulk milk</td>
<td></td>
<td>Milk</td>
</tr>
<tr>
<td>Coagulase-positive staphylococci</td>
<td>Bulk milk</td>
<td>See « Section VIII »</td>
<td>Milk</td>
</tr>
<tr>
<td><em>Listeria monocytogenes</em></td>
<td></td>
<td></td>
<td>Milk or swabs from milk receiver or milk pump after milking</td>
</tr>
<tr>
<td><em>Salmonella</em></td>
<td></td>
<td></td>
<td>Milk (only in cases of suspected disease of animals)</td>
</tr>
</tbody>
</table>

### II. TESTING DURING THE PROCESS - Product (Number of samples per batch: n=1)

<table>
<thead>
<tr>
<th>Organism</th>
<th>Time of the investigation</th>
<th>Standard value</th>
<th>What is checked</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Escherichia coli</em></td>
<td>At the time during the manufacturing process when the number of E. coli is expected to be highest</td>
<td></td>
<td>Product</td>
</tr>
<tr>
<td>Coagulase-positive staphylococci</td>
<td>At the time during the manufacturing process when the number of staphylococci is expected to be highest</td>
<td>See « Section VIII »</td>
<td>Product</td>
</tr>
<tr>
<td><em>Listeria monocytogenes</em></td>
<td>Before the food has left the immediate control of the food business operator, who has produced it</td>
<td></td>
<td>Product or via environmental testing</td>
</tr>
<tr>
<td><em>Salmonella</em></td>
<td>Products placed on the market during their shelf-life</td>
<td></td>
<td>Product or via environmental testing</td>
</tr>
</tbody>
</table>
## III. ENVIRONMENTAL TESTING - (Number of samples: n=1)

<table>
<thead>
<tr>
<th>Organism</th>
<th>Time of the investigation</th>
<th>Standard value</th>
<th>What is checked</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Listeria monocytogenes</em> in smear water</td>
<td>analysis of smear water after rind washing of the whole stock</td>
<td>Experience of the cheesemaker</td>
<td>Smear water (only if rind washed cheeses are produced)</td>
</tr>
<tr>
<td><em>Listeria monocytogenes</em> in raw milk</td>
<td>Swabs from milk receiver or milk pump after milking</td>
<td></td>
<td>Swabs (only if raw milk is used)</td>
</tr>
<tr>
<td><em>Salmonella</em> in samples of faeces</td>
<td>stool samples of the employees</td>
<td></td>
<td>Stool samples</td>
</tr>
</tbody>
</table>

## IV. VERIFICATION OF FSMS - (Number of samples per batch: n=5)

<table>
<thead>
<tr>
<th>Organism</th>
<th>Time of the investigation</th>
<th>Standard value</th>
<th>What is checked</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Escherichia coli</em></td>
<td>At the time during the manufacturing process when the number of E. coli is expected to be highest</td>
<td></td>
<td>a new product or after loss of control</td>
</tr>
<tr>
<td>Coagulase-positive staphylococci</td>
<td>At the time during the manufacturing process when the number of staphylococci is expected to be highest</td>
<td>See « Section VIII »</td>
<td>a new product or after loss of control</td>
</tr>
<tr>
<td><em>Listeria monocytogenes</em></td>
<td>Before the food has left the immediate control of the food business operator, who has produced it</td>
<td></td>
<td>a new product or after loss of control</td>
</tr>
<tr>
<td><em>Salmonella</em></td>
<td>Products placed on the market during their shelf-life</td>
<td></td>
<td>a new product or after loss of control</td>
</tr>
</tbody>
</table>