Cleaning:- Objectives, expectations and impacts

John Holah, Holchem Laboratories Ltd.

HOLCHEM
TRUE SOLUTIONS

Cleaning and disinfection objectives

1, Provide a safe working environment

- Cleaning of the food processing environment to prevent e.g. slip and trip hazards (housekeeping)
- Dedicated cleaning operatives who do not touch food or food contact surfaces.

2, Provide a clean working environment

- Cleanliness of the food processing equipment and environment is the basis of GHP/GMP.
- Frequent cleaning of food contact surfaces of food debris that has been spilt or otherwise been ejected from the main product (clean-as-you-go).
- Boosting staff morale and productivity.
- Favourable image to visitors and customers

Cont.

3, Extend the life of, and prevent damage to equipment

- Prevent damage to food processing equipment, primarily by preventing abrasive materials entering bearings and seals associated with moving parts or by removing materials which may be corrosive, particularly those of high chloride levels and at the higher end of the acid/alkaline pH range.

4, Maintain plant operating parameters

- Cleaning prior to fouling that, can either reduce product flow, create uneconomic pumping conditions because of pressure increases or reduce heat transfer to the product.
- Cleaning prior to ‘burn-on’ when product soils are more difficult to remove or may have unwanted organoleptic impacts.

Cont.

5, Remove materials that could lead to foreign body or pest contamination

- Undertaken on infrequently used food processing equipment or before equipment goes into storage or is being moved to a different processing area/site.
- Undertaken after maintenance work on existing equipment, when introducing new equipment into the factory and when re-introducing stored or infrequently used equipment. These types of clean may use detergents that would aid the removal of grease, lubricants and other protective oils.

6, Remove food soils to ensure organoleptic quality

- Cleaning to remove food soils to ensure the quality of current and subsequent skus.
- The default cleaning programme and the prerequisite for cleaning and disinfection programmes that seek to control specific hazards or brand protection issues.
- Visual cleanliness, e.g. the presence of carrots in a subsequent run of peas in a vegetable factory
- Sensory cleanliness, e.g. the presence of garlic in a subsequent batch following a garlic containing run in an ingredients factory.

Cont.

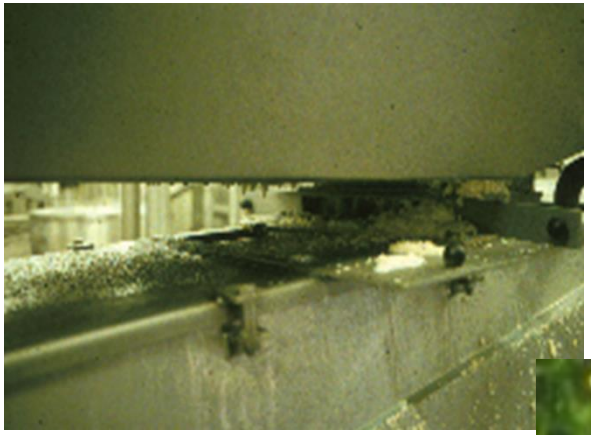
7, Remove DNA residues

- >1% of horse meat in a product labelled as beef is illegal,
- Now applied to the potential cross-contamination of one meat species into another, e.g. pork into beef products
- Same applies to cows milk/goats milk?
- What is absence of any meat DNA in a product for the purpose of a vegetarian claim or one species in another (e.g. pork in beef) for a religious claim

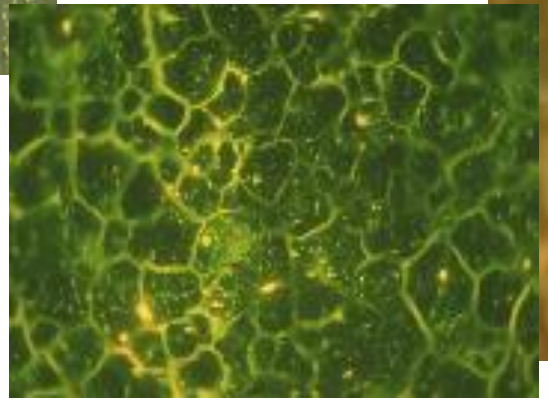
8, Remove and/or kill spoilage microorganisms

- Typical spoilage bacteria include *Pseudomonas, Acinetobacter, Shewanella, Moraxella, Lactobacillus, Carnobacterium,* and *Leuconostoc,* and spoilage fungi include *Penicillium, Saccharomyces, Candida, Rhizopus* and *Mucor*.
- To control such microorganisms, a two-stage cleaning and disinfection process is required, where disinfectants are used to further reduce viable microorganisms remaining adhered to surfaces, that have not been removed after visible cleanliness has been achieved by the cleaning phase.

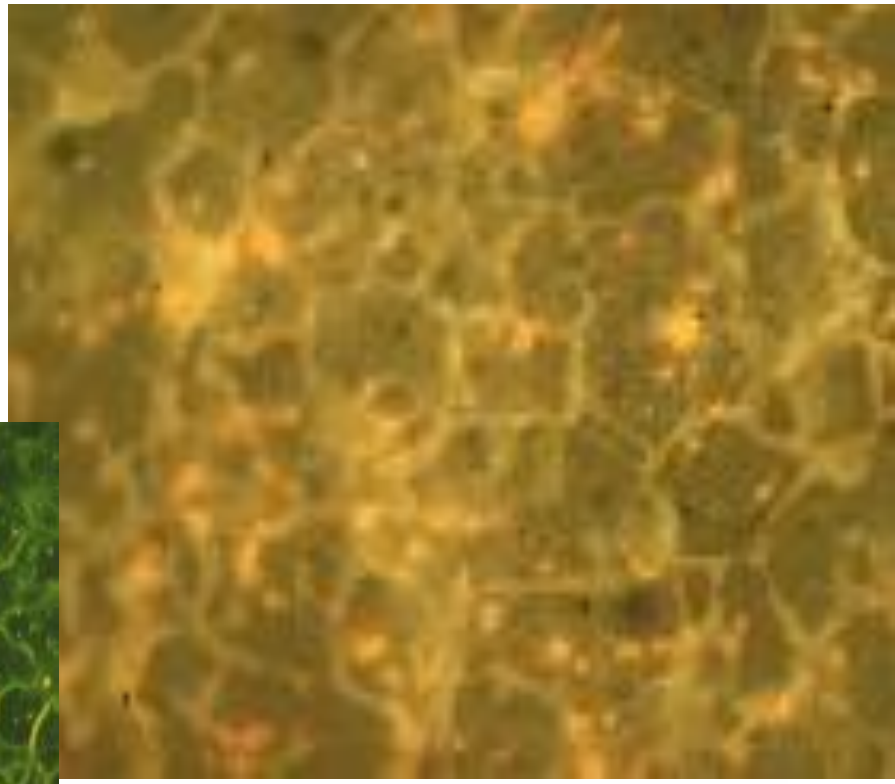
Division of *Staph. aureus* on a surface - first indication of surface growth (1988)



Buttermilk
4 hours



12 hours



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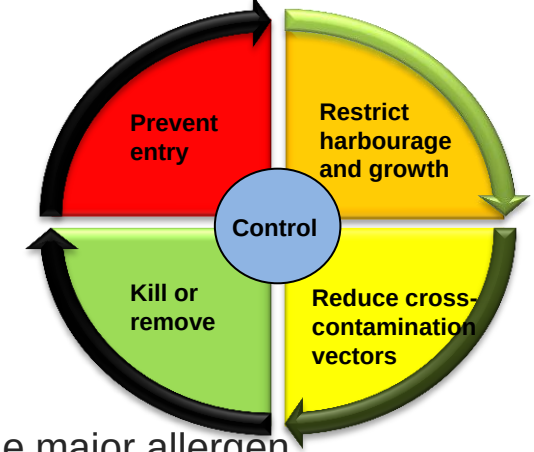


9, Remove allergens

- 14 food allergens are defined in (EU) 1169/2011
- Cleaning post allergenic production run, and pre-non-allergenic, is the major allergen control
- Such allergen cleans require validation to ensure that there is no detectable allergen, using the most sensitive detection technique, in the first product down the production line following the clean.

10, Remove and/or kill pathogenic microorganisms

- It has long been established that microbial pathogens may be occasionally be found on food processing surfaces
- Poor cleaning and disinfection will not cause pathogen problems, but may exacerbate them
- Persistence in wet cleaning (Listeria), survival in dry environments (Salmonella)

Organoleptic cleaning

Product hold-up causes product deterioration
Product should flow at the same speed
Cleaning of the lines is thus undertaken at a frequency to minimise such product hold up related quality changes.

Organoleptic cleaning

Organic cleaning is absolutely attainable, but: -

- Extended runs/reduced cleaning window
- Availability of operatives (primarily open plant)
- Poor hygienic design
- Accessibility of equipment to clean
- Accessibility of equipment to inspect
- Cleaning operative attitudes

Impact of BRC V8

Design something that works

Write it down

Make sure people understand how to do it

Engagement to make sure it happens properly

1.1.2	The site's senior management shall have a documented strategic plan for the development and continuing improvement of food safety culture. This shall include: • defined activities involving all sections of the company • an action plan indicating how the activities will be undertaken and intended timescales • review of the effectiveness of completed activities

PhD

Cost reduction, whilst maintaining or increasing food safety, via hygiene operatives behavioural change

Food Industry Centre
Cardiff Metropolitan University
ZERO2FIVE
Canolfan Diwydiant Bwyd
Prifysgol Metropolitan Caerdydd

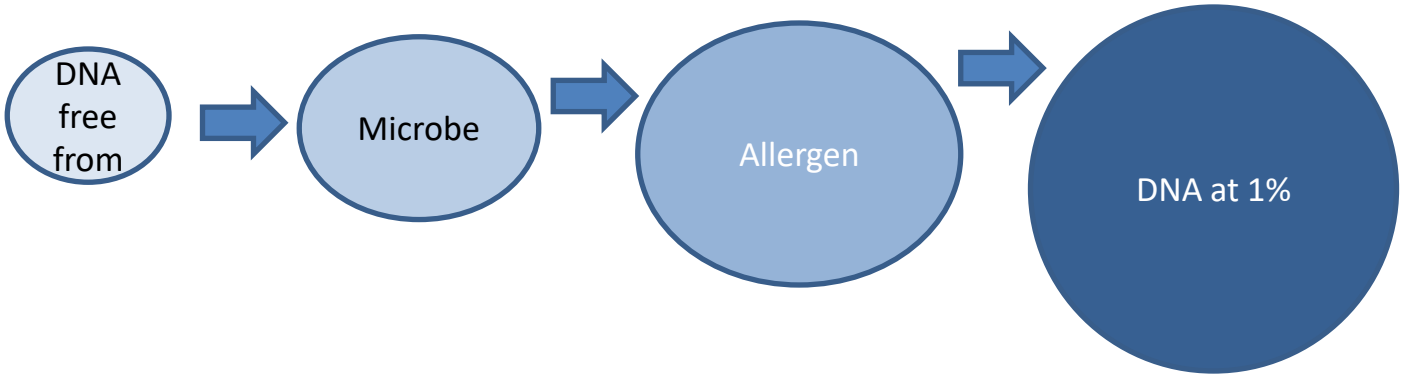
Arloesi Bwyd
Cymru
Food Innovation
Wales

HELIX

3 year programme predicted to start October 2018

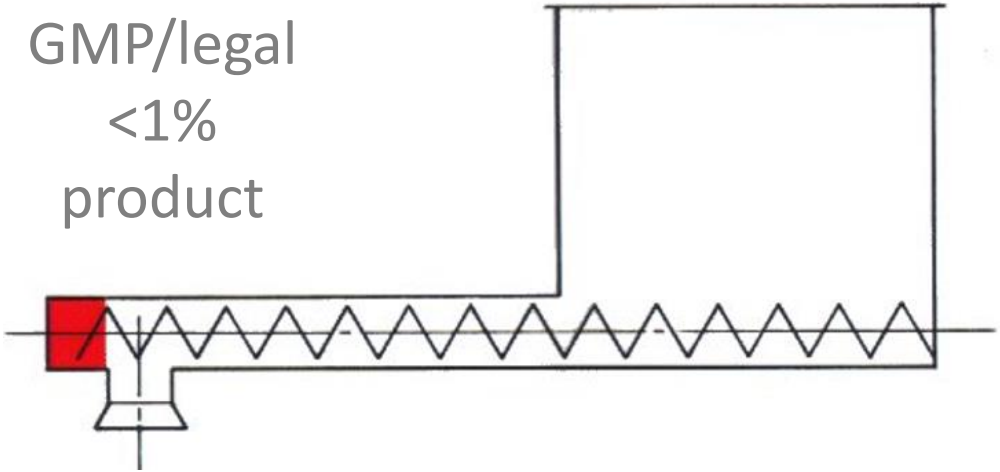
Size of hazard matters!

There is a relationship between the size of the hazard and the degree of hygienic feature that harbours that hazard at a level that it is a threat to the consumer.



Dead spaces – brand protection

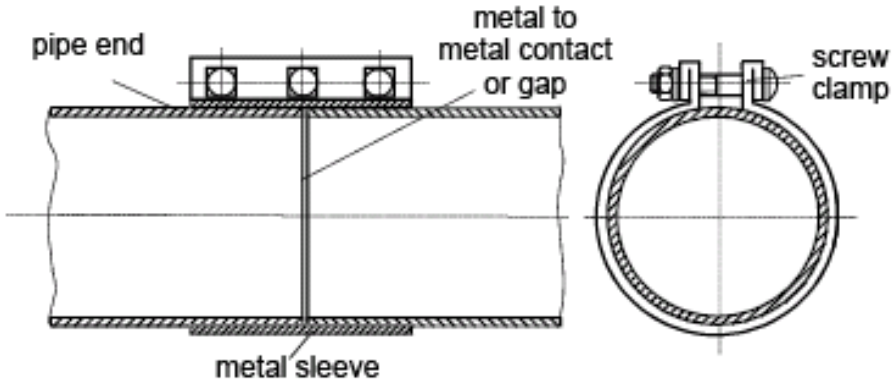
GMP/legal
<1%
product



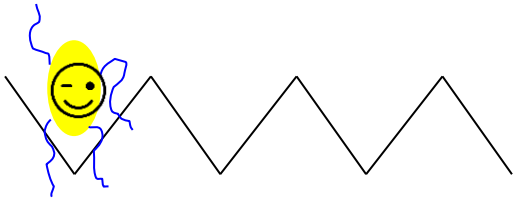
10Kg residual soil in next 1000Kg product

Dead spaces - allergens

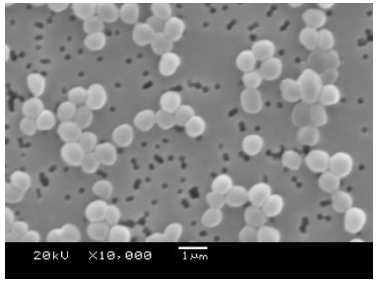
Allergen
mg/kg product

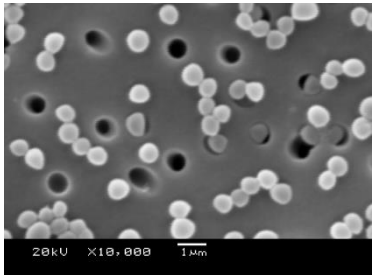


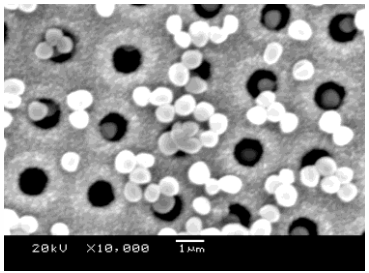
Surface characteristics – microorganisms

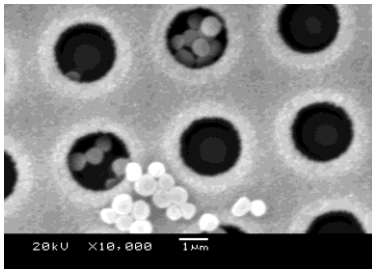


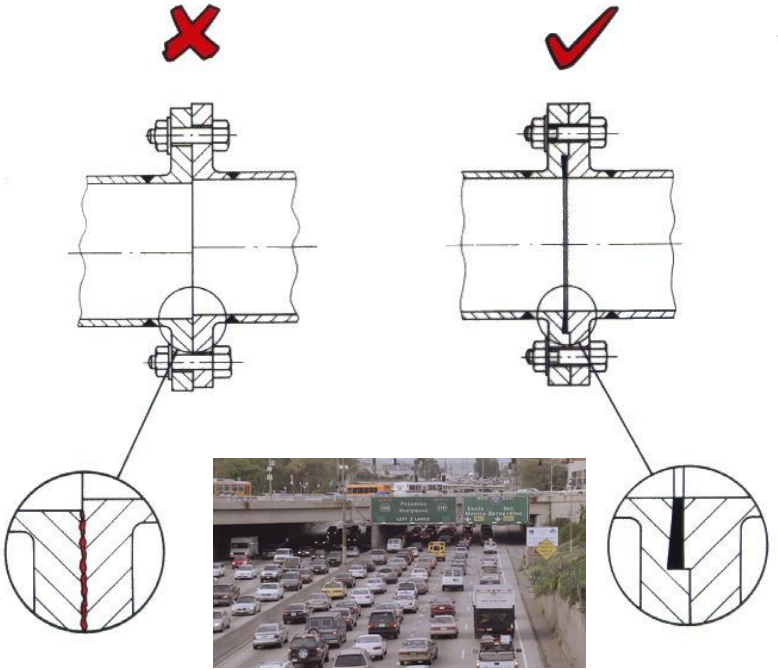
RA = 1.0 µm







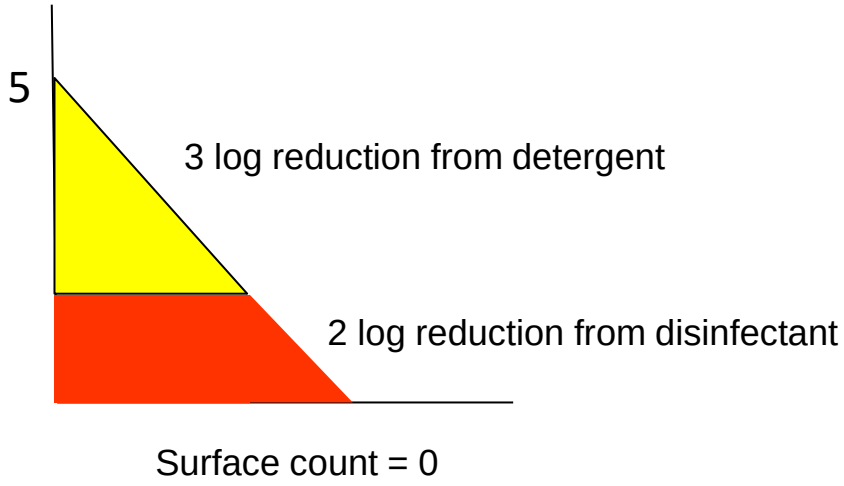


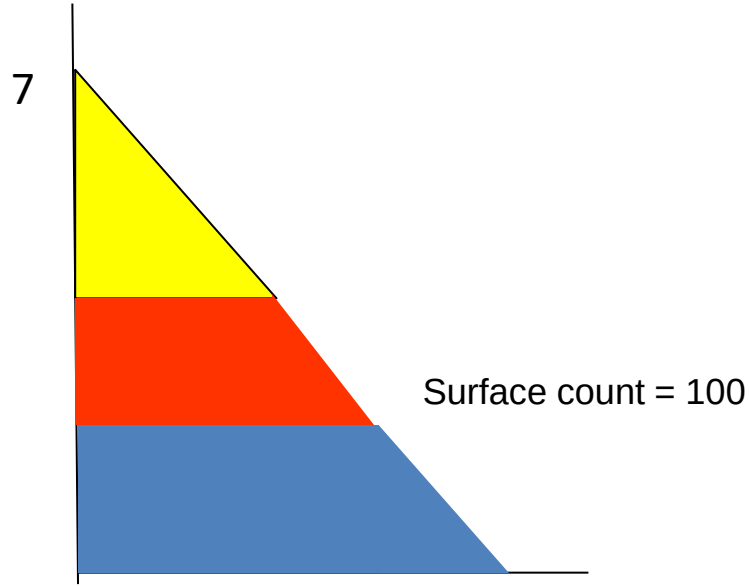


A metal-to-meatal joint is a 10 lane highway!

Effect of pre-clean population no.

Surface count after cleaning and disinfection



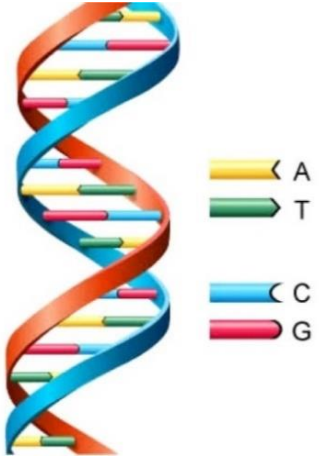


Same cleaning and disinfection programme applied

DNA and the future

DNA detection limit 1-2ng/kg
1pg/swab

- Manufacturer makes 7 types of sausage
- Chicken was found (by PCR) in a beef sausage
- Chicken sausage made on Tuesday am
- Beef sausage Thursday pm
- Lots of interim and end-of production cleaning
- 100 g chicken sausage on line
- Detection limit of 10^{-12}g
- 14 log reduction to remove detectable traces
- What is free from?



KTP

To use innovative surface contamination detection systems to develop a novel algorithm to relate surface contamination and processing conditions in the food processing industry to effective cleaning products and regimes to inform customer product selection and guide ongoing product development

Manchester Metropolitan University

3 year programme
starting August 2018

Why validate?

BRC GLOBAL STANDARD FOR FOOD SAFETY

EHEDG Guideline No. 45

https://www.ehedg.org/guidelines/

Clause	Area of concern	Comment
2.7.3	Validation	The HACCP food safety team shall consider the control measures necessary to prevent or eliminate a food safety hazard or reduce it to an acceptable level. Where the control is achieved through existing prerequisite programmes, this shall be stated and the adequacy of the programme to control the specific hazard validated. Consideration may be given to using more than one control measure
4.11.3	Housekeeping and hygiene	As a minimum for food contact surfaces , processing equipment and for environmental cleaning in high-care/high-risk areas, limits of acceptable and unacceptable cleaning performance shall be defined. This shall be based on the potential hazards (e.g. microbiological, allergen, foreign bod contamination or product to product contamination). Acceptable levels of cleaning may be defined by visual appearance, ATP bioluminescence techniques, microbiological testing or chemical testing as appropriate. Where cleaning procedures are part of a defined pre-requisite plan to control the risk of a specific hazard, the cleaning and disinfection procedures and frequency shall be validated and records maintained. This shall include the risk from cleaning chemical residues on food contact surfaces.

What sanitation programmes should be validated?

1. Hazard control:-
   - Pathogens
   - Allergens
   - Chemicals
2. Brand protection
   - DNA
   - Vegetarian,
   - Organic
   - GMO
   - Religious
3. Organoleptic and performance
   - Separation, taint, colour
   - Performance (cleaning time) and safety (e.g. fire risk)

1.3 Equipment and cleaning qualification

- Know the line. Observe the process flow to determine sites of product accumulation – operational hygienic design
- Define the hardest part(s) of the process line to clean
- Determine how to access unhygienic features e.g. by dismantling
- Ensure cleaning equipment and parameters are appropriately calibrated and fit for purpose

Health and Safety

- How do I assess the hardest place to clean
  - Dismantling
  - Guarding, isolation
  - Specific access
  - PPE

1.4 Cleaning qualification

Open Plant

- Define the water quality and pressure
- Define the soil characteristics of the products processed
- Determine any chemical approval and legality requirements
- Determine any chemical/material incompatibilities
- Describe the basic cleaning parameters – manual, chemical, temperature, automation
- Is all cleaning/dosing equipment serviced/calibrated and operating correctly
- Essentially, is the proposed cleaning action appropriate for the process environment and the types of soils present so as to achieve the desired cleaning target
- **Cleaning Method Audit**

1.4 Cleaning qualification

Closed Plant

- Define the water quality, soil characteristics of the products processed , chemical legality/approval and any chemical/material incompatibilitie
- Describe the CIP cleaning parameters:-
  - Flowrate through pipework is ≥1.5m/s
  - Flowrate through vessels is ~ 10m^3/h
  - For sprayballs - scavenge pumps > flowrate than supply pumps
  - For rotary jets, defined spray time
  - No shadowing
  - Complete separation between CIP fluid and product flows
- SCADA – walk the line
- Essentially, is the CIP designed to the recommended best practice design and is likely to achieve the desired cleaning target
- **CIP audit, CIP sequence audit**

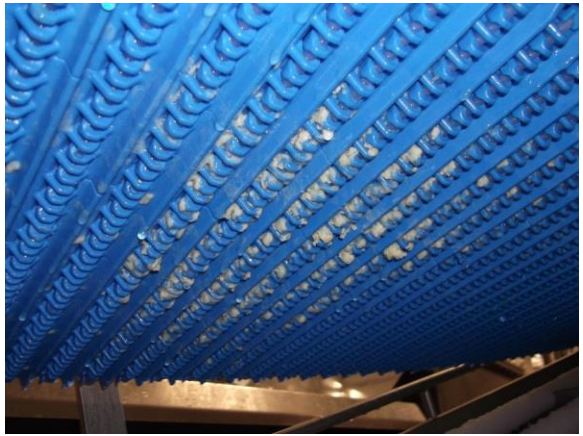
1.4 Cleaning qualification


CONVEYOR BELTS

For both open plant and CIP

- Provide a ‘draft’ CIC
- What is the minimal cleaning window and number of operatives
- What is the acceptable detergent concentration (e.g. 3-5%)
- What is the acceptable disinfectant concentration (e.g. 1-1.5%)
- What is the acceptable range of rinse/detergent temperatures
- What is the acceptable range of pressures, flow rates, cleaning times
- Validate at the lowest acceptable cleaning parameters

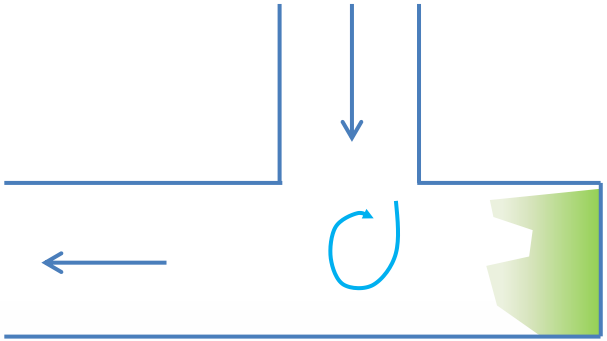
1.7 Soiling



- Influence of product
  - Strongest adhering soil
  - Highest level of a hazard (primarily allergen)
  - Most likely allergen free product to pick up an allergen
- Influence of process
  - Longest process time
  - Highest temperature
  - Product scheduling
  - Time before cleaning
- Determine soiling worst-case scenario

1.5.1 Sampling techniques

- Product (in general)
  - Open – first product down the line
  - Closed – first, middle and final product down the line
- Direct sampling
  - Swabs – hygienic features
  - Wipes/sponges – maximise detection
- Indirect sampling
  - Flushes
  - Final rinses



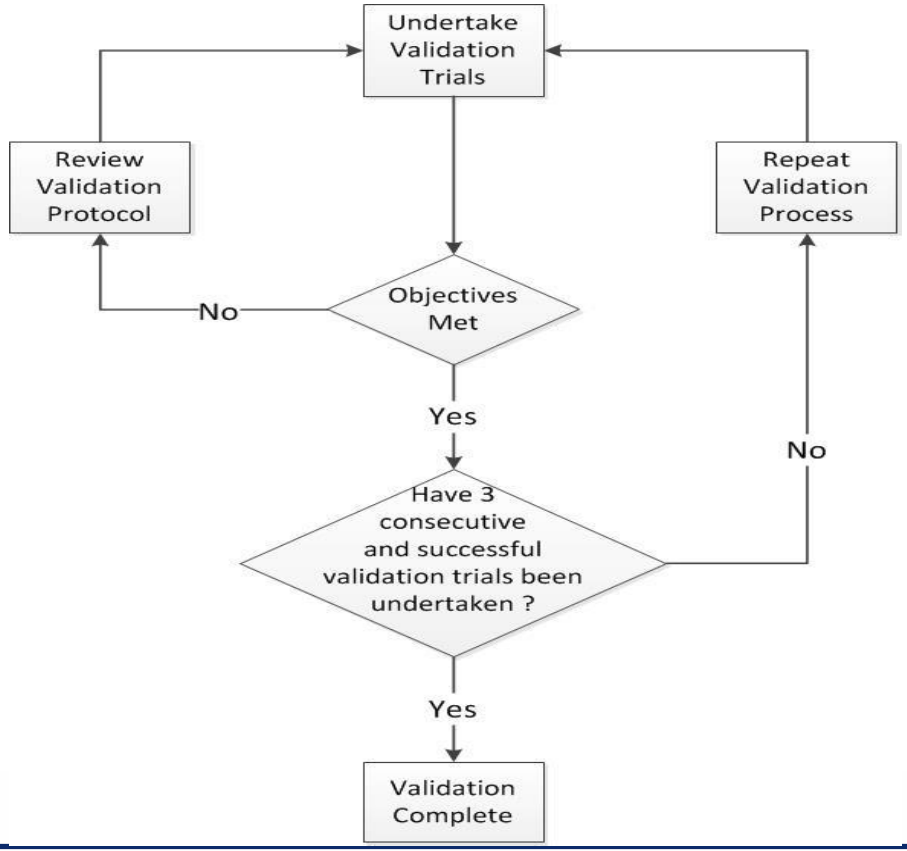
2.0 Cleaning validation report: Part 1, Protocol

- Scope
- Objective of the validation process
- Responsibilities for performing and approving validation study
- Identification of the equipment
- The interval between end of production and beginning of cleaning
- Worst case scenarios (run time, soil type, chemical concentration, temperature, time, flow, pressure)
- Influence of process time (new, summer/winter production rush)
- Sampling points and access

2.0 Cleaning validation report: Part 1, Protocol

- (Draft) Defined cleaning and disinfection procedure (CIC) including routine monitoring methods
- Number of cleaning cycles to be performed (3 min)
- Sampling procedures and analytical methods
- Analytical sampling methods used.
- Record sheets
- Sign-off sheet for parameters and procedure compliance
- Consequences of clean – e.g. spread to adjacent lines – does its risk need to be assessed as part of the validation?
- **Holchem Validation Guidance document**

3.0 Cleaning validation process



4.0 Cleaning validation report: Part 2, Results and Interpretation

- Date of validation
- Persons involved
- Cleaning and disinfection programme (SOP/CIC)
  - Sign-off sheets/photos/records (reviewed by technical)
  - Cleaning measurements (times, temps, conc., flow etc.)
  - Appendices e.g. process flow, validation data, photos of sampling points, CICs and records
- Deviations and corrective actions

Allergen interpretation

No allergen in product

Essential for a pass

No allergen on a surface by lab. ELISA
No allergen on a surface by LFD

Pass

Allergen on a surface by lab. ELISA
No allergen on a surface by LFD

Risk assess

Allergen on a surface by LFD
Re-design cleaning programme

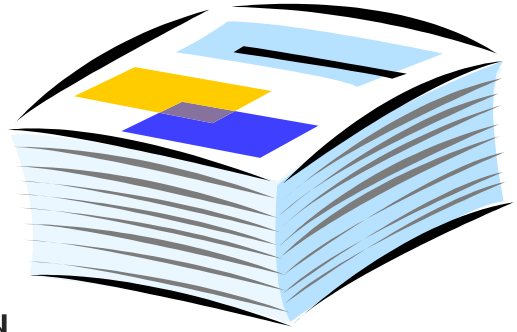
May choose to use ‘may contain’ label

Allergen in product

Re-design cleaning programme

If not possible risk assess product.
May choose to use ‘may contain’ label

4.0 Cleaning validation report: Part 2, Results and Interpretation



- Target setting (critical points for monitoring and verification) – develop as cleaning KPI’s
- E.g. average ATP result plus a comfort factor, dependent on data variability (e.g. 3 times standard deviation)
- Different Target for different surfaces e.g. conveyor belt and stainless steel
- Approve CIC

6.0 Maintaining validated state

- Monitor
  - Visual cleanliness sign-off sheets
  - ATP, protein
  - Lateral flow strips
- Verification
  - Microorganisms
  - Environmental sampling plan
  - DNA
  - 1st, 2nd, 3rd party audits
  - Training records
- Records

7.0 Validation review

- Periodic review to reflect slow changes in process and equipment – e.g. equipment surface wear. At least biannually
- To fit in with HACCP/prerequisite management schedules
- Following any change in:-
  - Ingredients
  - Product
  - Process
  - Equipment
  - CIP programme deviations
  - Routine/Increased KPI failure (negative quality or safety trends)
  - Cleaning and disinfection SOP
  - Process line shut-down and overhaul
  - New knowledge or legislation (e.g. allergen thresholds)

Listeria update: South African incident

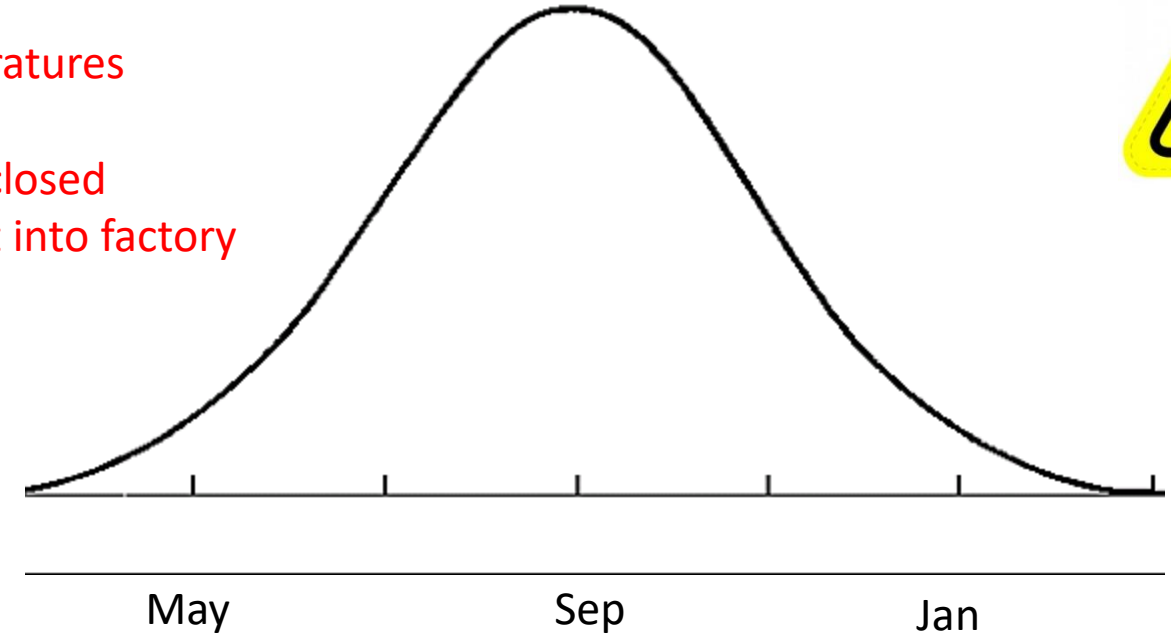
- 1056 cases, 214 deaths
- 92 neonates have died, with the majority of deaths in the 15-49 age group, associated with HIV +ve persons. (In Europe it is typically >60s)
- Fatality rate is 27%
- True cases and deaths likely to be 2-5 times higher.
- Historically, 1 food poisoning death/million population. Now 12-15/million
- Has been traced to Enterprise Foods, part of Tiger Brands
- 15 countries affected
- Discovered at a creche where a number of children became ill and Polony was found in a fridge.
- At this time approximately 100 people had died

South African Listeria incident cont.

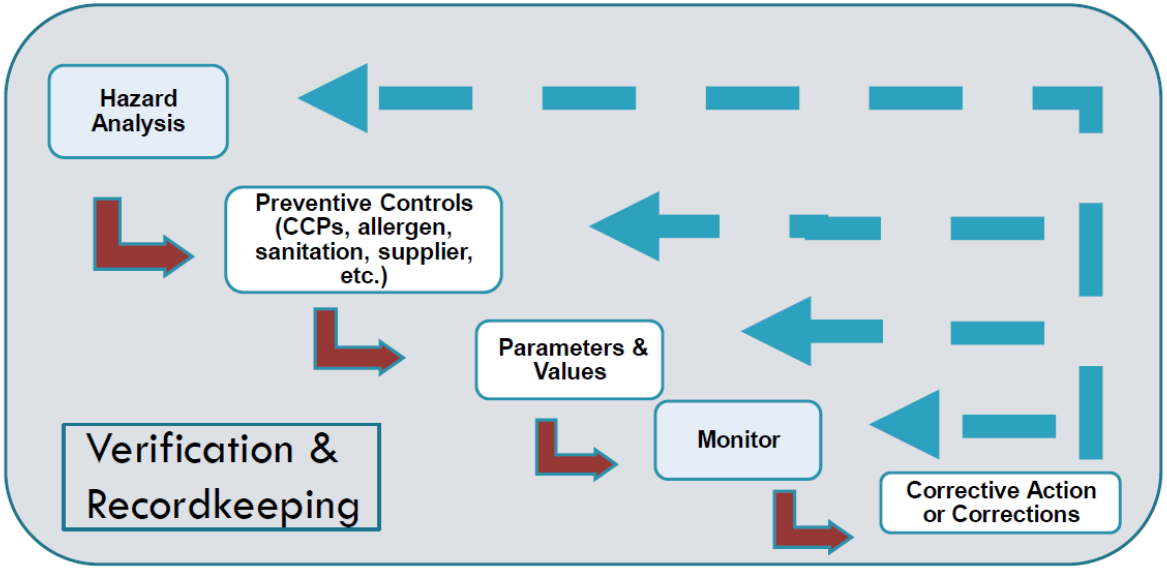
- Tiger Brands recalled everything they had ever made.
- Tiger Brands closed – had 36% of market share.
- A further 190 meat factories have closed
- Health Minister – don’t eat processed meat.
- SA Dept. Health sever under resourcing. No regulated levels of Listeria in foods. HACCP mandatory only for peanuts. Now HACCP mandated for meat and chicken, though 9 months to implement.
- SA has 2700 Environmental Practitioners – said to need 5600

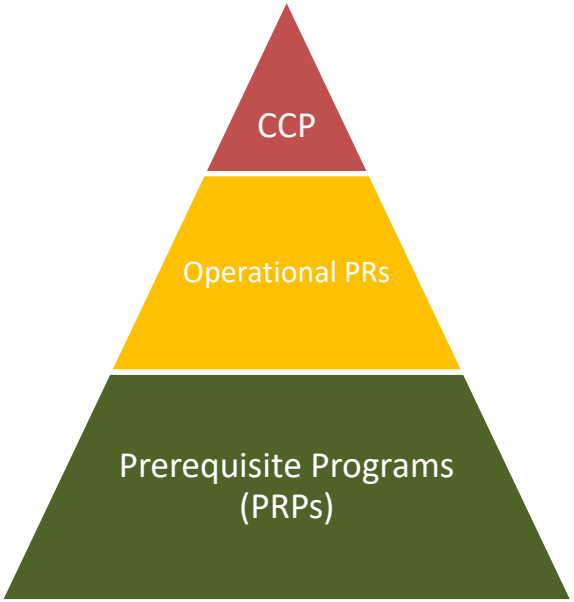
Environmental Listeria levels

Elevated temperatures
High dust levels
Keep doors etc closed
Limit movement into factory
Multi-species



Listeria Management Plan – White Paper





Food Safety Modernization Act (FSMA)

The Global Food Safety Initiative

- GFSI Technical Working Group mandate: Hygienic design
- To develop hygienic design elements to the GFSI requirements …. covering food processing equipment and food processing/handling facilities… from farm to fork.

BRC FOOD CERTIFICATED

international food standard IFS

SQF Safe Quality Food Institute

Any Questions?

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