Hygienic Design

Managing product integrity through hygienic design

Presenter: Peet Grobler
Chair EHEDG RS SA/OFT Group/Sentratek
27 May 2026

Agenda

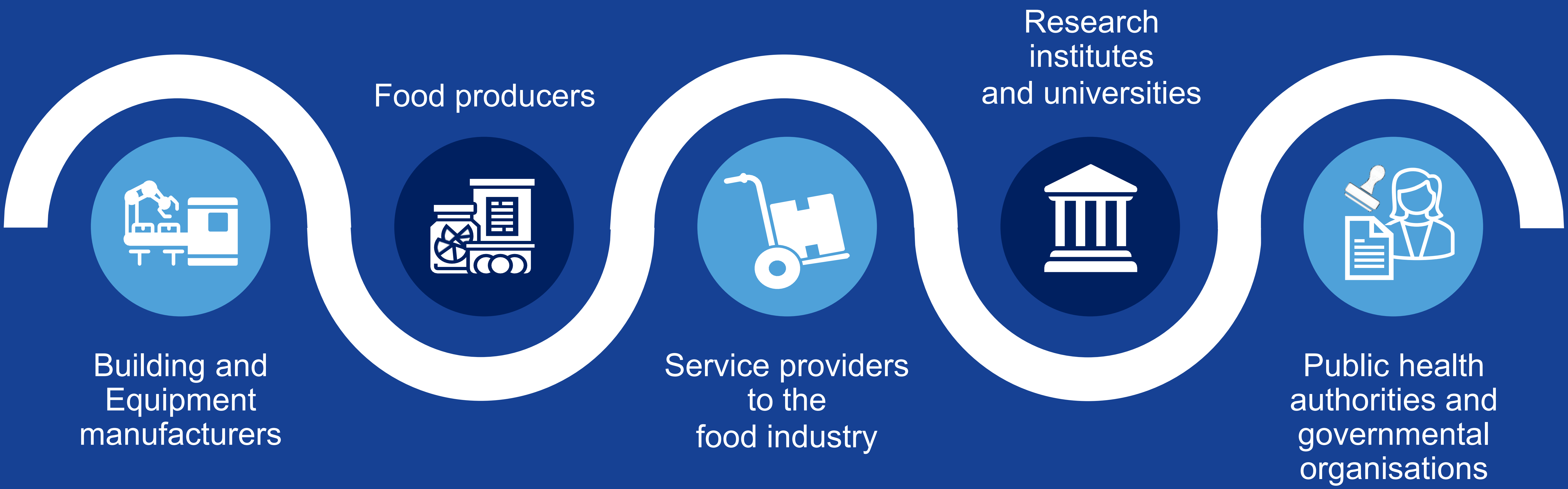
1. Introduction to European Hygienic Engineering Design Group

2. Efficiency and Efficacy
   - Trade-off
   - Case studies

3. Hygienic Design
   - Risk Management Approach
   - Risk Assessment and Mitigation examples

Who is EHEDG?

European Hygienic Engineering & Design Group (EHEDG) founded in 1989 as a non-profit consortium



Platform

The platform to discuss and define hygienic design and engineering requirements to manage food safety and quality, efficiency and sustainable operations

Some of our members

EHEDG
European Hygienic Engineering & Design Group

ABB
ADM
Agristo
we love potatoes
Alfa Laval
Barry Callebaut
Grupo Bimbo
Nourishing a better world

Bühler
Carlsberg Group
Danone
One planet. One health
Vikan
Advancing hygienic cleaning
Douwe Egberts
Yili

Endress+Hauser
Ferrero
FrieslandCampina
GEA
Engineering for a better world.
Heinz
Est. 1869

Kerry
Krones
Lactalis
LambWeston
Marel
Mars Snacking

Migros Industrie
Molson Coors beverage company
Mondelēz International
Nestlé
novozymes
OLVI

OSI
PepsiCo
Sidel
Sika
SMC
Sodiaal
Coopérative Laitière Française

SPXFlow
Tetra Pak
The Coca-Cola Company
Unilever

Uniqueness of EHEDG

Comprehensive Guidelines

Collaborative approach

Worldwide presence and recognition

Hands on Trainings and education

Addressing hygienic design challenges

Holistic approach

Focus areas of Working Groups

- Design Principles
- Hygienic Integration Systems
- Lubricants
- Materials of Construction
- Welding

- Air Handling
- Building Design
- Water Management

- Dry Materials Handling

- Packaging Machinery

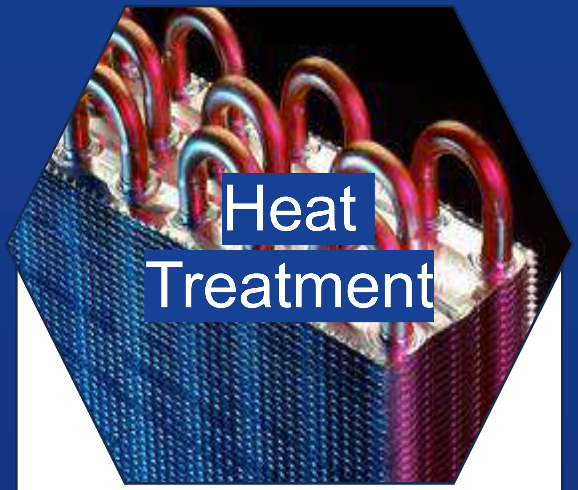
- Cleaning & Disinfection
- Cleaning in Place
- Cleaning Validation
- Foreign Bodies
- Tank Cleaning

Focus areas of Working Groups

- In-place cleanability
- In-line sterilizability
- Bacteria-tightness
- Pipe couplings
- Bacterial impermeability
- Open Process Equipment Cleanability

- Mechanical Seals
- Pumps, Homogenizers and Dampening Devices
- Sensors
- Separators
- Valves

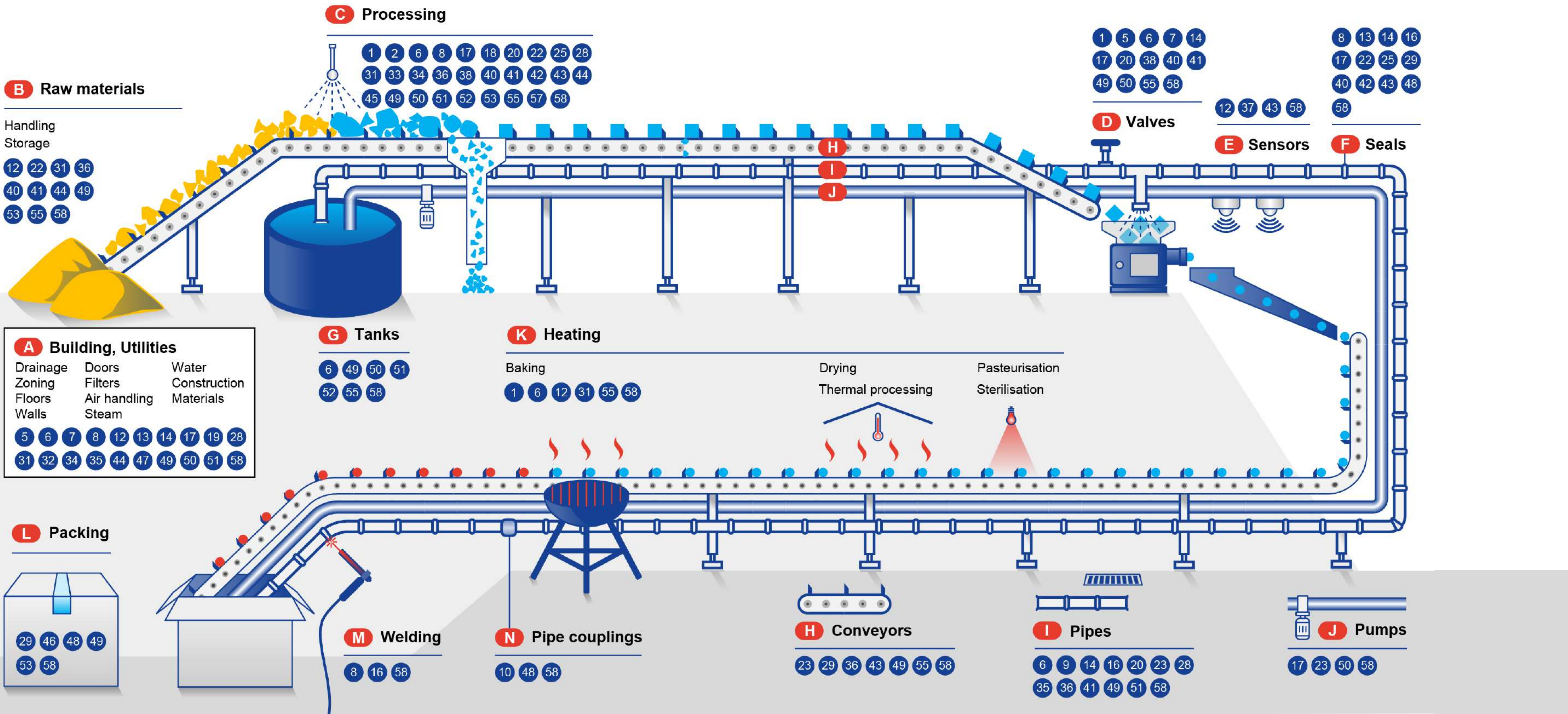
- Bakery Equipment
- Conveyor Systems



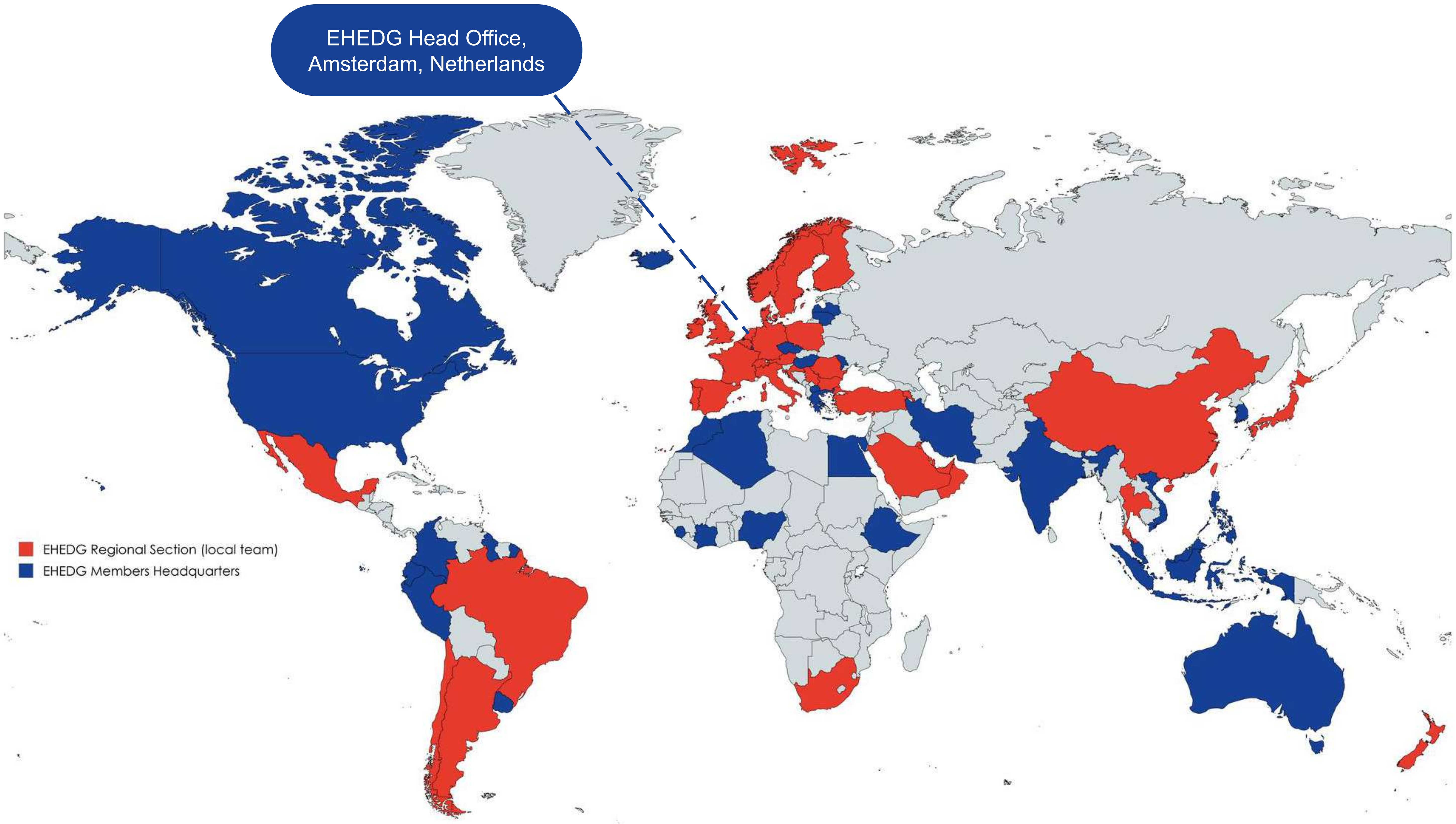
- Continuous Pasteurization
- Continuous UHT Sterilization
- Continuous /Semi Flow thermal treatment

- Chocolate
- Fish processing
- Meat processing

EHEDG Guideline Overview



EHEDG – European based – global reach



Learning opportunities: EHEDG Webinars

Webinar-External 27-01-2026

Hygienic Design for Safe Dry Processes | New EHEDG Webinar

Read more →

Webinar-External 23-10-2025

Keep It Running, Keep It Safe: Building Works During Food Production | New EHEDG Webinar

Read more →

Webinar-External 24-09-2025

Hygienic Design of Separators in Dairy Processing | New EHEDG Webinar

Read more →

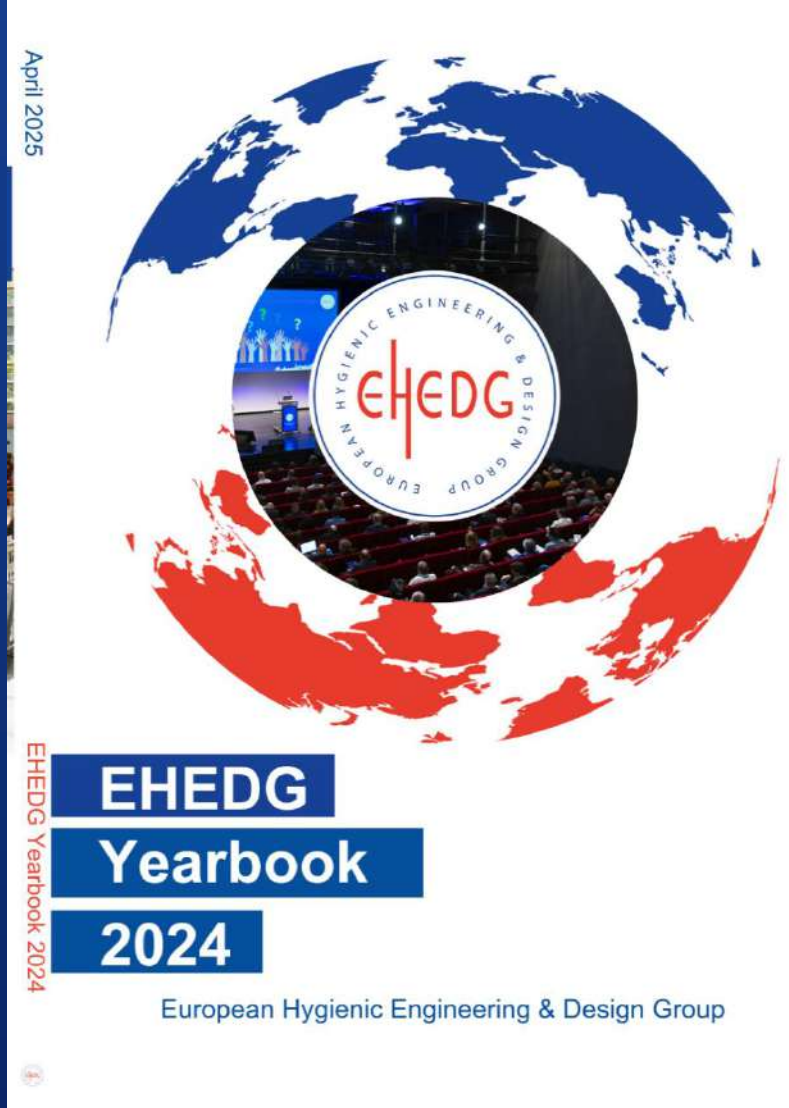
Webinar-External 15-07-2025

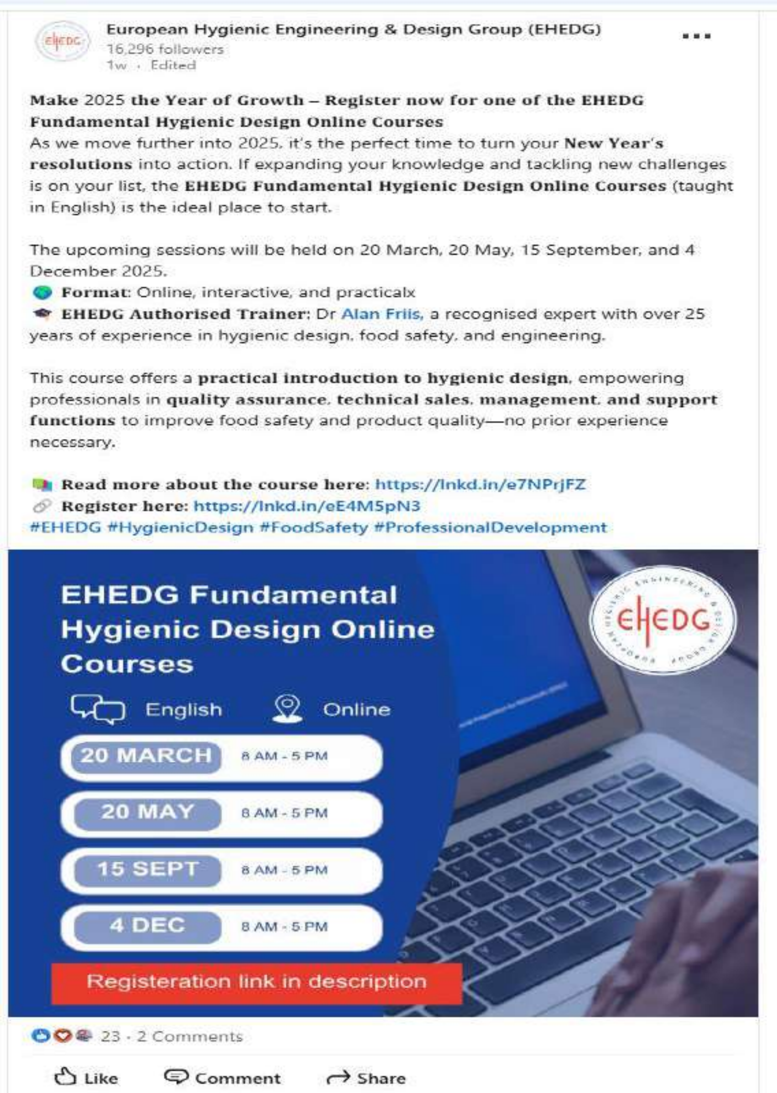
Hygienic Design Risk Management: Industry Challenges | New Webinar

Read more →

Sign-up here

EHEDG Communication





[EHEDG Publications](#) | [EHEDG LinkedIn Page](#) | [EHEDG Newsletter](#)

EHEDG Regional Section SA

EHEDG Summer School
'Food Safety & Hygienic Design'

This 5-day immersive programme in Hygienic Engineering & Design is grounded in internationally recognised EHEDG principles, blending regulatory and technical knowledge with intensive applied learning through real-world case studies.

ADVANCED COURSE IN HYGIENIC ENGINEERING AND DESIGN

Venue Pretoria

Course Dates
22 - 24 June 2026
https://www.enterprises.up.ac.za/course/advanced-course-in-hygienic-engineering-and-design-pretoria

Venue Cape Town

Course Dates
09 - 11 November 2026
https://www.enterprises.up.ac.za/course/advanced-course-in-hygienic-engineering-and-design

Hygienic Design

Efficiency and Efficacy

Efficiency vs Efficacy trade-off

Parameter	Impact on Efficacy	Impact of Efficiency
Temperature	Improvement	Higher costs
Chemical conc./Chemistry	To optimum, than plateau	Wastage reduced
Time	Improve to optimum	Longer down time
Flow	Critical for soil removal	Increased pump energy

Efficacy - integrated approach

Equipment & Facilities Design

- Construction material, surface finish
- Hygienic Design Criteria
- Line layout

Influence of Process Design on Soil

- Soil characteristic & amount
- Run Length

Cleaning Process

- Time
- Temperature
- Mechanical action
- Detergent type and concentration

Efficiency – maintaining validated efficacy

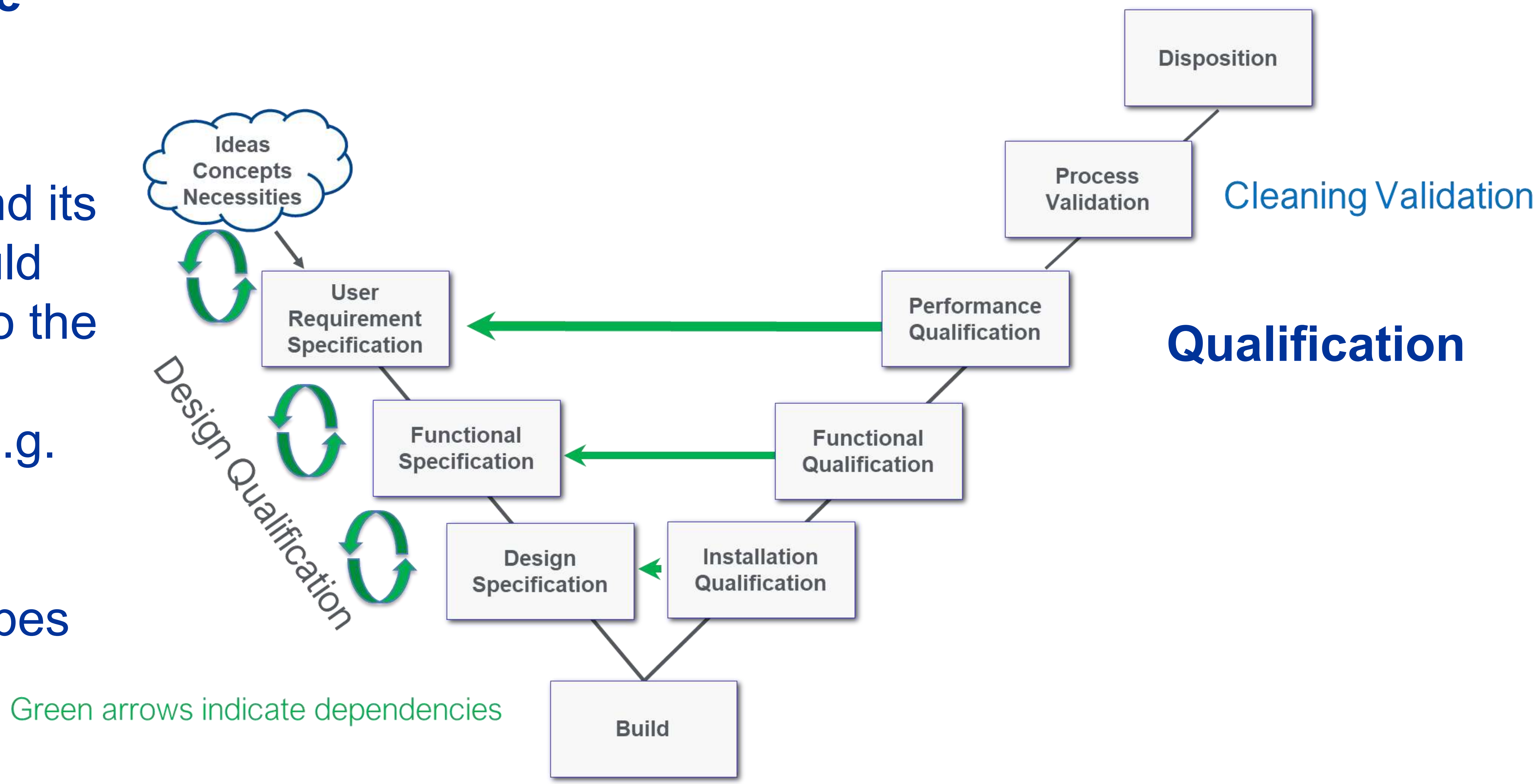
Hygienic design is a prerequisite for efficient and sustainable cleaning.

Cleaning Validation Process

"V"-model: Project stages with various qualification and validation steps.

Design Phase

The cleaning requirement and its validation should be translated to the design specification, e.g. CIP related installations, monitoring probes etc..



Documented Benefits of Hygienic Design

Water Usage: Companies consistently see 20–40% reduction in CIP water use

Energy: Heating less water (or pumping less through CIP) cuts steam or electricity consumption.

Chemicals: Reduced cleaning agents (up to 50% less) because of quicker, more thorough coverage.

Labour: Fewer cleaning hours or manual interventions.

Maintenance: Longer equipment life, fewer part replacements, more time in operation.

Waste Handling: Fewer by-products and lower disposal costs.

Documented Cost Savings & ROI

1 **Nestlé Dairy Facility**

30% reduction in CIP water use, shorter CIP cycles also meant energy savings, less chemical usage due to **more efficient cleaning**.

2 **GEA Brewery Implementation**

Product yields increase by 2–5%, because leftover beer in the lines could be reclaimed, **water needed for flushing lines decreased significantly.**

3 **Retrofit Meat Processing Plant**

Fewer cleaning hours, lower maintenance labour, and spare-part costs. Longer intervals between major overhauls. **Equipment lifespans increased by several years.**

4 **Krones Beverage Processing Line:**

Downtime between production runs dropped by 15–20%, due to shorter CIP cycles. More predictable maintenance schedule, **reducing unplanned stoppages.**

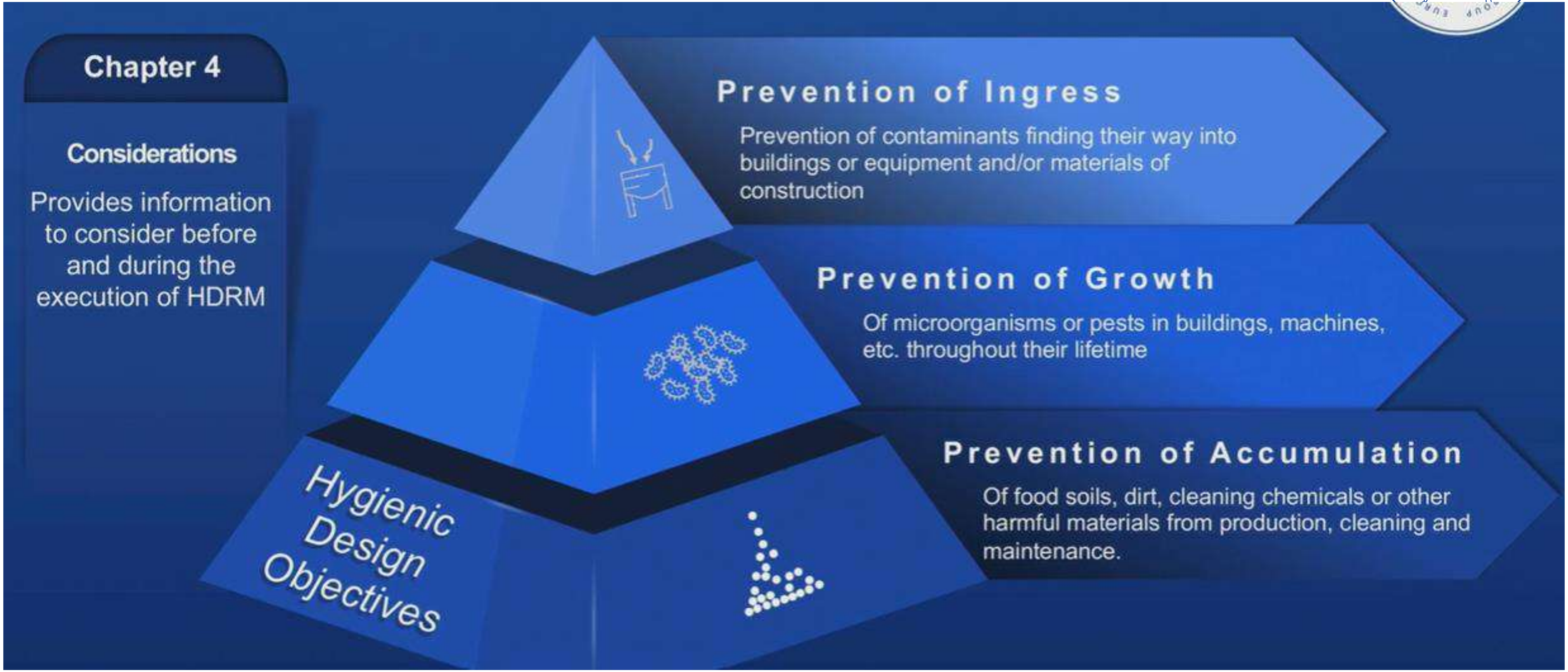
5 **Tetra Pak CIP system in confectionery plant:**

Reduced risk of chemical exposure for operators, lower volume of cleaning chemicals due to **more effective use of targeted sprays**.

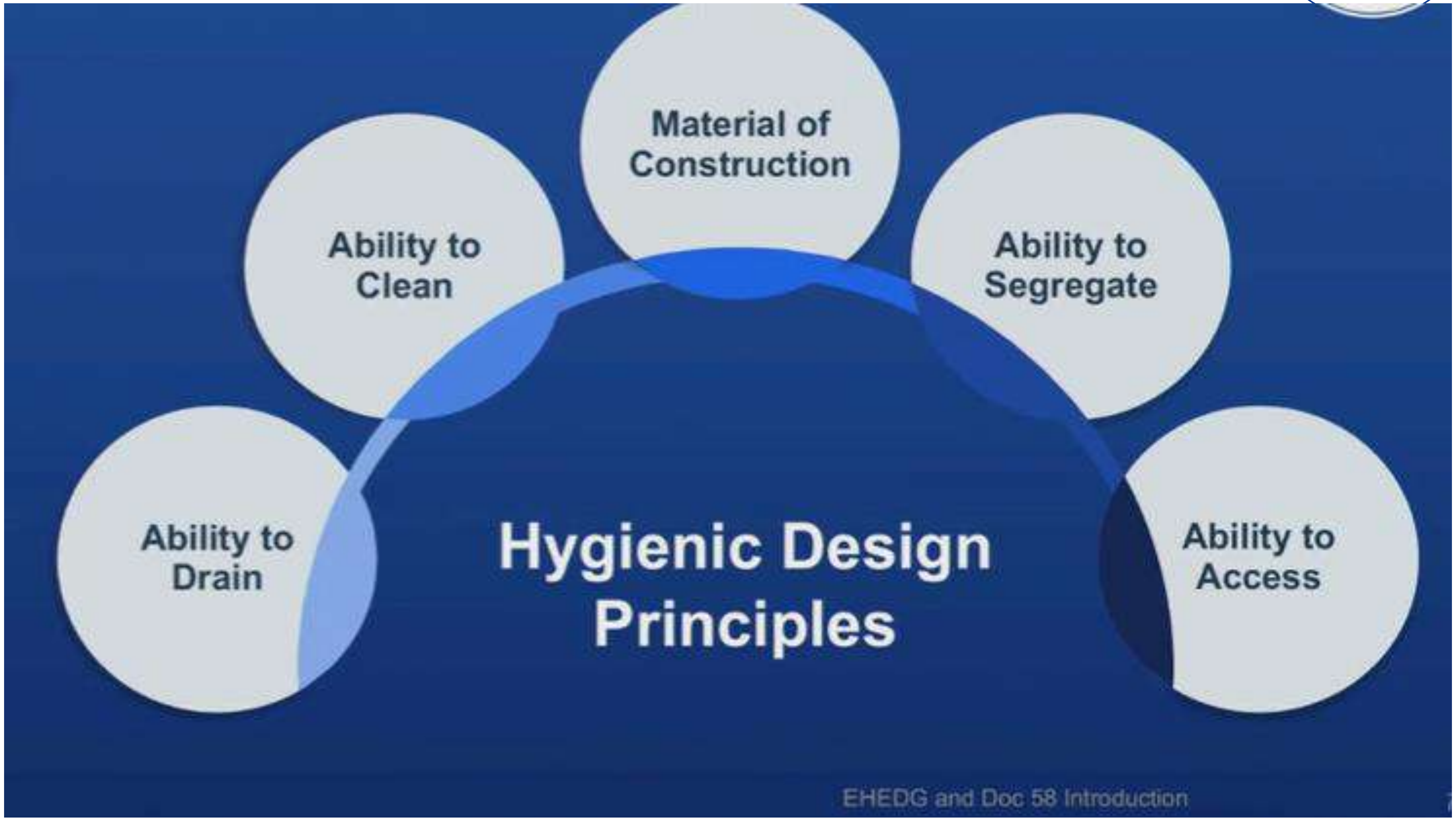
Hygienic Design

Risk Management - Intergrated Approach

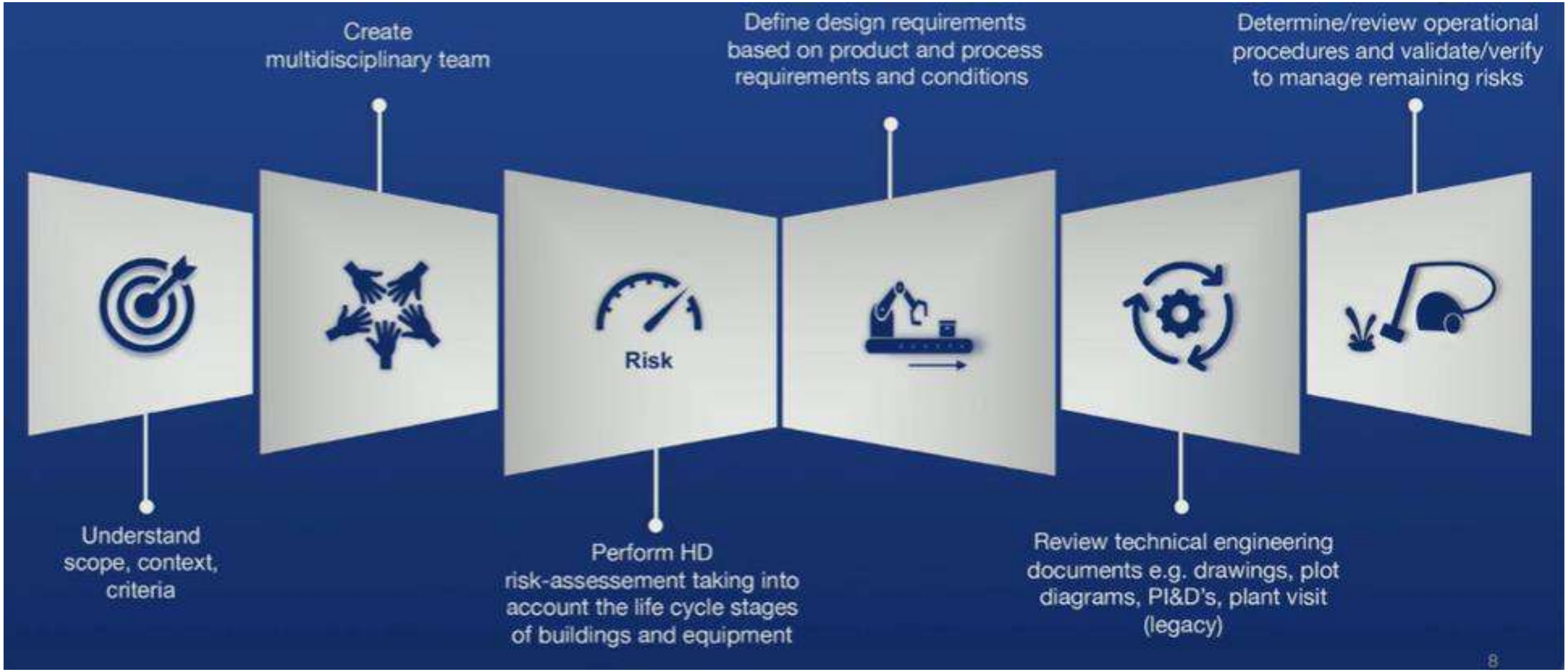
Hygienic design objectives



Hygienic Design Principles



Hygienic Design Approach



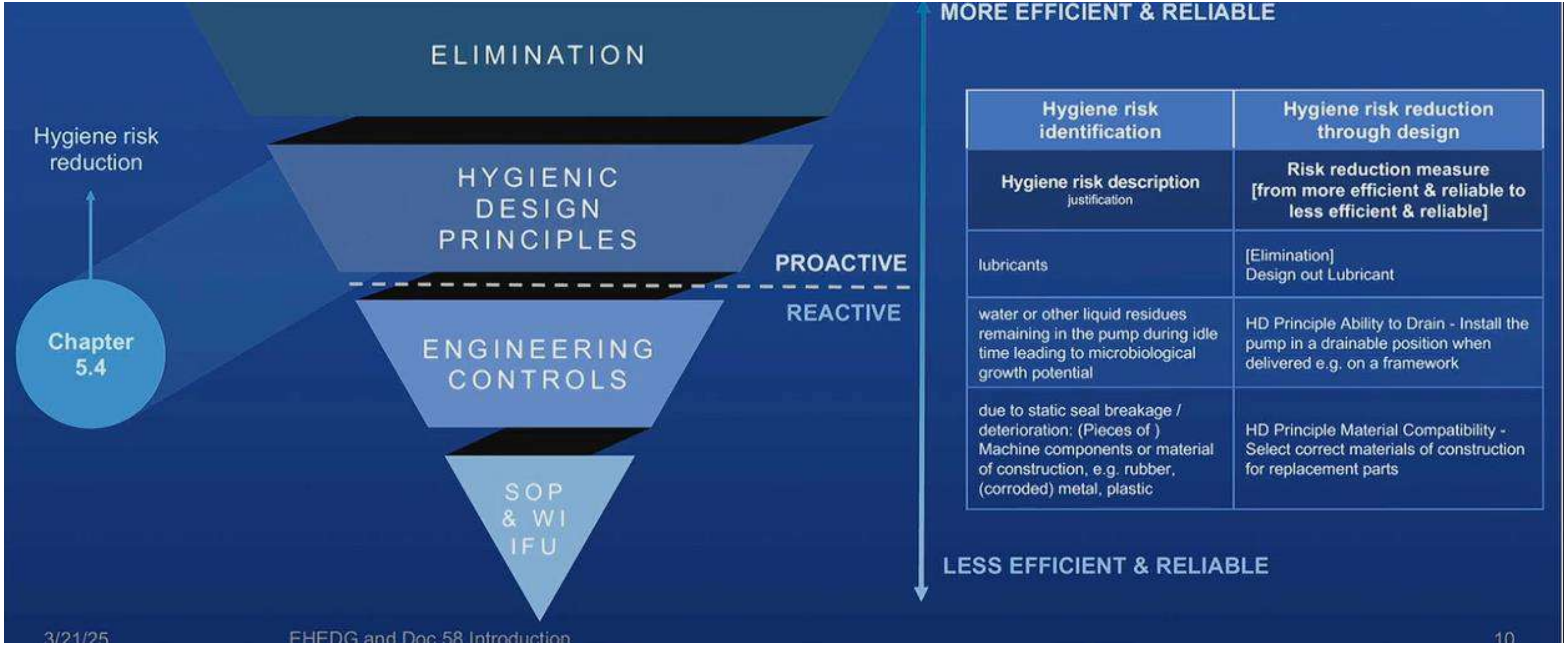
Hygienic Design Physical Life Cycle

Hygienic Design Risk Assessment

Hygiene risk assessment - Example

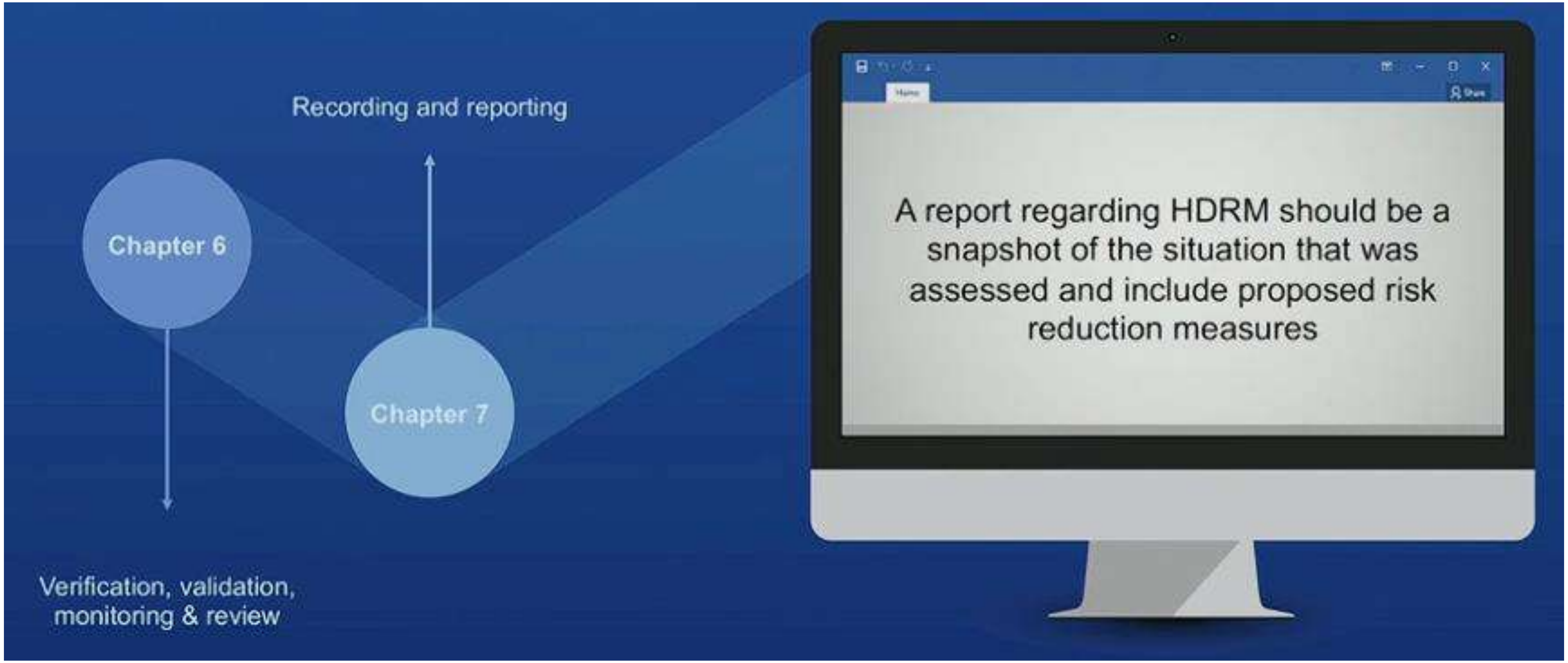
Hygiene risk identification					Hygiene risk analysis & evaluation		
No	Physical life cycle	Contaminant incl. food safety hazards and quality threats	Mechanism ingress-accumulation-growth	Hygiene risk description justification	Likelihood	Negative Impact	Risk Level
1	Processing	chemical	ingress – entry from outside	lubricants	ME	HI	HI
2	Cleaning	biological	accumulation	water or other liquid residues remaining in the pump during idle time leading to microbiological growth potential	ME	ME	ME
3	Maintenance	physical	ingress – generation within inside	due to static seal breakage / deterioration: (Pieces of) Machine components or material of construction, e.g. rubber, (corroded) metal, plastic	HI	ME	ME

Hygienic Design Risk Reduction/Elimination



Hygiene risk identification	Hygiene risk reduction through design
Hygiene risk description justification	**Risk reduction measure [from more efficient & reliable to less efficient & reliable]**
lubricants	[Elimination] Design out Lubricant
water or other liquid residues remaining in the pump during idle time leading to microbiological growth potential	HD Principle Ability to Drain - Install the pump in a drainable position when delivered e.g. on a framework
due to static seal breakage / deterioration: (Pieces of) Machine components or material of construction, e.g. rubber, (corroded) metal, plastic	HD Principle Material Compatibility - Select correct materials of construction for replacement parts

Hygienic Design Reporting



HDRM – Appendixes GL58

Appendix 1
Key Learning points

Appendix 2
Checklist - Scope, Context & Criteria

Appendix 3
Checklist Hygiene Risk Identification

Appendix 4
Checklists Hygienic Design Principles

- 4-1 Checklist and Related Criteria to Manage Various Contaminants
- 4-2 Checklist HD Principles Equipment and Risk Reduction Measures
- 4-3 Checklist HD Principles and Hygiene Risk Reduction Guidance for Buildings

Appendix 5
HDRM Examples

- 5-1 Generic Pump
- 5-2 URS Pasteurised milk pump
- 5-3 Room Design
- 5-4 Incident investigation legacy situation
- 5-5 Example Conveyor
- 5-6 Process line
- 5-7 Mix-proof valve
- 5-8 Change intended use legacy equipment

HDRM - Examples

Hygiene risk identification					Hygiene risk analysis & evaluation		
No	Physical life cycle	Contaminant incl. food safety hazards and quality threats	Mechanism ingress-accumulation-growth	Hygiene risk description justification	Likelihood	Negative Impact	Risk Level
1	Processing	chemical	ingress – entry from outside	Lubricants entry into the product stream	ME	HI	HI
2	Cleaning	biological	accumulation	water or other liquid residues remaining in the pump during idle time leading to microbiological growth potential	ME	ME	ME
3	Cleaning	biological	growth	Product residues remaining due to inadequate the cleaning	HI	HI	HI

HDRM Example

	Material compatibility	Ability to clean	Ability to drain	Ability to segregate	Ability to access
Ceilings	Ceiling to be designed using light-coloured, dense, tough (made of materials unable to provide harbourage for pests), impact-resistant, durable, rustproof, unable to absorb grease or food particles.	Sandwich panel / FRP panel. Surfaces without exposed structures.	Design should not allow for accumulation of moisture.	Ceiling to be designed to segregate utilities and roof structures and to be insulated to prevent condensation.	Ceiling to be installed so as to allow access for inspection, maintenance and cleaning.
Doors (external)	All external (emergency) doors to be weatherproof and waterproof, effectively sealed against pest ingress and not opening directly into food production areas (except emerg doors which have to be alarmed).	Doors, especially on the inside, designed for cleanability, no ledges, smooth surface.		Doors fitted with kick plates, push plates and self-closing. Doors designed to prevent (un)intentional opening from the outside.	Closing plates of the door lock trimmed into the frame to avoid gaps where pests can enter, or which may be difficult to clean.
Doors (internal)	Internal doors made of light-coloured, solid, tough, impact-resistant, durable materials. Internal doors rustproof, able to withstand cleaning chemicals, non-absorbent and constructed of non-toxic materials.	Door closing device must not accumulate residues. Doors having smooth surfaces, no sharp corners or ledges.	Internal doors must close tightly to the floor and frames to prevent excessive air movements and pest access.	Closing plates of the door lock trimmed into the frame to avoid gaps where pests can enter, or which may be difficult to clean. Sliding doors have all gaps closed between the door and the frame.	
Drain	Drainage system components (gullies, channels, gratings, etc.) made from compatible materials to prevent corrosion or wear (e.g. stainless steel or concrete).	Drain components easy to clean, free of crevices or dead spaces, with continuous welding of joints, radiused corners, smooth surfaces.	Drain location allows easy drainage of (waste) water/fluids. Drain design capable of removing all wastewater from the drain itself and the floor, and of preventing puddles around drains.	Drainage system installation prevents contaminated water leakage. Process lines physically segregated from the drain by an atmospheric break. Drainage system has sediment baskets to capture solid material.	Drain location allows easy access for cleaning, inspection and maintenance. Channel design allows easy access for manual cleaning and complete visual inspection - slot channels must be avoided.
Lifts	Lifts made from materials that are durable, dense, tough and able to withstand the cleaning chemicals and methods used.	Lifts designed to be easy cleanable.		Lift doors opening in corridor, not in production area.	Lift base (and headspace) protected from pest access and easily accessible for cleaning.

Risk Assessment and Mitigation

Situation:

Microbiological Spread linked to:

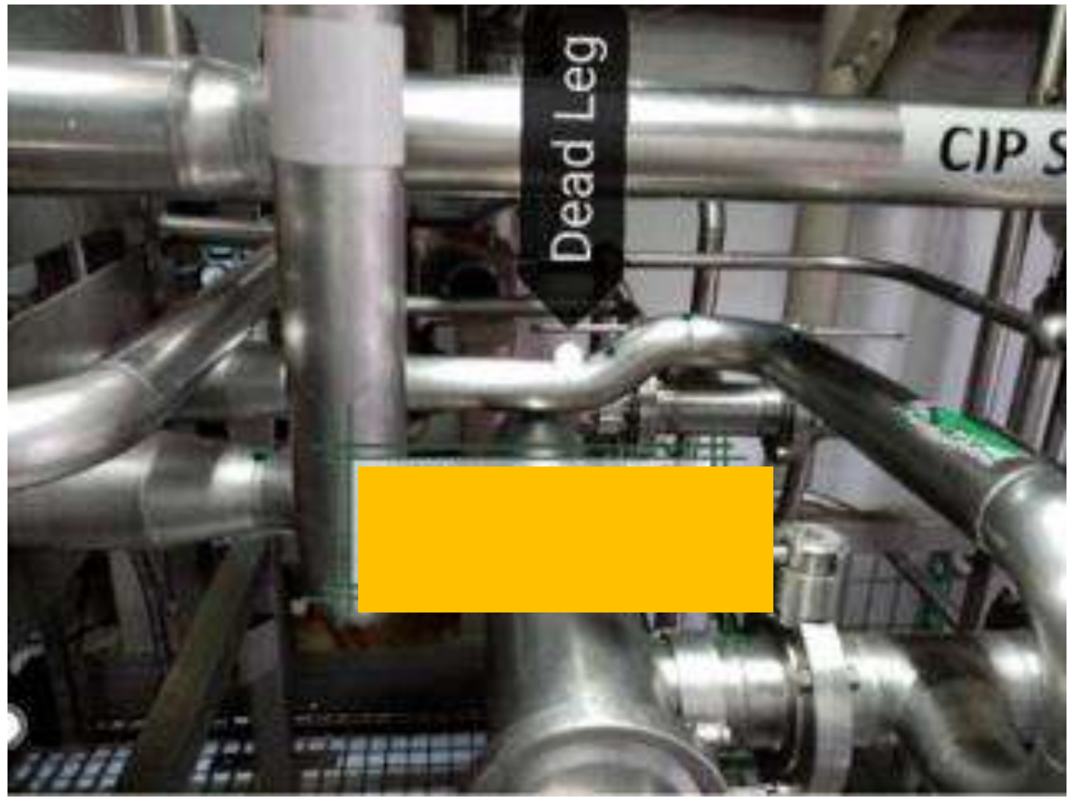
- Poor hygienic practices
- Equipment design limitations

Root Causes:

- Non-drainable surfaces
- Hard-to-clean zones

Improvements:

- Sloped, drainable surfaces
- Hygienic piping (no dead legs)
- Improved cleanability



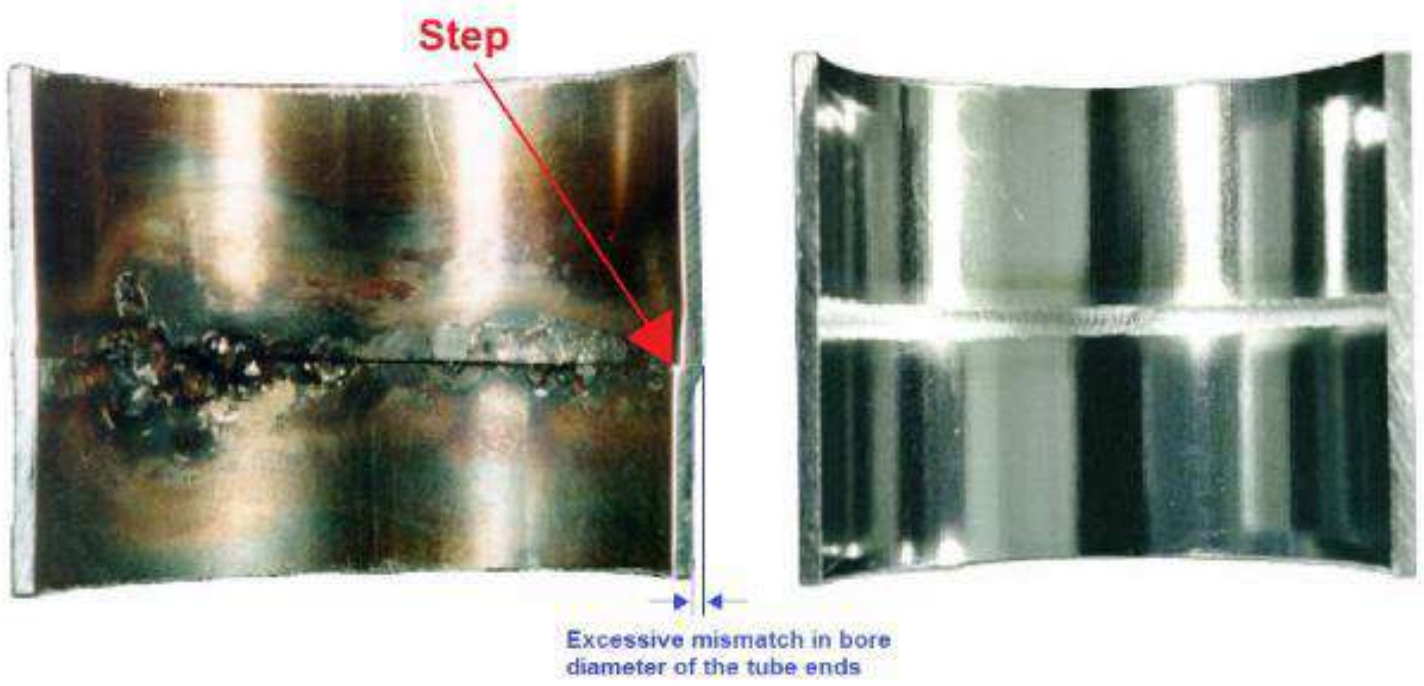
Risk Assessment and Mitigation

Situation:
Biofilms formed inside:
- Milk pipelines
- Bulk tanks

Persistent contamination over time

Route Cause:
Biofilms act as **reservoirs of pathogens**
Poor design (crevices, rough surfaces) promotes attachment

Improvements:
- Smooth welds and polished surfaces
- CIP-optimised flow velocities
- Elimination of dead legs



Risk Assessment and Mitigation

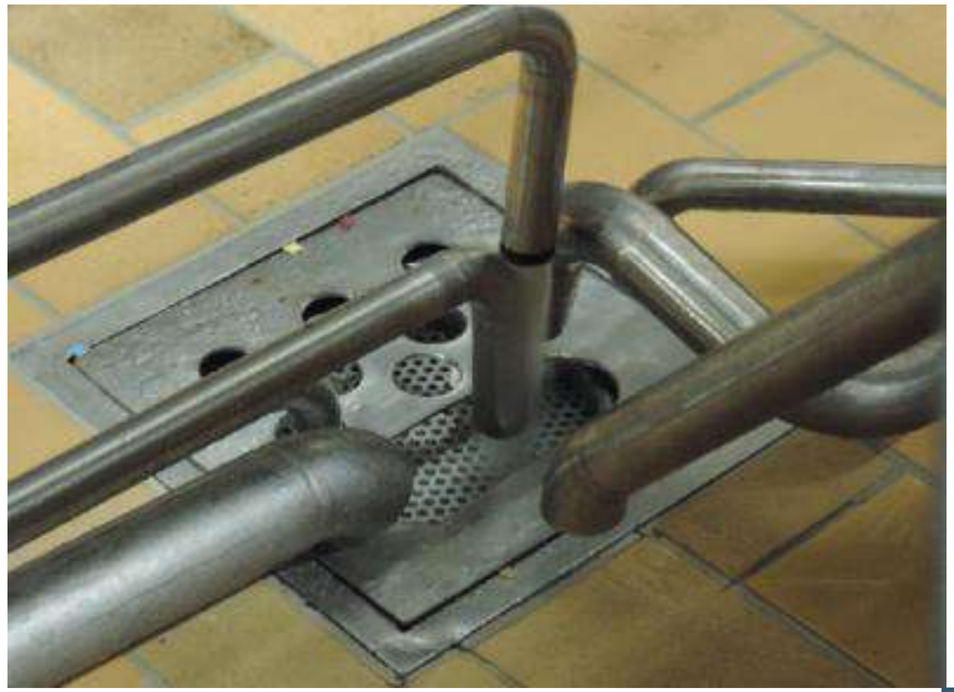
Airborne

- Microorganisms fly as passengers on dust particles/ aerosols
    - High pressure spray!

Risk Assessment and Mitigation

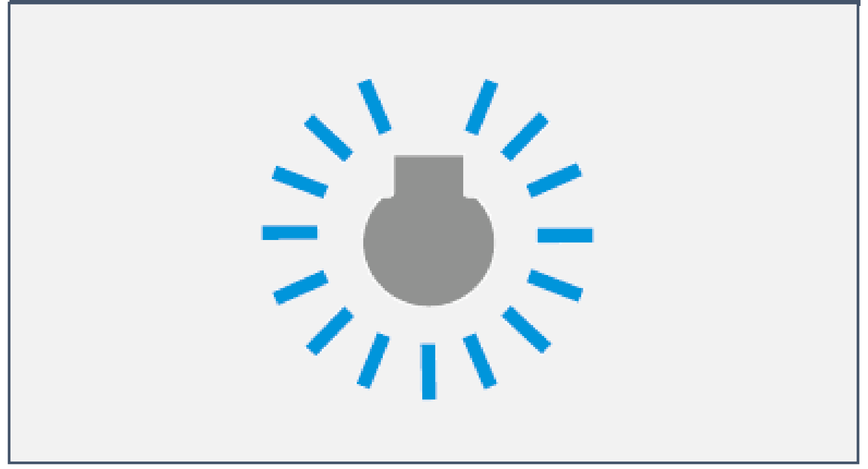
Good examples

Bad examples

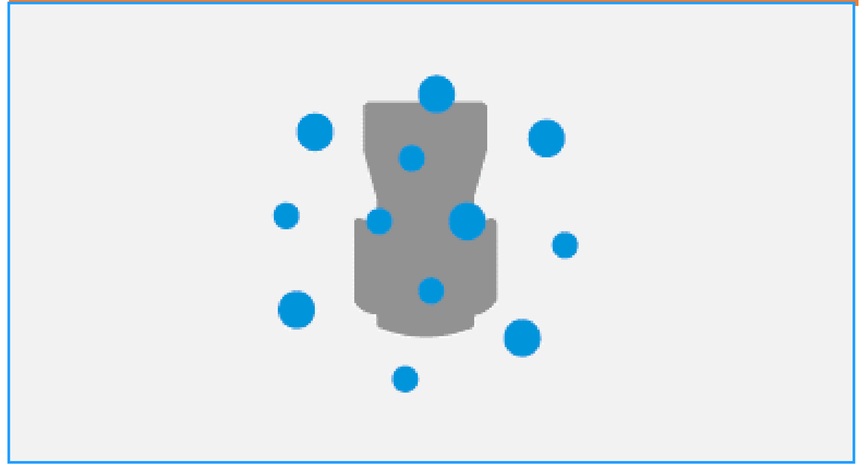


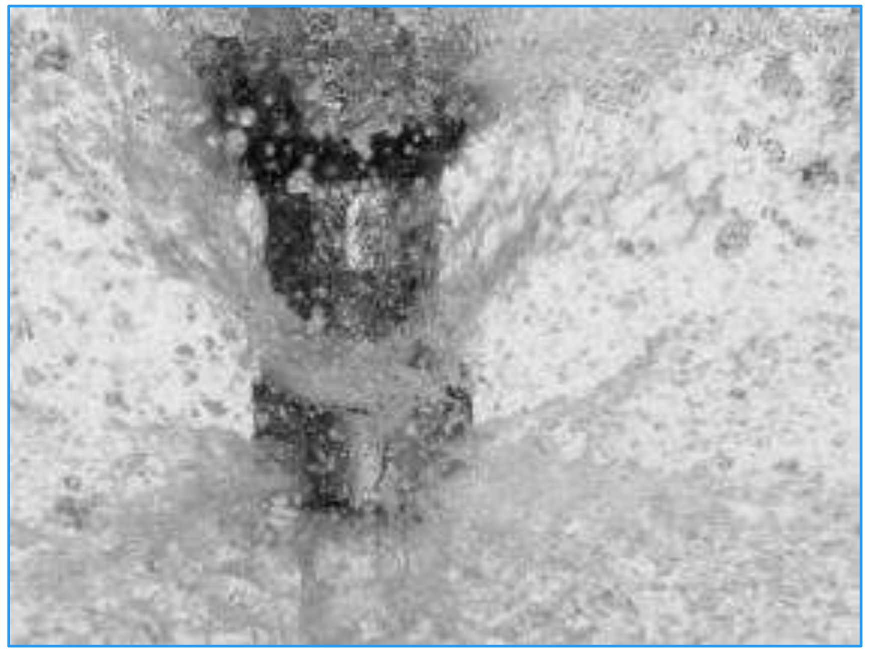
Efficiency and Efficacy – CIP Optimization

I Rinse cleaning

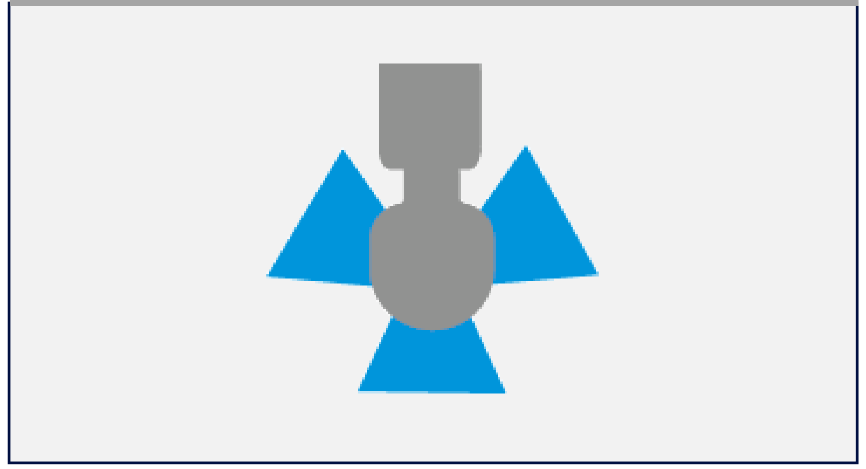


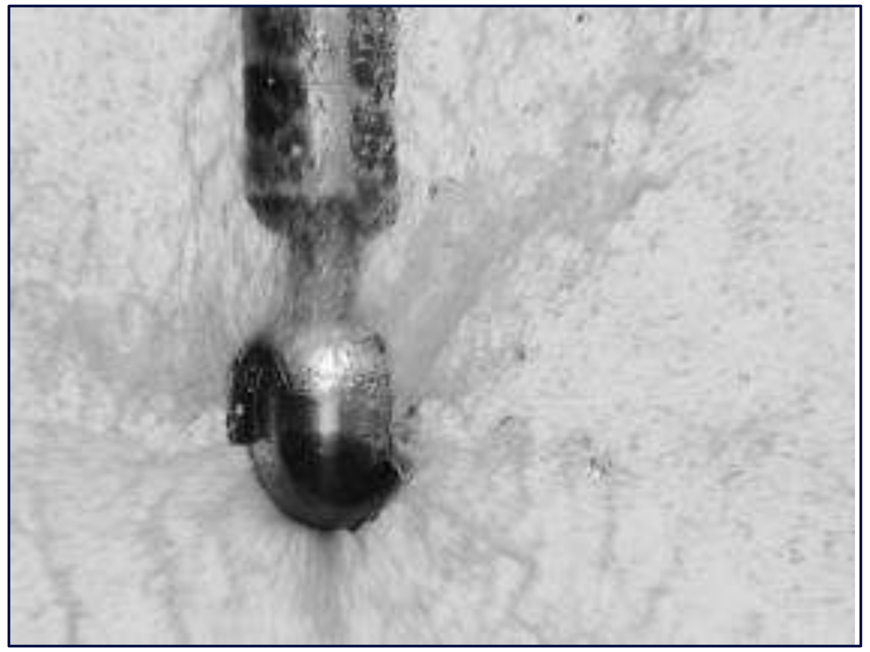
II Low impact cleaning



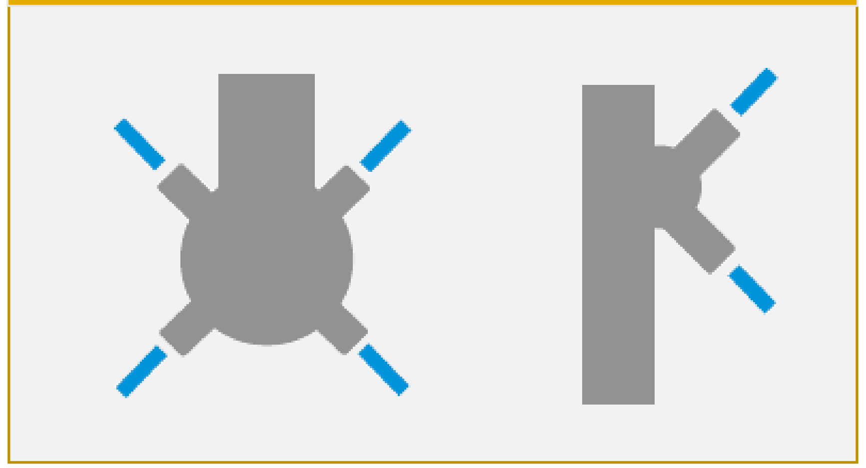


III Medium impact cleaning





IV High impact cleaning



Chemicals / Time / Water

Mechanical force

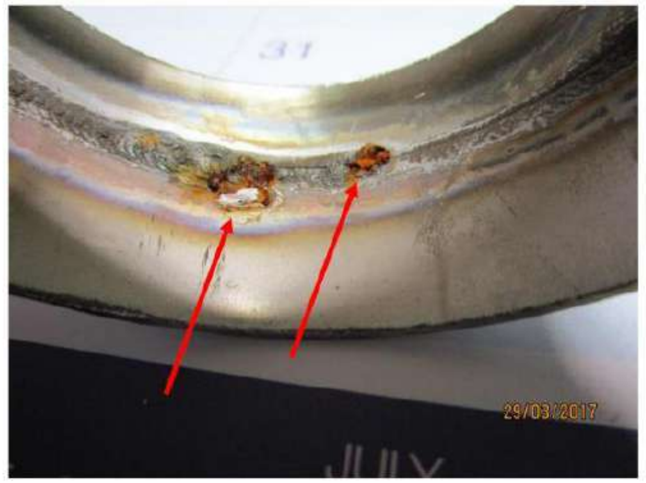
Courtesy GEA

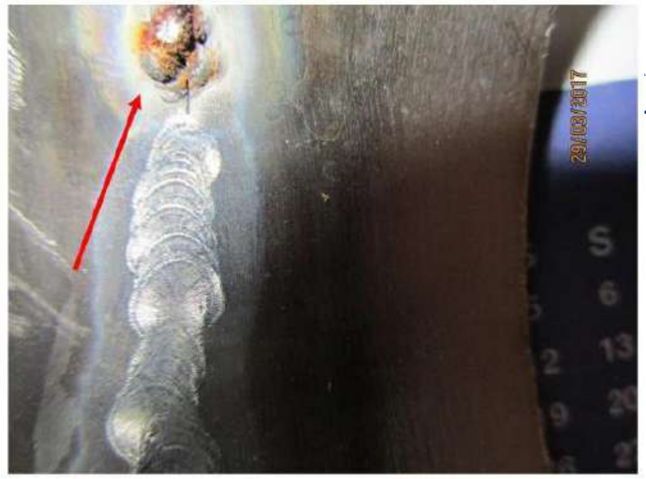
Practical Applications – SA :CIP Efficacy and Efficiency

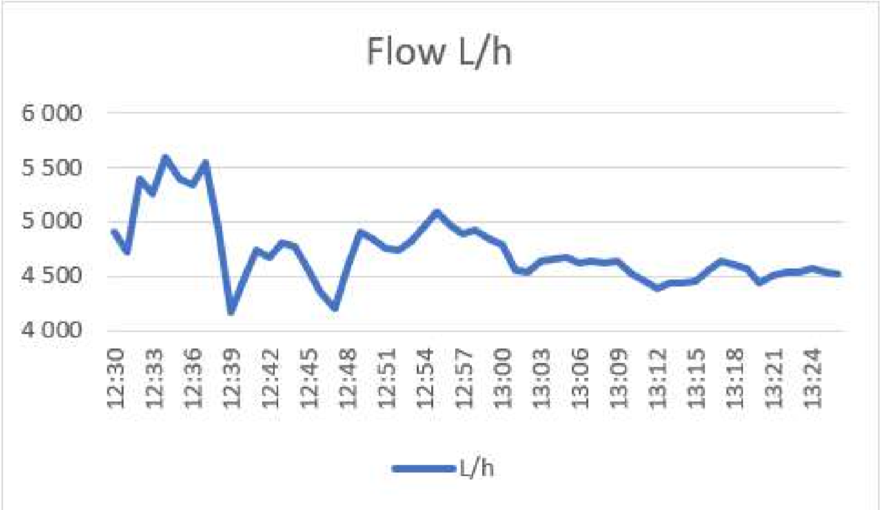
Hygienic Design criteria relevant to CIP

1. Hygienic Design principles
2. Hygienic Design criteria for CIP Installations
3. Design of closed equipment for processing of liquid food products
4. Design of valves, pumps and pipe couplings.
5. Treatment of Stainless Steel Surfaces
6. Design and construction of materials for equipment in contact with food

7. CIP process validation





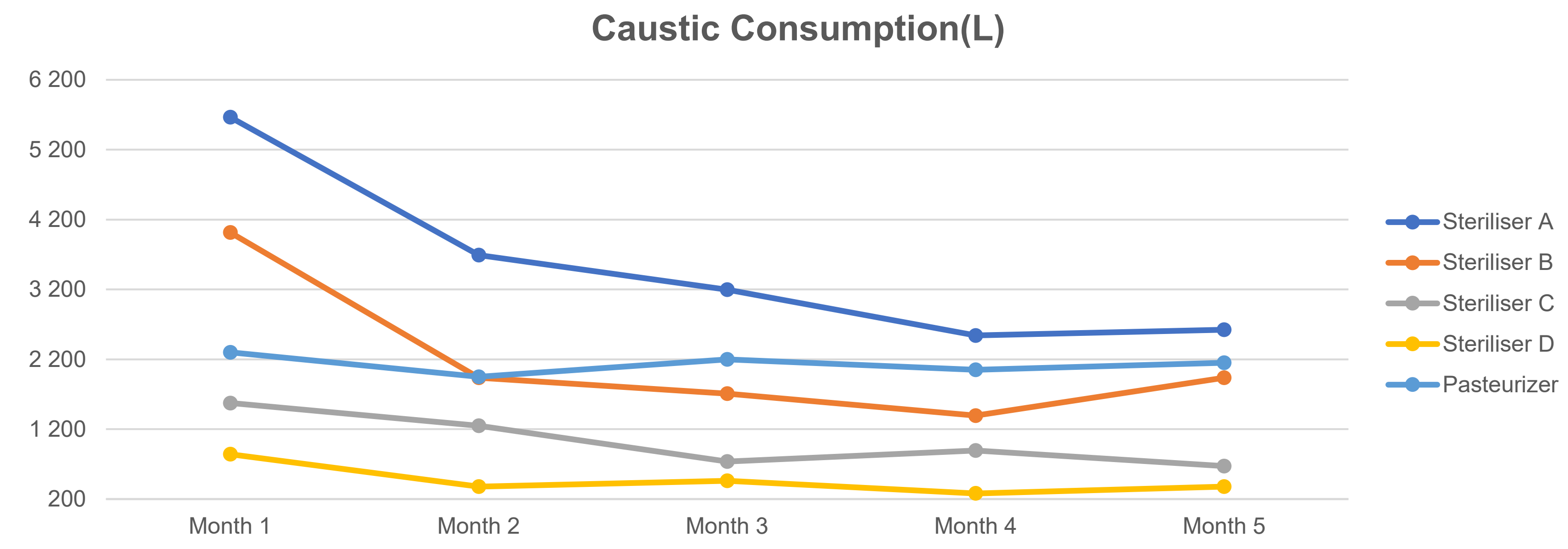


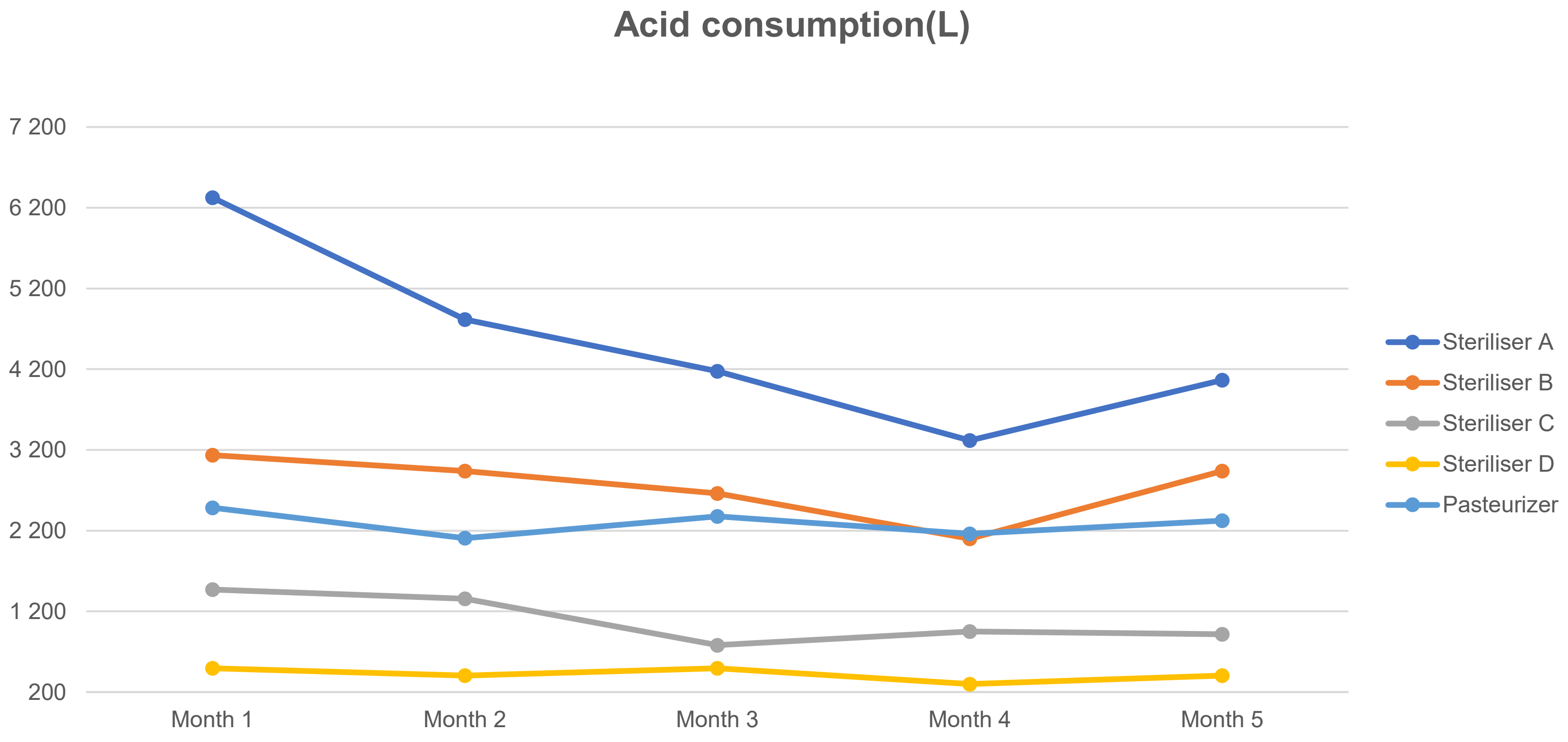
Other factors

1. Soiling and soil composition
2. Microbiological fouling
3. Detergent chemistry
4. Cleaning methodology basic and specialized

Risk	Acceptance	Method of evaluation
Microbiological soiling post CIP	Meet specifications	Microbiological swab analysis
Poor drain-ability	No pooling in lines and vessels post CIP	Visual Inspections
Dead- legs	No dead-legs	Pipe Route Inspections
Internal pipes and equipment	No undetected imperfection at welding joints where micro-organisms may colonize the resulting cavities as biofilms	Borescope testing/Endoscope.
Visible soiling post CIP	All visible soiling removed post CIP operation	Visual Inspection

Practical Applications – SA :CIP Efficacy and Efficiency





1. Hygienic Design principles
2. Hygienic Design criteria for CIP Installations
3. Design of closed equipment for processing of liquid food products
4. Design of valves, pumps, pipe couplings and homogenizers.
5. Treatment of Stainless Steel Surfaces
6. Design and construction of materials for equipment in contact with food

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