


**Relating Microbiological Testing and Microbiological Criteria  
to Public Health Goals**

**Washington 31.10. - 1.11.2005**

**Industry uses of microbiological testing  
and microbiological criteria  
in the manufacturing and marketing  
of processed foods**

J.L. Cordier NN-QS/OP


*Different types of criteria exist* 



*They are used to determine  
the acceptability of a food.*

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## Microbiological standards



**Public Health Authorities**

**Codex Principles**


*They are used to determine the **acceptability** of a food or **compliance** with regard to a regulation or policy*

**Control Authorities**

**Industry**

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## Microbiological guidelines



**Control Authorities  
Industry  
Associations**


*Are advisory and may be established to indicate expectations when best practices are applied to manufacture safe foods.*

**Control Authorities**

**Industry**

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**Microbiological specifications**



*Industry  
Retail*


*Purchase specifications  
defining the microbiological  
limits for an ingredient or  
a finished product.*

*Supplier*

*Customer*

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**How are criteria established ?**



Basic Texts Codex Alimentarius


PRINCIPLES FOR THE ESTABLISHMENT AND  
APPLICATION OF MICROBIOLOGICAL CRITERIA FOR  
FOODS

*CAC/GL21 -1997*

**Based on principles of the ICMSF (Vol 2)**

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## New approach - From MRA



**ALOP → FSO/PO → MC**

**FSO**

*Goal for **process design** to obtain acceptable food.*

*Applied to **processing operations***

**Micro Criteria**


*Statement of conditions that differentiates acceptable from unacceptable **lots** of food.*

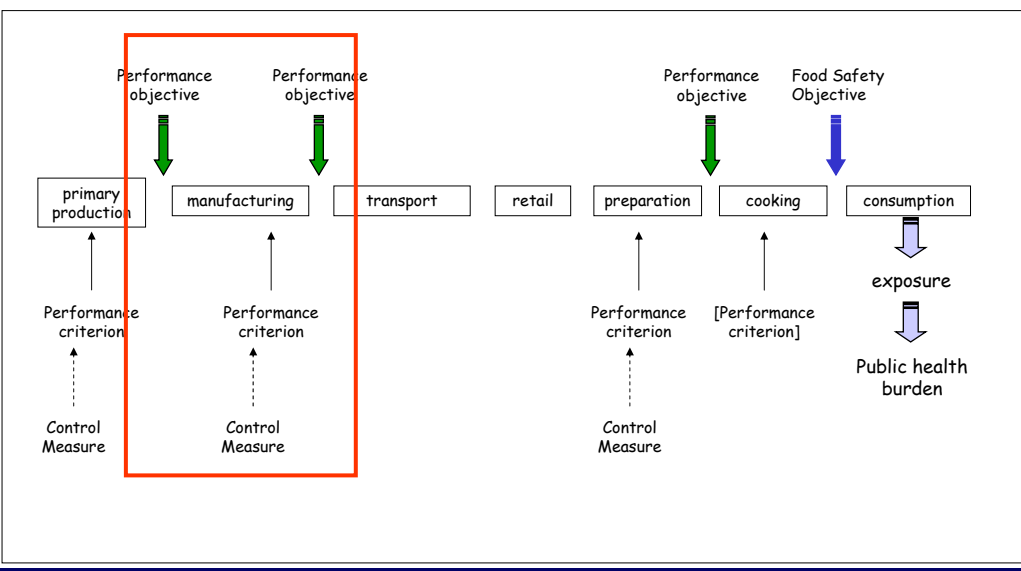
*Applied to **individual lots** or consignments of food.*

(Comparison of a few elements only; for more see ICMSF Vol 7)

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## Food Chain - Example






The diagram illustrates a food chain with the following stages and associated elements:

- primary production**: linked to a **Performance objective** (green arrow) and a **Performance criterion** (dashed arrow), which is supported by a **Control Measure** (dotted arrow).
- manufacturing**: linked to a **Performance objective** (green arrow) and a **Performance criterion** (dashed arrow), which is supported by a **Control Measure** (dotted arrow).
- transport**: no specific objectives or criteria are shown.
- retail**: no specific objectives or criteria are shown.
- preparation**: linked to a **Performance objective** (green arrow) and a **Performance criterion** (dashed arrow), which is supported by a **Control Measure** (dotted arrow).
- cooking**: linked to a **Performance objective** (green arrow) and a **[Performance criterion]** (dashed arrow).
- consumption**: linked to a **Food Safety Objective** (blue arrow) and **exposure** (blue arrow), which leads to **Public health burden** (blue arrow).

A red box highlights the **primary production** and **manufacturing** stages.

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### How are FSO or PO used by industry?


$$H_0 - \sum R + \sum I_{RC+G} \leq FSO / PO$$

Starting level

Reduction


Increase  
RC: Recontamination  
G: Growth

Hazard level at moment of consumption

Hazard level in the food chain

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### Food Chain - Ingredients




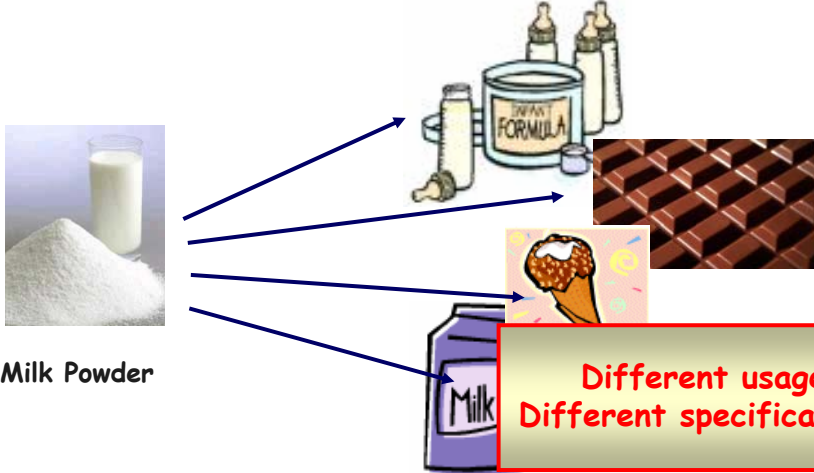
MANUFACTURE

Specifications

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## Ingredients - Specifications






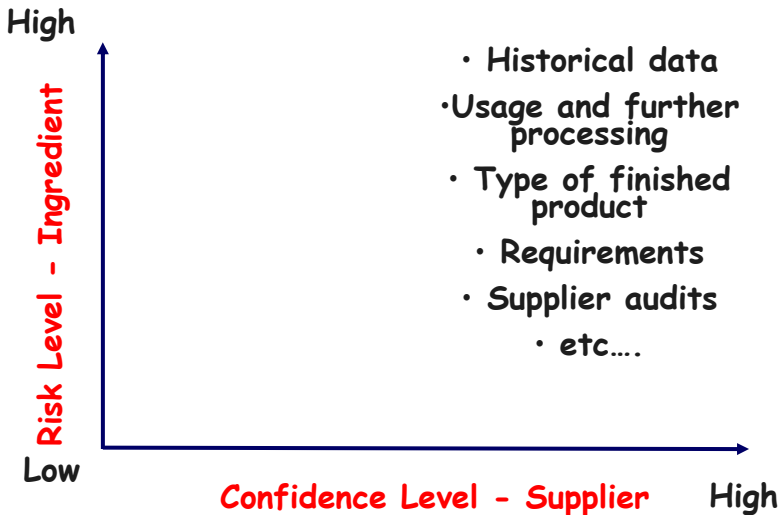
Milk Powder

**Different usage  
Different specifications**

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## Ingredients - Specifications



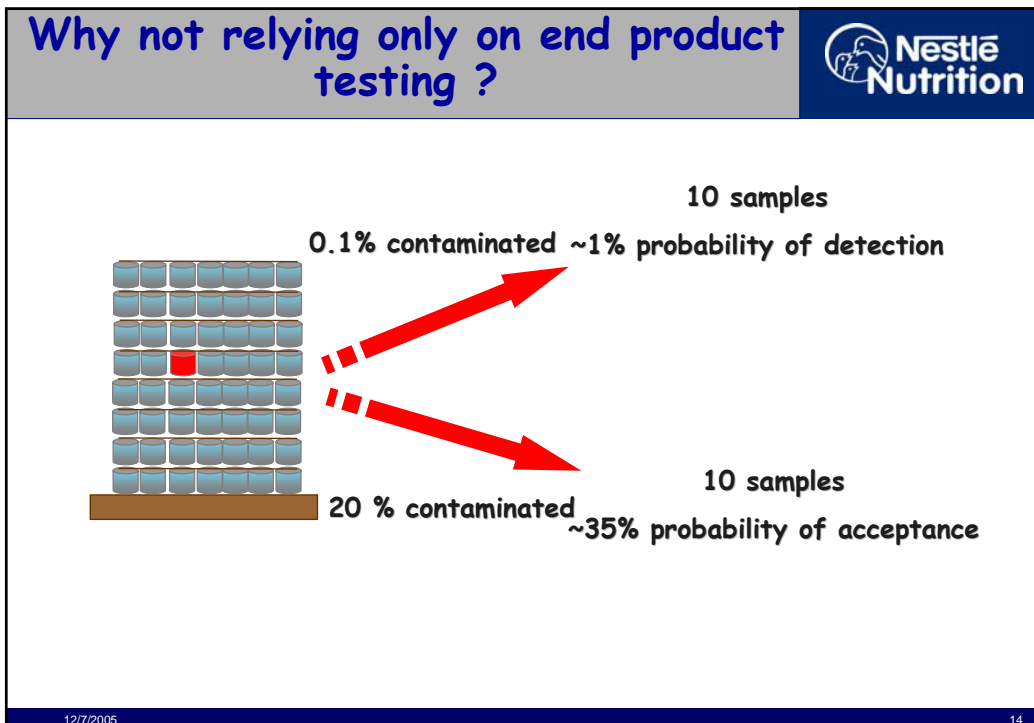
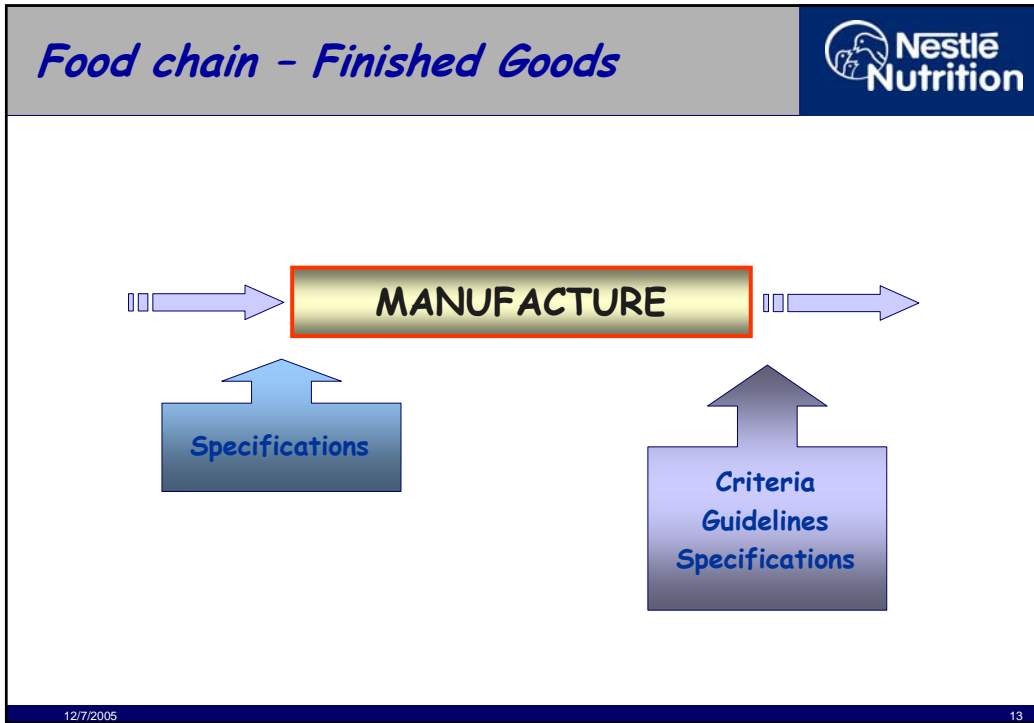


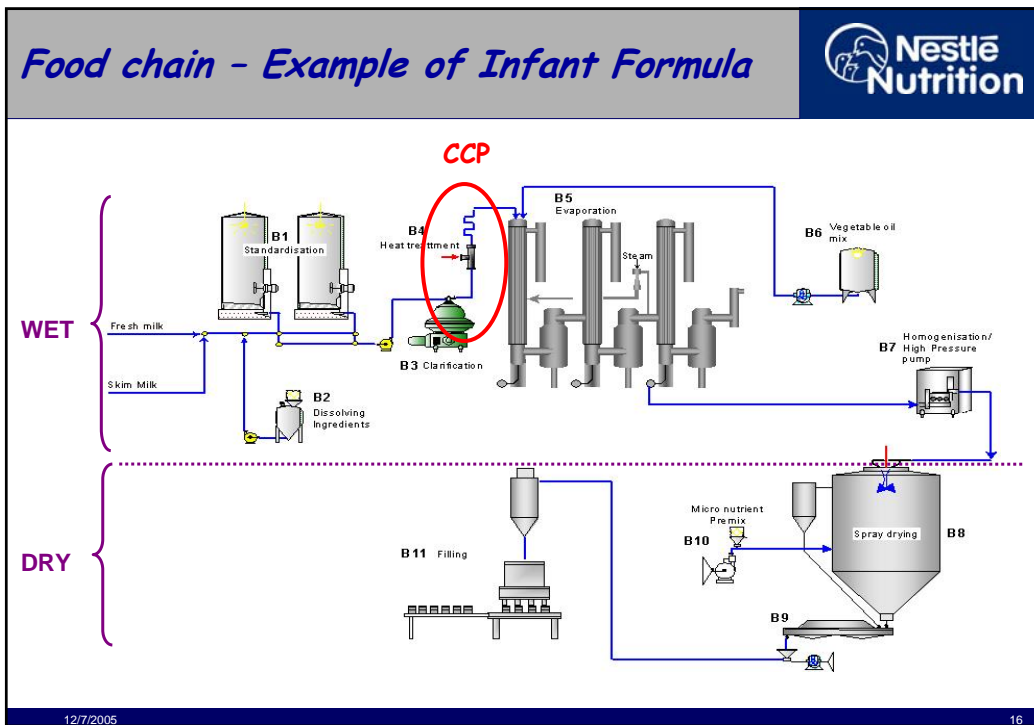
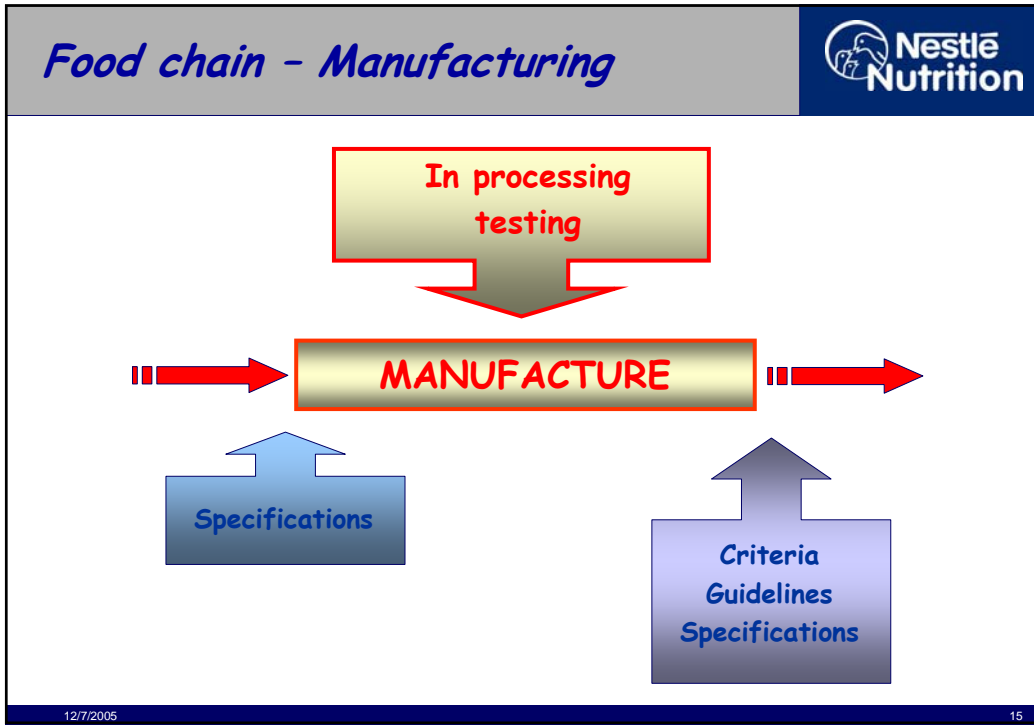
**Risk Level - Ingredient**

**Confidence Level - Supplier**

- Historical data
- Usage and further processing
- Type of finished product
  - Requirements
  - Supplier audits
  - etc....


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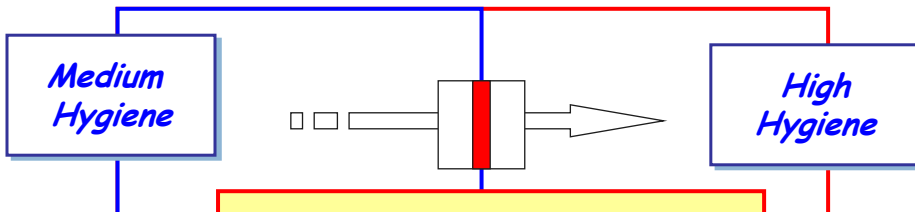




## How to control Salmonella or Enterobacteriaceae?





**Medium Hygiene**  **High Hygiene**




**Zoning includes appropriate**

- Design of building(s),
- Design of air handling/flow,
- Flow of people and materials




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## How to control Salmonella or Enterobacteriaceae?



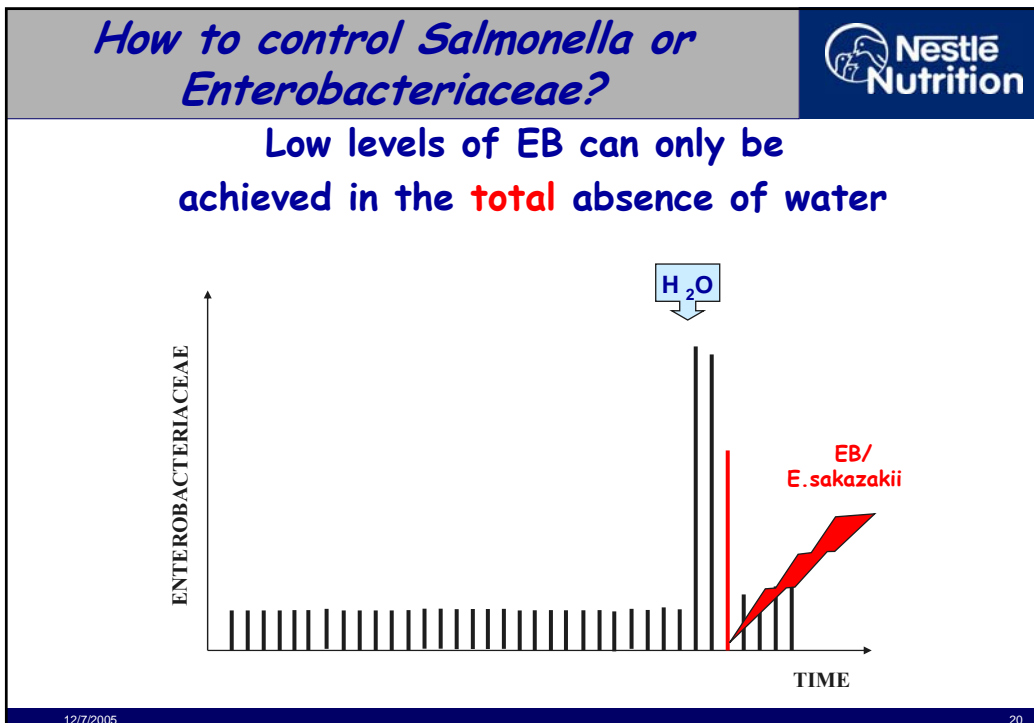
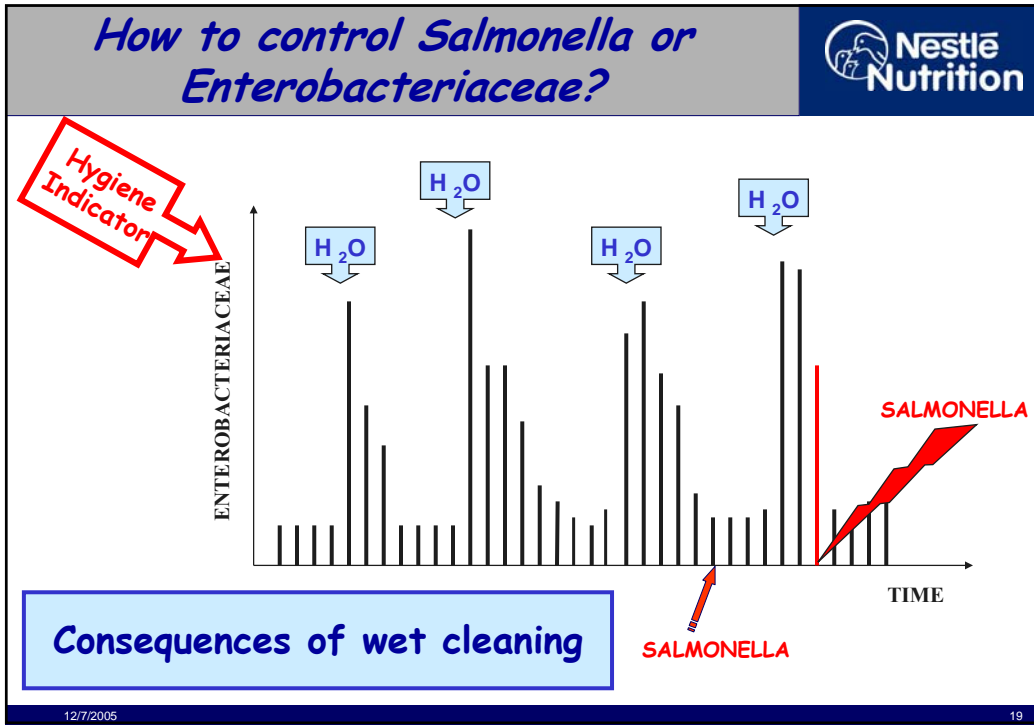
**WET CLEANING**

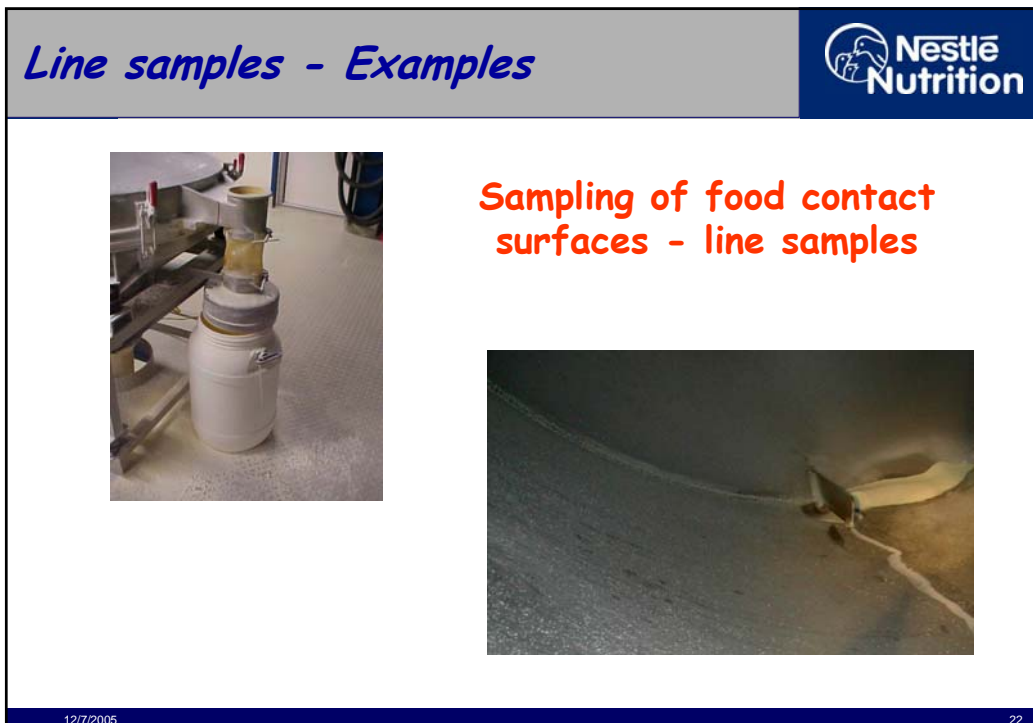
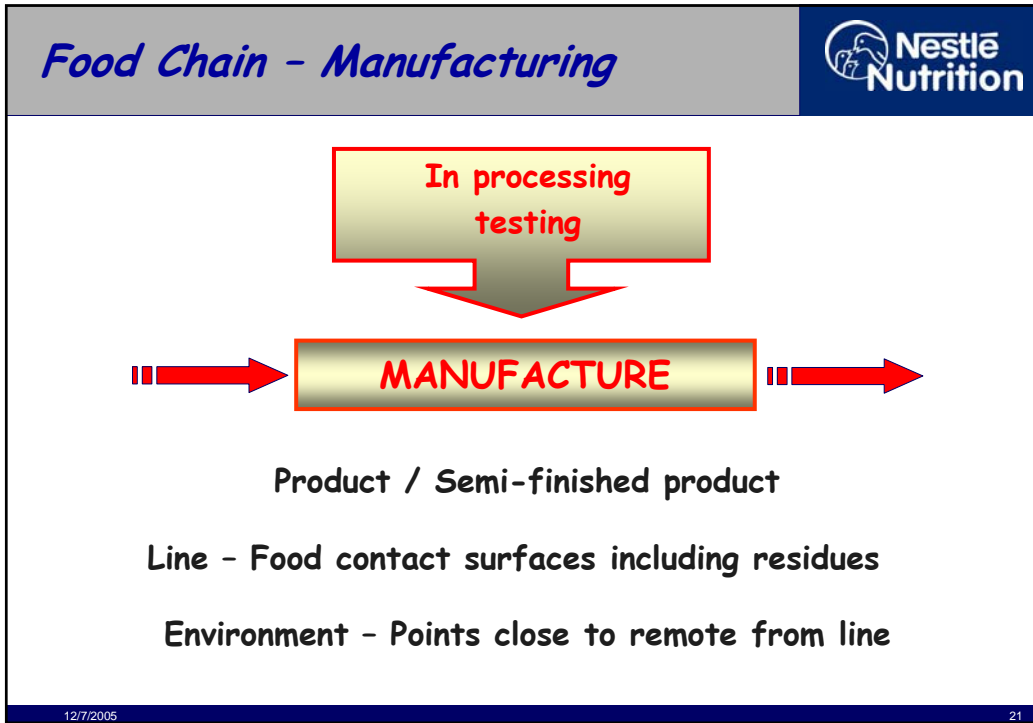


**DRY CLEANING**



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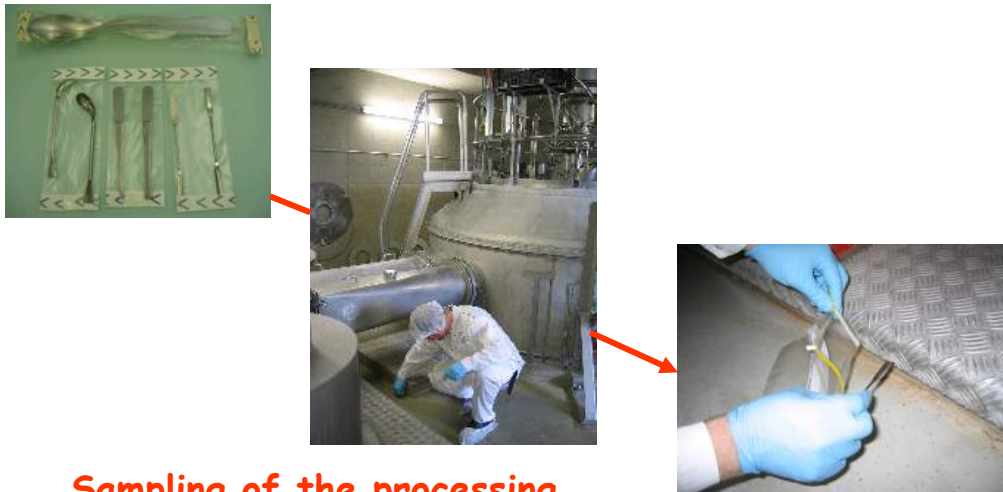
## Environmental samples - Examples



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## Environmental samples - Examples



**Sampling of the processing environment**

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## Environmental samples - Examples



**Sampling of the processing environment**

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## Environmental samples - Impact



Deviations in environmental samples  
such as

**Positive *Salmonella* result**

**Enterobacteriaceae above an defined level**


**Abnormal situations - maintenance, cleaning, etc.**

have an immediate impact on sampling frequencies  
of line samples and finished product samples.

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### How to model relationship between line and product samples ?



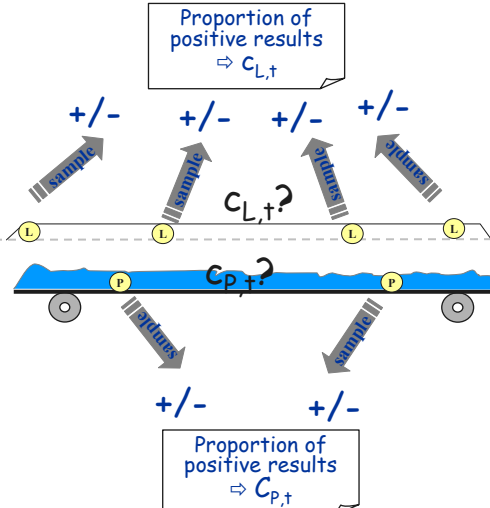
$n_2=4$

**Line**  
(first powder, sieve output, first & last can)

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**Product**  
(can/soft pack)

$n_1=2$




Proportion of positive results  $\Rightarrow C_{L,t}$

Proportion of positive results  $\Rightarrow C_{P,t}$

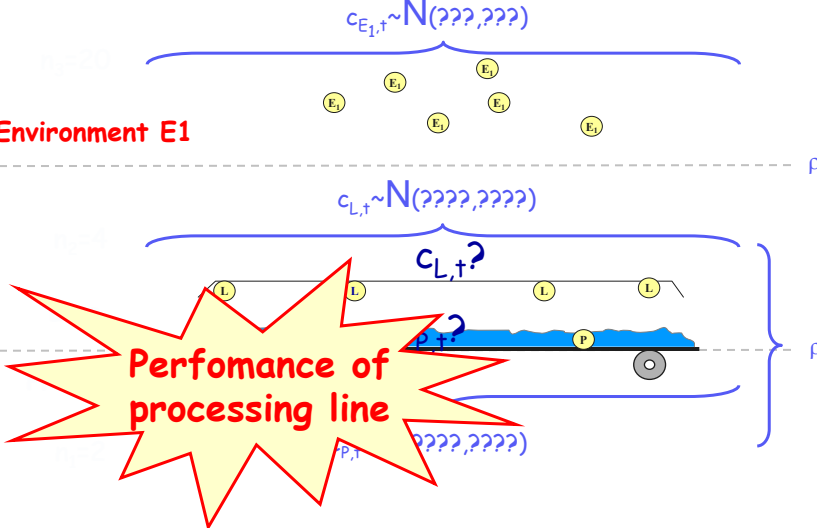
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### How to model relationship between line, product and environmental samples ?



$c_{E_1,t} \sim N(???, ???)$

**Environment E1**



**Performance of processing line**

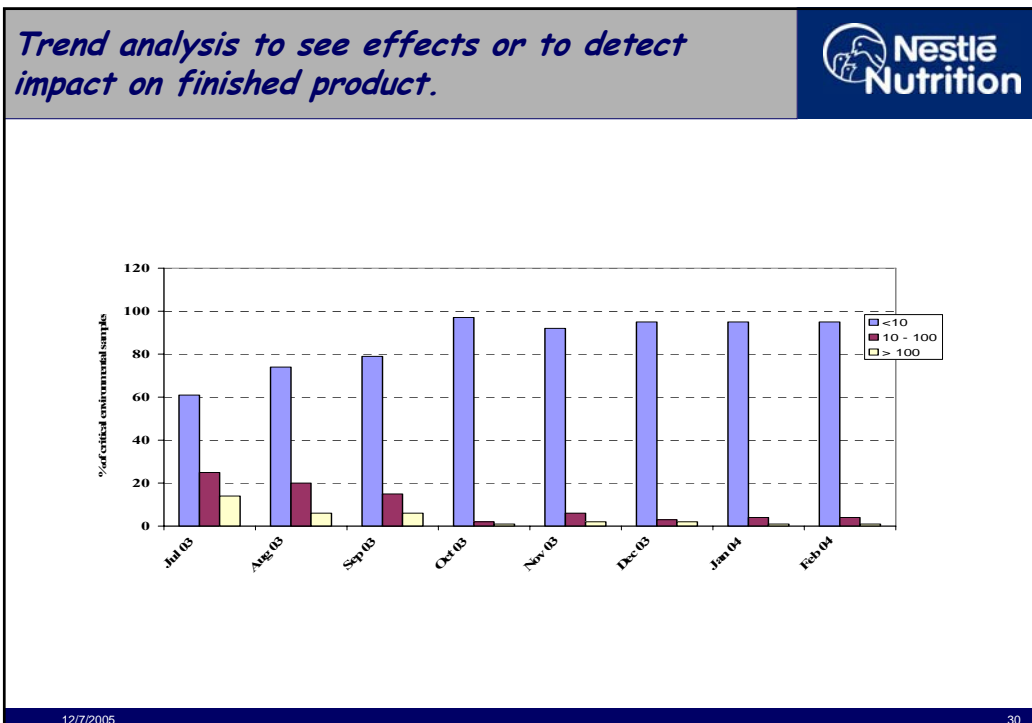
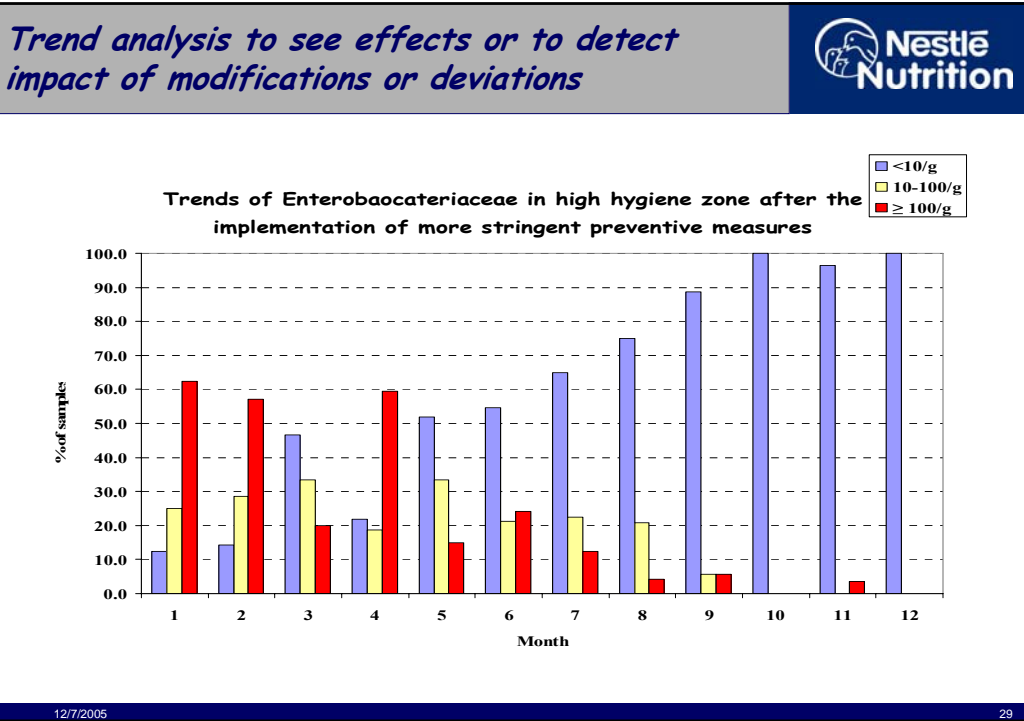
$c_{L,t} \sim N(????, ?????)$

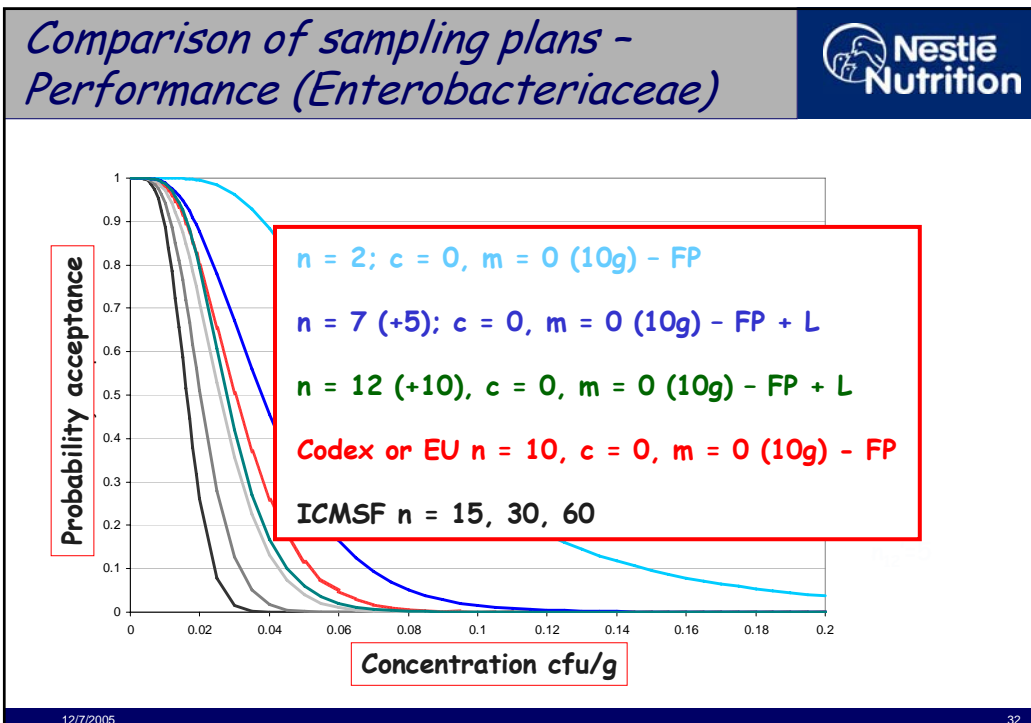
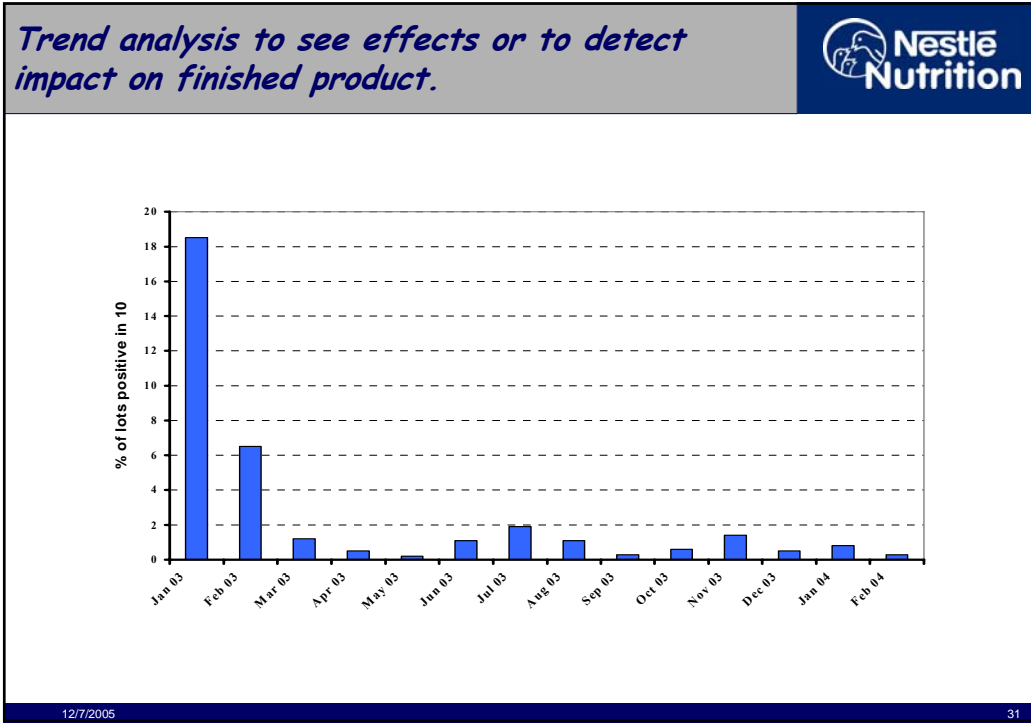
$c_{P,t} \sim N(????, ?????)$

$p_{P,E_1} = ???$

$p_{P,L} = ???$

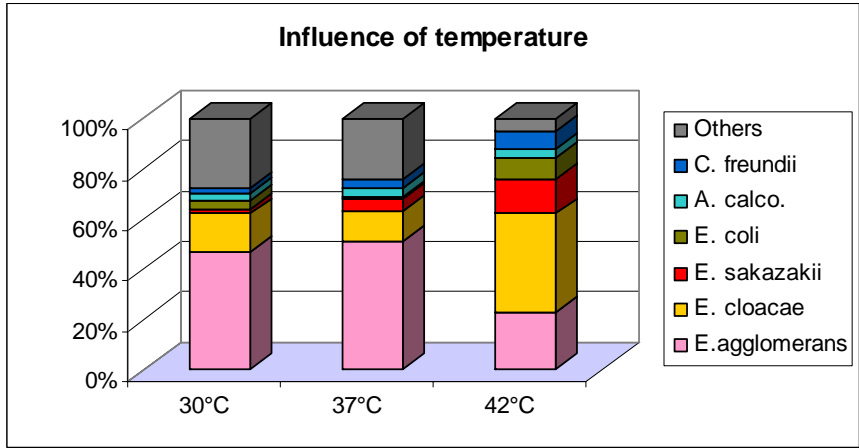
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## Effective methods to test FP, L, E



***E. sakazakii* difficult (if at all) to find in environmental samples if competitive flora (EB) important.**