The challenges facing Dairy industry Cip
Annual SDT Conference Penrith 2023
Optimising CIP to reduce energy costs

NORTHSTAR
TRAINING AND ADVISORY

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Optimising CIP to reduce energy costs
Nial Mullane is a UCC graduate of Dairy Science and has 35 years’ experience across a number of blue chip companies in both the UK and Ireland in soft drinks manufacture with Coca Cola, Aseptic packaging of juices, milk and sauces with Tetra Pak and both liquid UHT and powdered infant formula manufacture with Wyeth Nutrition.

He has held project management, validation, and senior operation management roles in these companies. Nial has been a CIP champion for many years and frequently lectures in University College Cork. Nial is a director of NorthStar, a training and advisory company to food and beverage companies in Ireland and the UK. Nial is a fellow of the IFST and a member and contributor to the EHEDG (European hygienic engineering design group) and a member of the SOFHT.
Cip : The backstory :

What is Clean ?

Plant Cleaning
Process of removing unwanted soil from equipment and /or manufacturing facilities by the application of an effective procedure either manual or automated.

Sanitisation
Process of reducing microbiological contamination on effectively cleaned surfaces by means of a bactericidal treatment such as heat or chemicals, to a level acceptable to local health regulations or market requirements.

For effectiveness this must be preceded by cleaning.
Cip : The backstory :

What is Cip ?

- CIP stands for Cleaning-In-Place
- Cleaning the production lines without dismantling the installation
- Cleaning effect obtained by circulation of liquids during a certain time, with a combination of thermal, mechanical and chemical energies
Cip: The backstory:

What is the expectation?

- **Increased plant utilisation**: downtime is minimised – as long as CIP remains effective.
- **Minimal manual work**: No or little need to dismantle plant, no or little risks of human error and recontamination of clean plant is minimised.
- **Greater safety for personnel**: protection from heat and chemicals (as long as chemicals are automatically dosed) and no necessity to enter into vessels.
- **More consistent results**: capable of being accurately and rapidly monitored.
- **Improved protection of the environment**: Reduction of hydraulic load and smarter chemicals.
- **Cost savings**: optimum use of water, chemicals, heat and technology.
Cip: The backstory:

What are the outputs?

- Quality Improvement
- Reproducible Results
- Documentation
- Economical process
- Time managed
- Safe system
Cip : The backstory :
What makes it work ?

• Technology: discipline that requires detailed engineering
• Turbulence: 1.5 to 2m/s
• Titration: not too high/ not too low
• Temperature: adapted to process
• Time: depends on the circuit
• Training: everybody needs the same understanding
CIP: The baseline:

What makes it work?

Efficient Cleaning – 4 Key Parameters
Cip: The baseline: Current challenges?

- Design and layout poor outdated
- Scheduled cleaning regime not in place
- Correct chemicals available/overreliance on chemical suppliers
- Data acquisition systems not in place—no visuality.
- Cip not a KPI—poor management commitment.
- No Cip Champion.
- Training
- No cip policy - site wide/company wide
Cip : Optimisation : Where to start?

A food or beverage plant has 4 key objectives

<table>
<thead>
<tr>
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<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAFELY</td>
<td>No bad batches, no worker accidents</td>
<td>Maximum utilization, minimum downtime</td>
<td>Lowest total cost</td>
<td>Least use of water, energy, effluent</td>
</tr>
<tr>
<td>Quality &amp; Consistency</td>
<td>Productivity</td>
<td>Cost</td>
<td>Sustainability</td>
<td></td>
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</tbody>
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**NORTHSTAR**
**Time Temperature Titration Turbulence Technology Training**
Cip : Optimisation : Where to start?

Optimisation resolves challenges in CIP

By improving cleaning quality while reducing CIP time and utility costs

Eliminating over-cleaning without risking food safety

Identifying previously unforeseen issues
Cip : Optimisation : Prerequisites ?

Using too much water/Chemicals/Energy due

• Plant not achieving the 4 T’s
• Unverified rinse times
• Poor water/chemical interphases
• Lack of monitoring data
• Poor calibrations
• Incorrect spec of tank cleaning equipment
• CIP frequency - too often
• Poor commitment to Cip as a critical process.
• Optimisation team with good inter-department relations
Cip : Optimisation :

- Water – Rinse times (Pre, Mid and Final)
  - Over rinsing
  - Poor rinse/chemical interphase
  - Hot or cold prerinse – removal + Thermal

- Chemical (caustic and acid)
  - Sharpening of interphases
  - Correct chemicals

- Data, spray device and instrumentation upgrades
  - Statistical analysis
  - Spray ball to spinner to turbine
  - Turbidity measurement to change phase

- Question Cip Frequencies
  - Do we need to do a full wash?
  - Do we need to wash at all now?

- Re-using chemical / water
  - Do we capture our final rinse
  - How often do we drop our chemical tanks
  - Do we desludge

Targets ?
Cip : Optimisation :

Solutions?

CLEANING CIP ANALYSIS
Below you see the comparison between the equipment profiles

<table>
<thead>
<tr>
<th></th>
<th>SPRAY BALL DB4 180U LKRK ST</th>
<th>SANIMEGA SB 2750 CLIP-ON</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STEP VOLUME</strong></td>
<td><strong>STEP COST</strong></td>
<td><strong>STEP VOLUME</strong></td>
</tr>
<tr>
<td>1 Pre-rinse Water</td>
<td>3.6667 m³ 5 min</td>
<td>€11.00</td>
</tr>
<tr>
<td>2 Caustic</td>
<td>0.7333 m³ 10 min</td>
<td>€2.93</td>
</tr>
<tr>
<td>3 Intermediate rinse Water</td>
<td>1.1000 m³ 5 min</td>
<td>€3.30</td>
</tr>
<tr>
<td>4 Acid</td>
<td>0.7333 m³ 10 min</td>
<td>€2.93</td>
</tr>
<tr>
<td>5 Final rinse Water</td>
<td>0.0000 m³ 5 min</td>
<td>€0.00</td>
</tr>
<tr>
<td><strong>Total per CIP</strong></td>
<td>8.23 m³</td>
<td>€20.17</td>
</tr>
</tbody>
</table>

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Time Temperature Titration Turbulence Technology Training
Cip : Optimisation :

Solutions :

- Detect when the alkaline or acid wash solution has achieved ideal concentration (conductivity)
- Detect and adjust for fluctuations in the concentration of the wash solution due to soiling (conductivity)
- Confirm the flow of soil in the waste return (optical)
- Confirm the end of the wash cycle by detecting no further soil (optical) and normal chemical concentration (conductivity)
- Confirm the end of a rinse cycle when all chemicals have been flushed (conductivity)
Cip : Optimisation : Solutions ?
Cip : Optimisation : Solutions ?

Time, water and energy wasted.

Effective  Safety  Overwash

NUMBER OF WASHES

100  80  60  40  20  0

1 min  2 min  3 min  4 min  5 min  6 min  7 min
Cip : Optimisation :

Sum Up !

• Get your House in order !
• Form a multi disciplined team
• Leverage OEMs and chemical companies
• Measure the current state
• Target water first!
• Timely and meaningful – Don’t Box tick!!!
Thank you!