Mondelēz International
Dairy Products Processing Expectations

CIP specifics & Pest management

Web Seminar for MEU & EEMEA based Dairy Suppliers of MDLZ

June 17, 2015

Mondelēz International Supplier Quality Forum

This Forum is a continuation of our Dairy Supplier series of training Webinars on Mondelēz expectation for Dairy materials.

As a reminder, the first two sessions within this series were related to the topics:

- Zoning & PEM
- CCP management expectations

This last specific dairy training will cover CIP and Pest management.

You will be able to find this training posted on our Web site after this session.

Mondelēz International

Mondelēz International Supplier Quality Web Site

The Mondelēz International Supplier Quality web site is designed to facilitate the communication between Mondelēz International and our suppliers.

Here you will find all of the Quality Requirements and Guidelines for Suppliers to Mondelēz International, as well as the slides used in our Supplier Forums.

The web site includes:

- Supplier Quality and Food Safety Contractual Requirements
- Key requirement documentation
- Supplier Forum presentations
- Quality Support Material
- Contact email address
- eLearning modules

Browser Address:

http://www.mondelezinternational.com/procurement.aspx

CIP – COP Essential Course

Mondelēz International

SQE Resume

Cleaning in Place (CIP) - Program Control

- *The sanitation* program that ensures cleanliness of the food processing environment, equipment and tools

  - Documentation in paper (hardcopy) or electronic format or a combination of both containing:
  - An index that lists all CIP circuits,
  - Description of all program steps for each circuit
  - Cleaning steps, times and temperatures used
  - Type/name of detergents and sanitizers used with range of concentration to be applied.
  - Simple schematics of circuits or P&ID's
  - A list of items in each circuit that require dismantling and manual cleaning.

SQE Resume

Cleaning in Place (CIP) - design Requirements

- An automatic recording device for time and temperature located on the return pipe.
- An automatic recording of the supply pump discharge pressure or flow meter.
- A method to detect return pressure (flow) that is capable of shutting down the system during the initial rinse cycle or contains an alarm that signals a manual shut down.
- A strainer located after the supply pump.
- An automatic recording device for chemical concentration (conductivity) on the return pipe.
- If during a circuit the minimal conditions for temperature and/or concentration are not met the time shall be paused until acceptable conditions are re-established.

CIP / COP Systems

Agenda

- CIP systems
- CIP Basic components
- CIP Design Requirements
- CIP Case Studies
- CIP Watch Outs
- CIP requirements (SDS 102)
- COP

What is CIP (Cleaning In Place)?

CIP allows process plant and pipework to be cleaned without dismantling and no/little manual involvement.

CIP cleans solely by circulation and/or flowing chemical detergent solutions and water rinses by mechanical means.

- Reliable and repeatable
- Safe for operators
- Difficult to access areas can be cleaned

Typical Steps in a CIP Operation

1. **Remove items that require manual cleaning** (e.g. fill tubes, manhole gaskets, plug valves, etc.).
2. **Ensure separation between any circuits or tanks containing product** (physical breaks, mix-proof valves).
3. **Gross soil removal** (may include product recovery)
4. **Pre-rinse or flush thoroughly with cool water (max. 25˚ C). Discard pre-rinse water, flushing until relatively clear.**
5. **Run detergent solution throughout the circuit for the period of time necessary to remove the residues in the circuit.**
6. **Circulate a rinsing water.**
7. **Second detergent run** (normally acid)
8. **Disinfect/sanitize/sterilize immediately before use.**
9. **Rinse after chemical disinfection/sanitizing.**

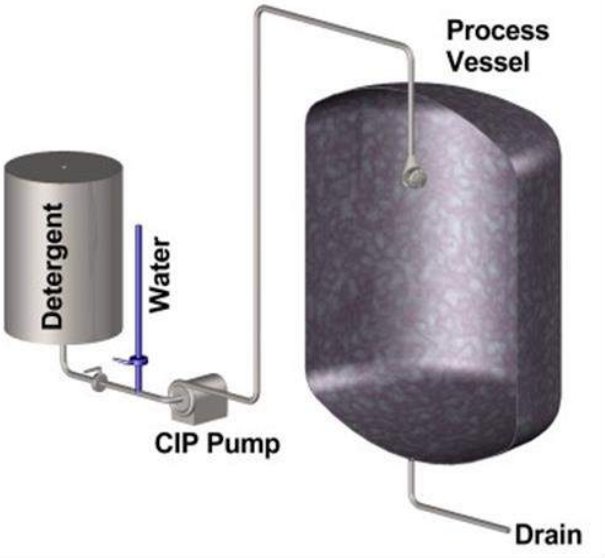
Basic Components of CIP Systems

- Permanently installed product piping and air operated valves
- CIP solution make-up tanks
- CIP pumps
- CIP supply and return solution piping
- Spray devices
- Solution collection manifolds
- Chemical feed systems and equipment
- Control/monitoring systems and recorders.

Types Of Cleaning In Place Systems

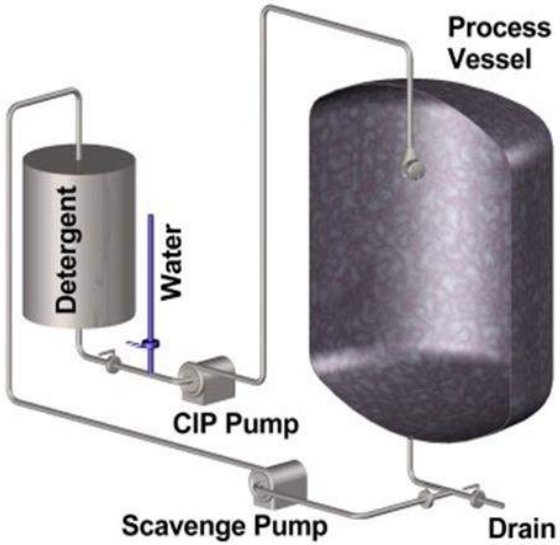
Single Pass systems

After pre-rinse a cleaning solution is introduced to the plant to be cleaned and then disposed to drain.



Recirculation system

Cleaning solution prepared in an external tank then introduced to the plant to be cleaned. It is recirculated and topped up as required until the cleaning cycle is complete.

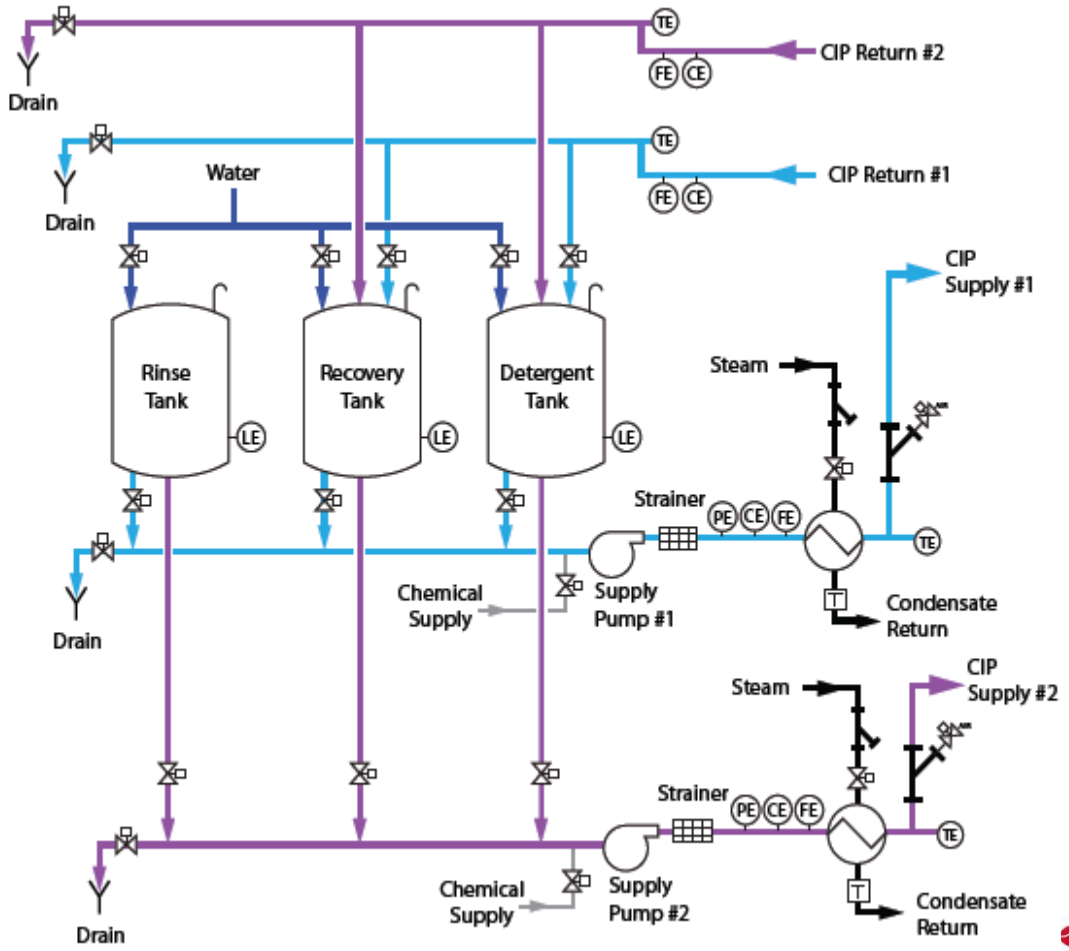


Mondelēz International

Types Of CIP Systems

Re-use / Multicircuit System

- Cleans 2 or more clients simultanously



Types of CIP Systems

Recirculation System

- less water & detergents
- greater capital outlay
- may be unsuitable due to cross contamination from one process to another (raw/pasteurized, allergens)
- Solution recovery: efficiency may be improved

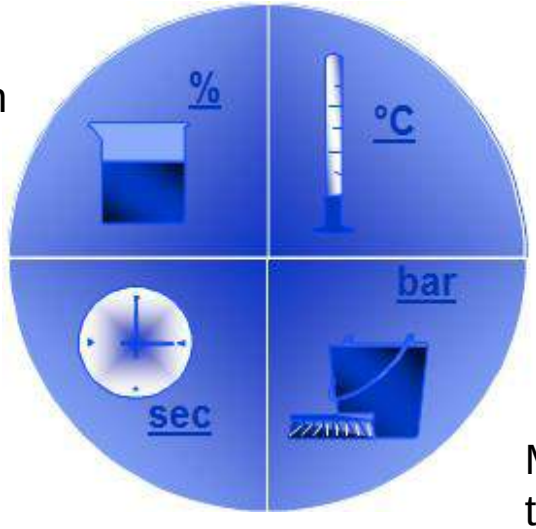
Single Use / Pass System

- More water & detergent
- Less capital
- Low cross contamination risk

4 Key Cleaning Parameters

Energy provided by the solution temperature (thermal), use of detergents (chemical), pipeline velocities/pressures (kinetic)

Cleaning effectiveness increases with concentration to a maximum, but might even decrease then.



Cleaning effectiveness increases with temperature.
Maximum with caustic at about 85° C, then adverse effects possible

Time will be a function of temperature and chemical activity. Time counts only when set point values for temperature and concentration are achieved

Mechanical action through pressure, flow rate and flow velocity.
Lines and spray devices require specific parameter values.

Mondelēz International

4 Key Cleaning Parameters – Physical Impact

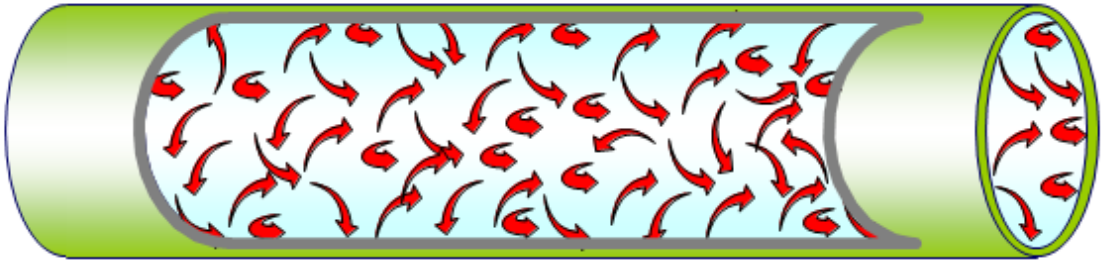
- The chemical process of dissolving needs support by mechanical force (strong fluid flow)
- Removal of dissolved dirt
- Supply with fresh detergent and temperature
- Flow speed 2 m/s, ensure turbulent flow
  - Think of pressure lost & speed reduction due to pipe length, fittings and valves!
  - Ensure proper spray pattern and volume for spray balls (1,5 mm film)
  - Rinse volume approx. 1,5 ltr/m² tank surface
  - Consider volume of film water left at tank wall after rinsing

CIP Hydraulics- Physical Impact

Turbulent and Laminar Flow

Laminar flow: uniform motion of liquid layers, travelling at different velocities without any intermixing .

Turbulent flow: turbulent motion causing intense intermixing of liquid layers.



CIP Hydraulics - Physical Impact

Turbulent Flow

•Knowing the required flow rate and the maximum (!) pipe diameter allows to determine the total pressure rating required for the supply pump.

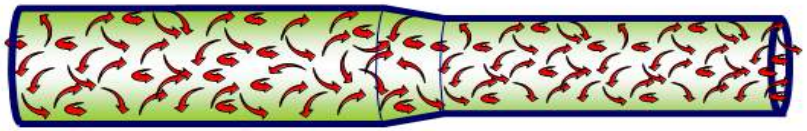
•Pressure losses due to sensors, dead ends, etc.

•Practical values for flow velocities: 1.5 – 2.0 m/sec.

- •Below values:risk of poor cleaning efficacy
- •Above values: most likely no improvement in cleaning, risk of liquid hammer and damage to pipework and fittings

Diameter:	80 mm	65 mm
Flow velocity:	2 m/sec	3 m/sec
Pressure drop:	0.55 bar/100 m	1.6 bar/100 m

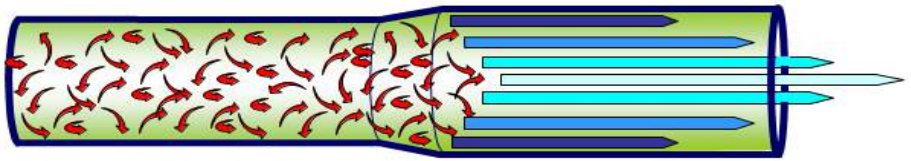
Acceptable



flow calculation

Diameter:	80 mm	100 mm
Flow velocity:	2 m/sec	1.2 m/sec
Pressure drop:	0.55 bar/100 m	

Not acceptable

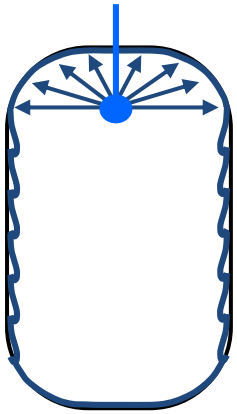


CIP Hydraulics - Physical Impact

Tank Cleaning

Low pressure spray devices

- Complete tank surface filming (04 – 0.6 mm) and mechanical action.
- Drain hole in the lower part to allow for self draining
- Typically 0.8 – 1.2 l liquid per m² of tanks surface required (1- 3 bar pressure, static spray balls), depending on soil and placing of the system
- Sprayball test Procedure (Riboflavin orange powder solution)



Difficulty of cleaning task	Flow rate per meter of vessel circumference (l/min)
Low	27
Medium	30
High	32

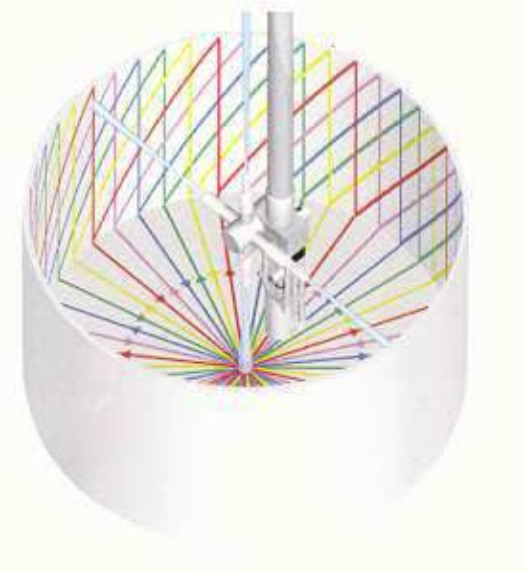
Mondelēz International

CIP Hydraulics - Physical Impact

Tank Cleaning

High pressure spray-heads (>5 bar)

- produce jets of liquid, which create mechanical action by their impact with the vessel surfaces.
- High pressure spray-heads rotate to ensure coverage of all surfaces.



CIP Hydraulics - Physical Impact

Tank Cleaning

Rotary Spray Ball

Rotating Sprays

Spinner

Flat jet nozzle

Rotating disc washers

Cluster spray heads

Mondelēz International

EHEDG Video [Automated Cleaning Devices]

4 Key Cleaning Parameters – Time Impact

- The chemical process of dissolving works on the surface of the dirt. Shift by shift the flowing detergent carries away the dirt. Layer by layer get dissolved and washed away, therfore it takes time.

- It is mandatory to ensure that the
  - Right Concentration on chemical,
  - The right Temperature and
  - Flow speed

  Working during <u>all the this time</u>

4 Key Cleaning Parameters – Chemical Impact

- During Cleaning residuals and contaminants have to be dissolved.
  - Some is water soluble (flour, starch, sugar)
  - Most of **organic dirt** (margarine, fat, oils) is insoluble in water – an **alkaline cleaner** is required!
  - **Acidic cleaners** are used for the most of **inorganic dirt** like (calcification, rust, tarnish).

- The dissolved dirt is carried and flushed away by the detergent.
- Additives (additional chemical compounds) can improve the effects of cleaning

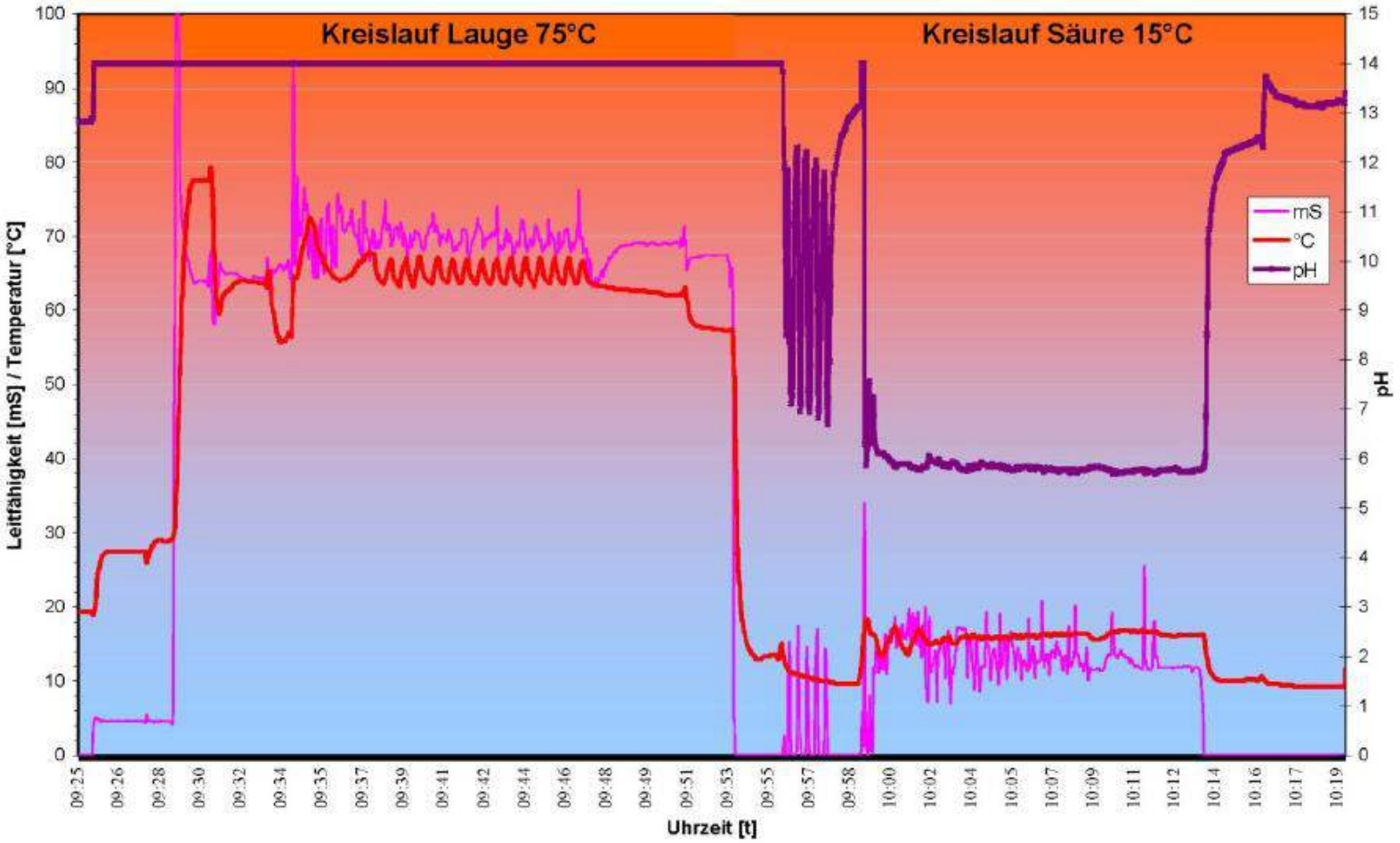
- Clean before you disinfect!
- Disinfectants
  - Oxidizing agents – effective disinfection (chlorine dioxide, peracetic acid, hydrogen peroxide)

4 Key Cleaning Parameters –Temperature Impact

- Higher temperature improves cleaning effect for many (not all) deposits
- Effectiveness of Chemical is directly link to Temperature
  - Caustic 80 – 85° C
  - Acid 60 – 65° C

- A high temperature has a microbiological effect on many microorganisms
- It is important to provide the right temperature through out the whole system you -want to clean
- Calculate the energy cost against the effects – high temperature is not always cost effective!
- Higher temperature may causes limestone
  - Makes acid step during cleaning necessary

CIP Monitoring



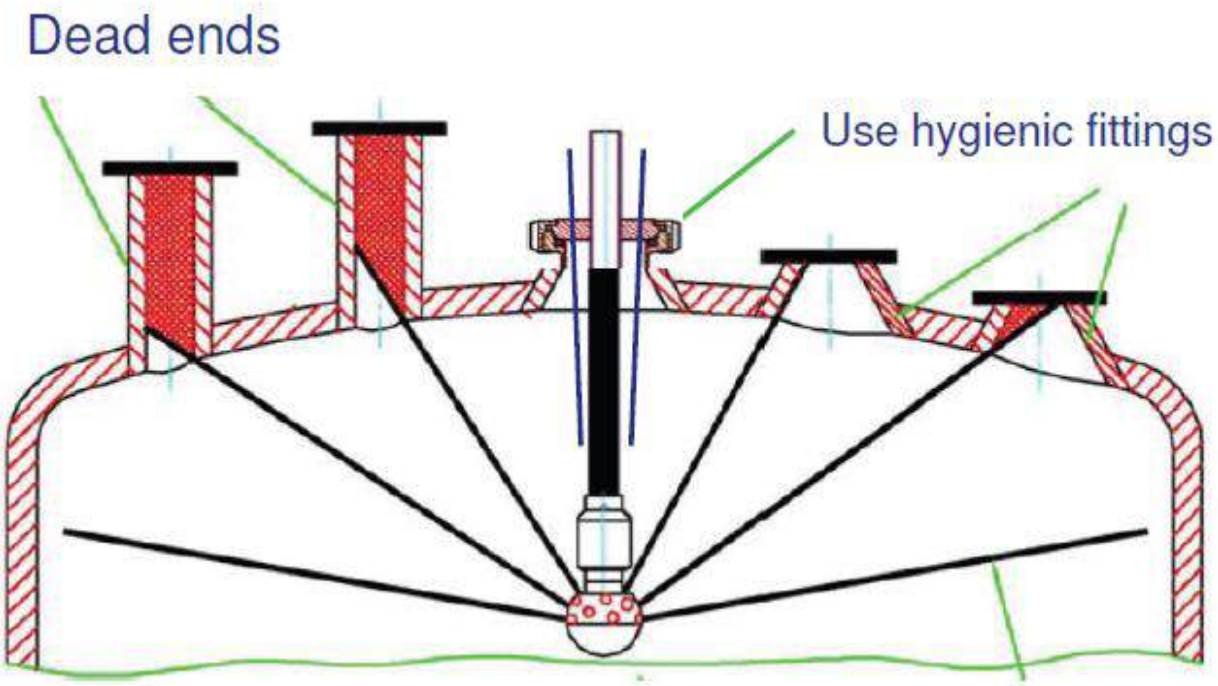
Mondelēz International

General Design Aspects

- **Functional Design Principles of Hygienic Design**
  - No Dead Ends
  - Drainability all installation
  - Compatible Materials; stainless steel 316L recommended

- Appropriate **mechanical action** through appropriately sized pumps (pressure, flow rate, flow velocity)

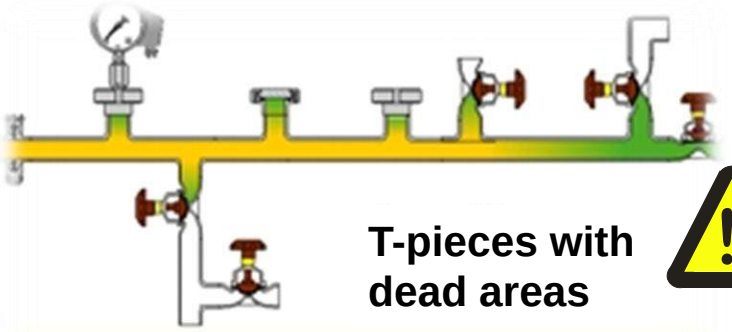
General Design Aspects



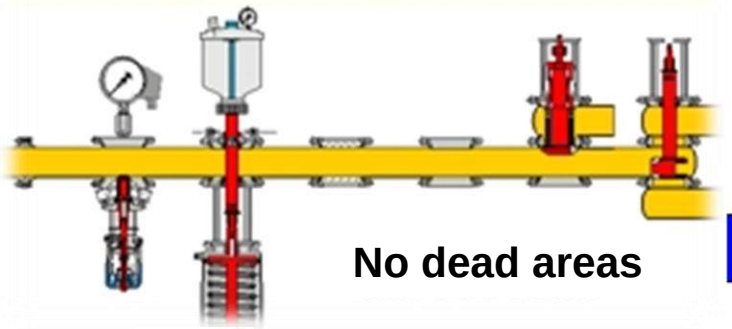
Mondelēz International

General Design Aspects

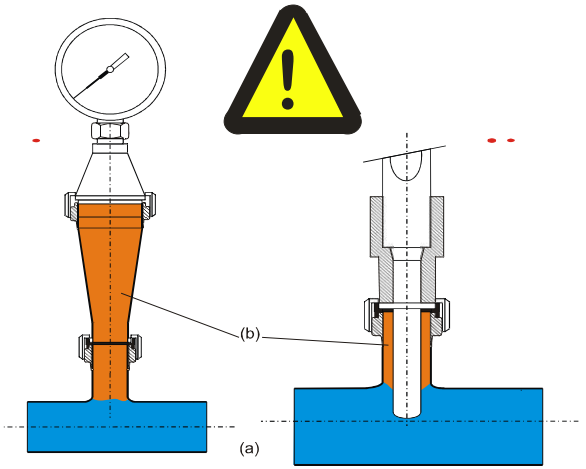
Dead Ends (stagnant zones)

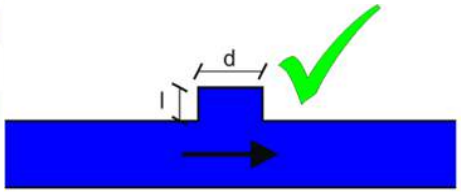


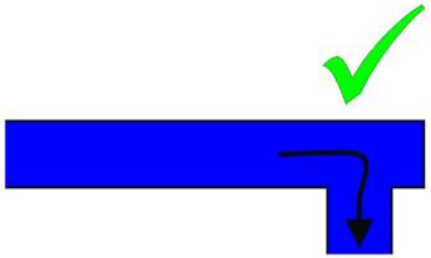
T-pieces with dead areas



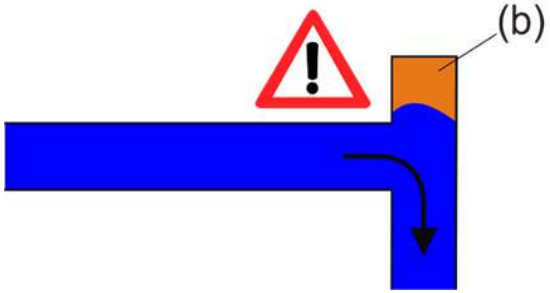
No dead areas

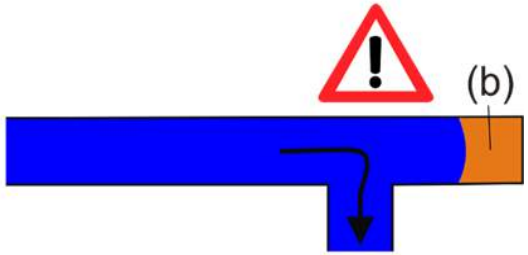






L < 1.5 D

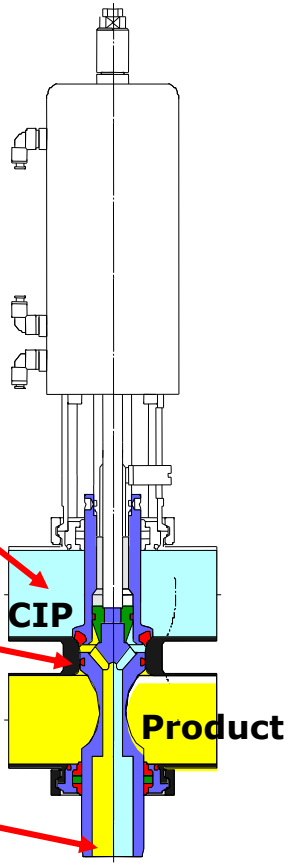




EHEDG Clip

General Design Aspects

Double Seat Valve (Leak-Free Type)



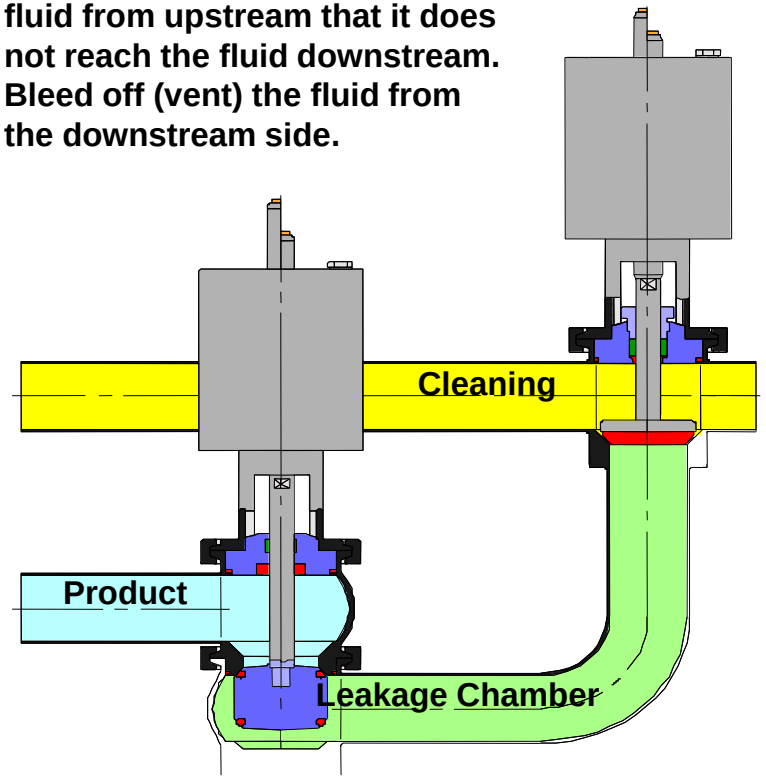
Valve position closed

Separation between product / cleaning solution

Any leakages must be discharged without pressure to the outside

"Block & Bleed" using Single Seat Valves

Principle: block the flow of the fluid from upstream that it does not reach the fluid downstream. Bleed off (vent) the fluid from the downstream side.



General Design Aspects

Pumps

- Usually centrifugal pumps are required to deliver sufficient flow

- Monopumps, Lobepumps, etc. will not provide sufficient flow.
  - Removal of lobes for CIP might be required

General Design Aspects

Strainer/Filter

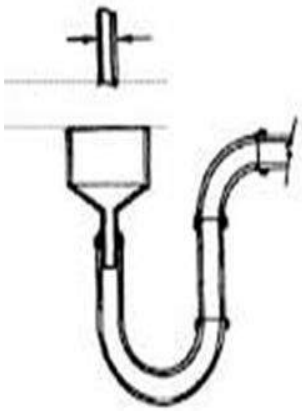
- Will catch debris that may plug spray device or valve seats.
- Installed in the supply line.
- Mesh size to be smaller than spray devices.
- Check after allergen changeovers (nuts, herbs, etc) !
- Filter directly before spray devices will reduce inspection frequencies on spray balls..

Mondelēz International

General Design Aspects

Drain Air Gap

- **No direct/welded connection to the drain.**
- **The air gap is essential to avoid cross contamination coming from back flow or creation of vacuum from the drainage to the equipment.**



CIP Case Studies

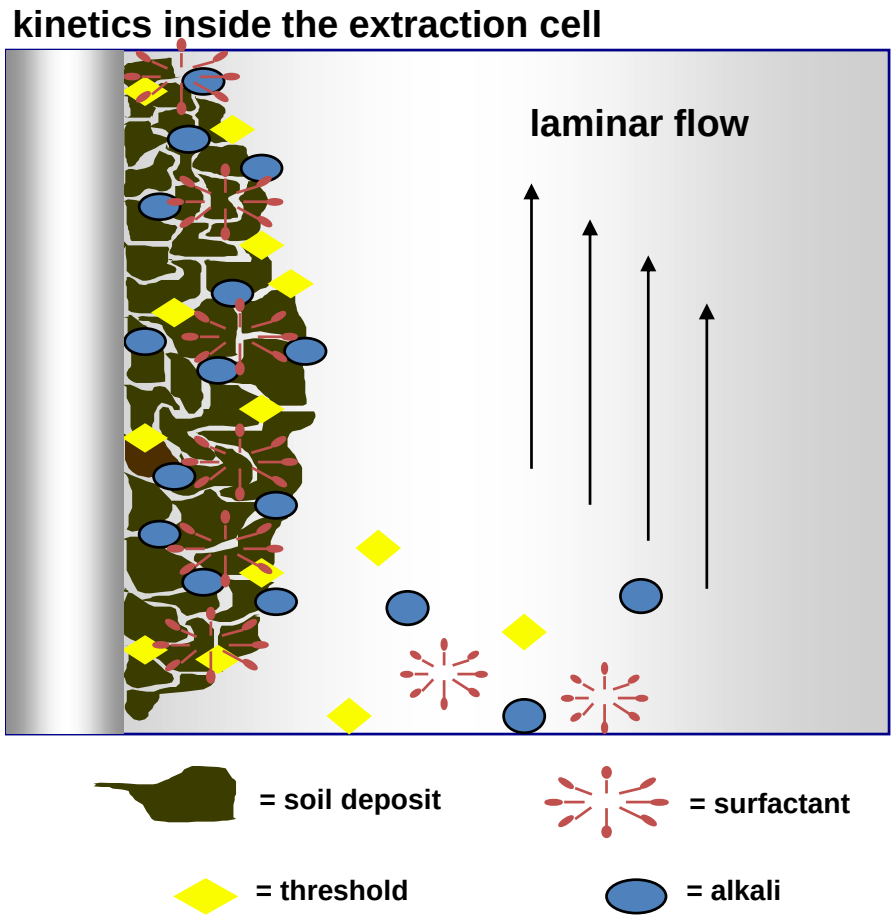
Burnt product residues adhered to the side walls of a tank. Product with high protein content. “Standard” CIP with caustic wash wasn’t effective

Addition of an oxidizing agents into the caustic wash result in effective cleaning

Mondelēz International

CIP Case Studies

Cleaning formulation



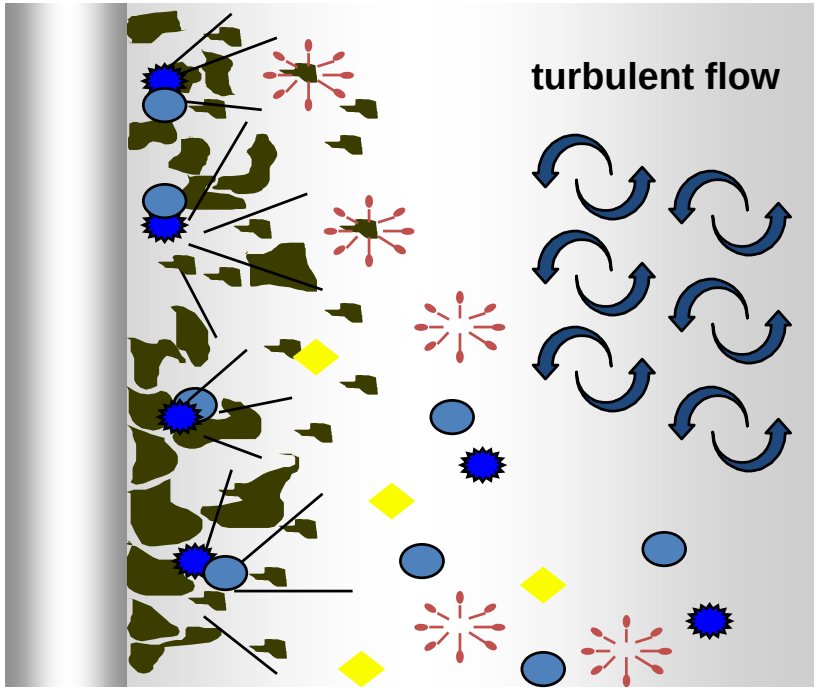
Alkaline detergent with surfactant and additive. The Surfactants support the penetration of additives and alkali into deposits.

As a result the deposits become soft. But soil doesn't break into small particles and laminar flow doesn't generate mechanical forces.

Mondelēz International

CIP Case Studies

kinetics inside the extraction cell



= deposit = small particles of deposit

= threshold = alkali = booster

= surfactant

A combination of detergent with mechanical forces (formation of oxygen)

Oxygen formation generates high mechanical forces throughout the system. Formation of oxygen also takes place inside the soil and will break high stubborn soil-deposits into small particles and carry them away.

Gas bubbles combined with additives, alkali and surfactants are responsible for this effect.

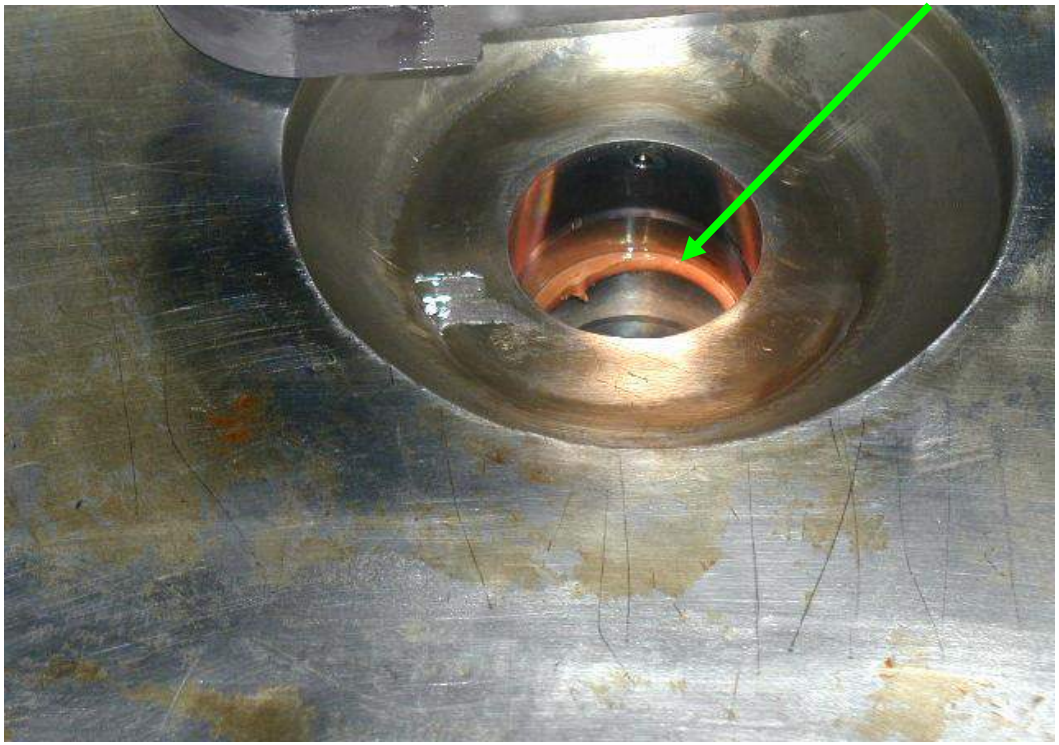
Mondelēz International

CIP Watch Outs

- Validation !
  - Every two years
  - Tear down (Physical inspection is the key)
  - Check of automatic controls, Seat valve pulsing, documentation, …
- Hygienic Design
- Simple Systems w/o automatic controls: last rinse verified
- Venting of tanks
- Spray ball maintenance (accessibility!)
- Gasket maintenance/cleaning
- Tank shadowing
- Cleaning of the CIP tanks
- Calibration of sensors

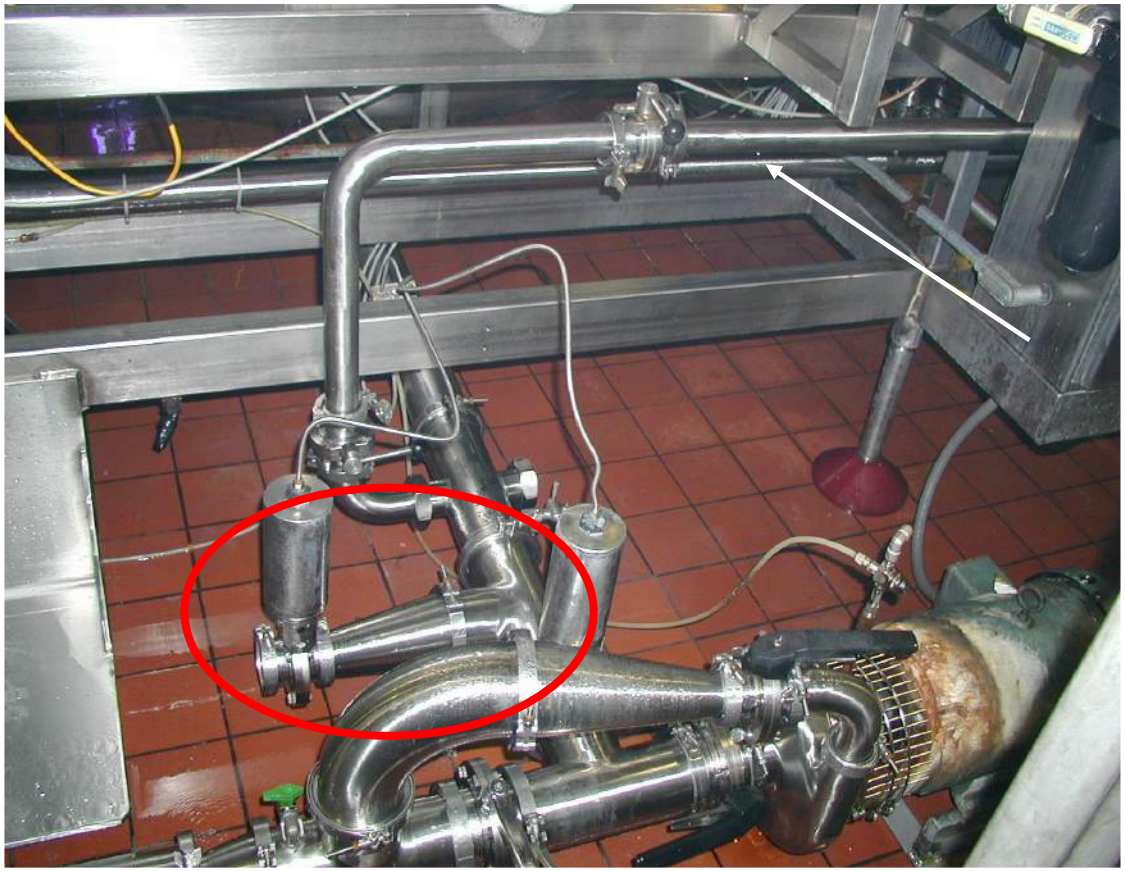
CIP Watch Outs

Damaged Gasket in Drain



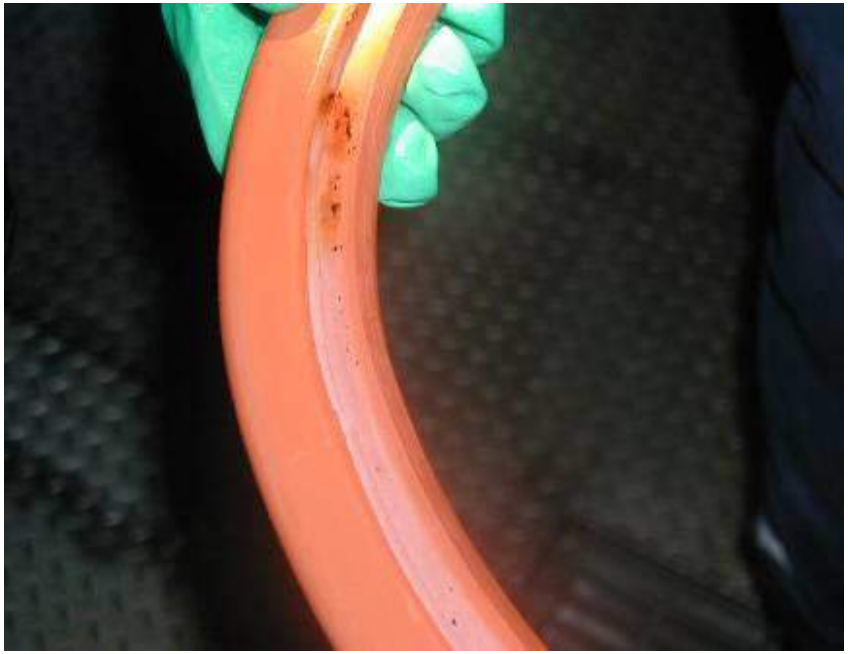
CIP Watch Outs

Dead Legs in CIP Systems



CIP Watch Outs

Inadequate gasket cleaning



Gasket left inside tank during CP

Gaskets in soak tub – not enough space and not enough solution

Mondelēz International

CIP Watch Outs

Incomplete flow coverage
Under lip of doorway

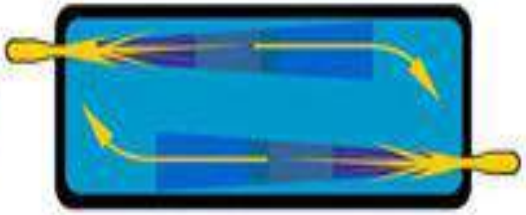
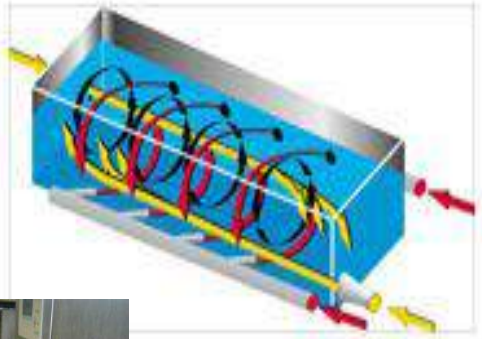
CIP Watch Outs

Cock valves dismantled for each cleaning?

Mondelēz International

COP- Cleaning Out of Place

- Washing of disassembled equipment parts
- Immersion washers with turbulent circulation systems to clean the interior and exterior of a wide variety of parts with and without internal cavities
- Manual or automated.


COP- Cleaning Out of Place

Key Steps

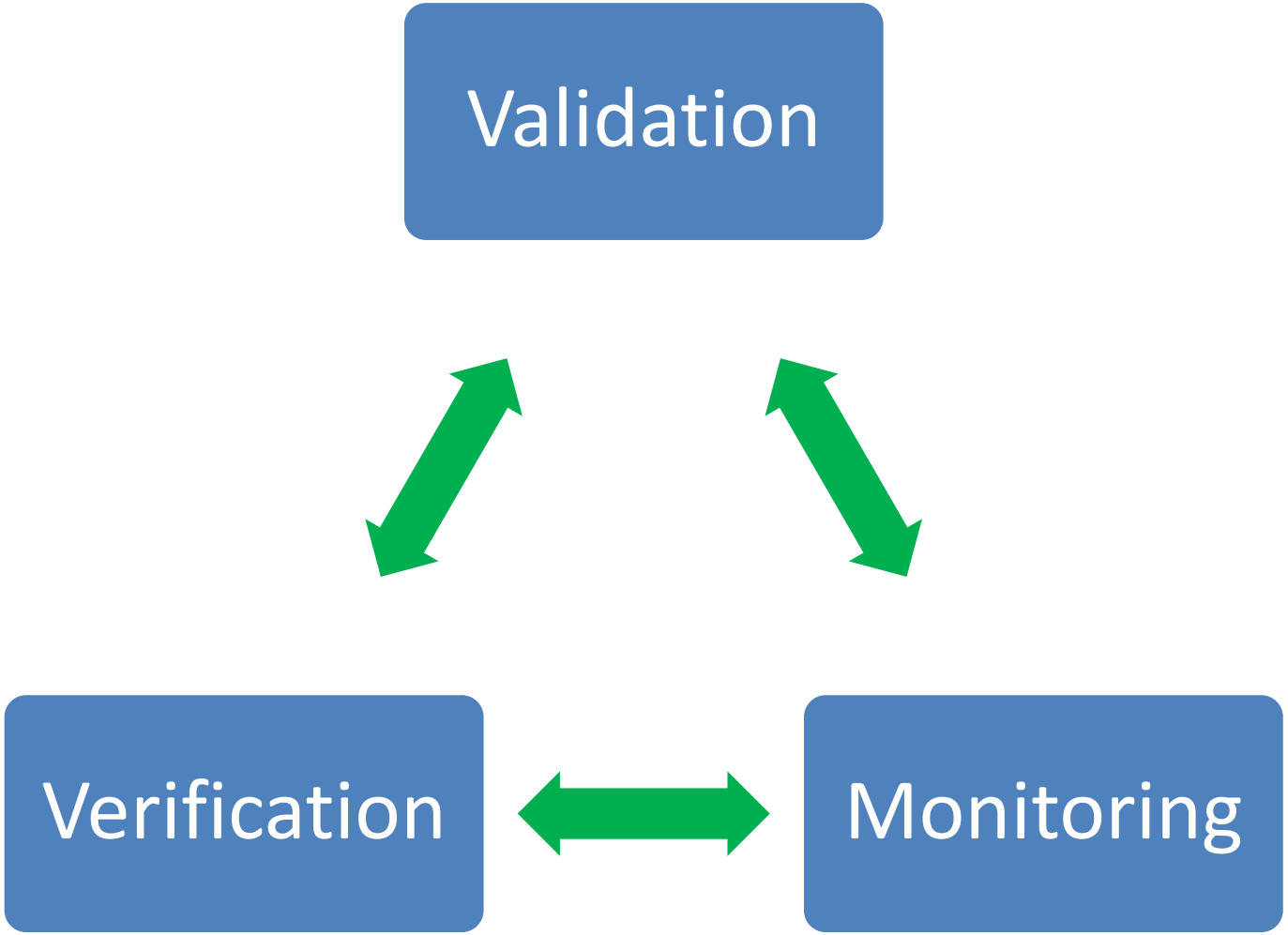
- Pre-rinse/brush to remove gross soil
- Place parts in COP tank, add water to cover parts (gaskets removed prior cleaning)
- Turn on agitation/circulation in COP tank
- Add detergent - check concentration
- Turn on steam to maintain temperature (e.g. min. 65ºC)
- Circulate solution, then overflow COP tank to floor to remove floating soils. Drain.
- Disinfect /sanitize after reassembling).

Recommendations:

- NO re-use of COP cleaning solution that contain allergen particulates
- If fat is present, overflow the unit tank during the final rinse to remove displaced soil and ensure not redeposit upon cleaned equipment when the COP tank is drained.

Mondelēz International

Cleaning Control



Definition

VALIDATION

The specified performance of the system is confirmed, i.e. the cleaning regime as specified is appropriate and meets the standards of cleanliness.

VERIFICATION

Confirmation on a regular basis that the system is continuously meeting the specification. NOTE: Before a verification program can be set up a validation is required.

MONITORING

Systematic observation, registration and recording of data to control a system and to avoid out-of-limits situations.

Validation

- Expected program
  - Tear down and physical inspection.
  - Microbiological test (where applicable – in dependence upon product sensitivity).
  - Documentation review (cleaning parameter, inspection log, Non-PEM results).
  - Update of the post-cleaning / pre-operational inspection forms based on the outcome.
  - Additional validation requirements for CIP/ACS systems
    - Documentation Review (List of all CIP/ACS units, circuits, tanks…)
    - Review of the CIP program (Parameter, Cleaning steps,…)
    - Check of automatic controls, interlocks, valve pulsing…
    - List of items in each circuit that require dismantling and manual cleaning is current.

Methods
Example of a tear down inspection

Critical items :

- Pumpes / Manifold and dosing pieces / Valves / Probes and dead legs

Mondelēz International

Verification

- Expected Program

- Functionality check of spray devices through visual inspection

- cleaner solution strengths control.

-Strainer integrity checks,

  - frequencies of measures depend on:
    - Product sensitivity
    - Frequency of cleaning
    - Type of equipment
    - Cleaning procedure

Monitoring

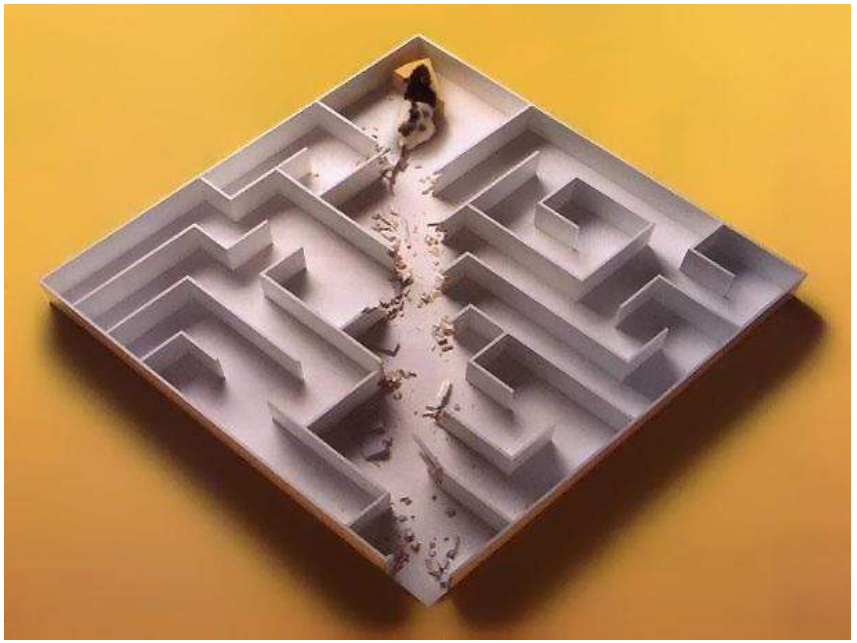
- Expected Program
  - Visual pre-operational and/or post clean inspections performed and documented (includes corrective actions and verification of corrective actions!).
  - Hygiene (non-pathogen) monitoring programs.
  - Clean equipment swabbing
  - ATP testing is optional.

The procedure shall be documented and shall define the following:
- Target organism (product and process dependent);
- Sampling location;
- Frequency of testing (recommended minimum monthly);
- Methods and test result acceptance criteria;
- Process for corrective actions

Mondelēz International

Pest Management

Mondelēz International



Pest Management

MDLZ Requirements

❑ SQE - Pest Management

All suppliers shall have effective pest management programs and pest control practices

The pest management program shall include:

- Pest management plans, methods, schedules
- Inspection procedures and frequencies.
- Required documentation of pest activity log and analysis of records for trends in activity.
- Corrective actions for increased trends /activity.
- Training requirements.
- A map showing the location of pest control devices, such as indoor rodent traps, glue boards, insect light traps, outdoor bait stations, and pheromone traps.
- Records of application of pesticides.

- To assist in establishing appropriate programs to **control pests** that help to ensure the safety and quality of products…
- Pest control activities shall be performed by certified pest control contractors or personnel with equivalent training.
- Pest Control Company is not an guarantor of an effective pest control.
  - Not pro active
  - Lack of experience in the food industry
  - Lack of education

Mondelēz International

Pest Management

REGULATION (EC) No 852/2004 Hygiene of foodstuffs

“At all stages of production, processing and distribution, food is to be protected against any contamination likely to render the food unfit for human consumption, injurious to health or contaminated in such a way that it would be unreasonable to expect it to be consumed in that state.

Adequate procedures are to be in place to control pests. Adequate procedures are also to be in place to prevent domestic animals from having access to places where food is prepared, handled or stored .”

European Regulation requires that no animal and no excrements of animals can be found in food manufacturing facilities.

Pest Management

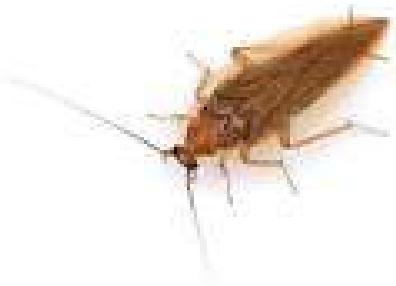
The presence of pests in any food handling premises is unacceptable

- The spread of disease – pathogens are transferred from the gut or external surface of the pest
- Damage to assets in the facility
- Damage to food materials and finished products
- Contamination of work surfaces and foodstuffs
- Adverse public opinion and loss of reputation

Mondelēz International

Classification of Pests










Classification of Pests

Three categories of pests (FDA Guidance)

Category I - Vectors

- Pest in that category are high priority pest. There are able to transmit pathogens (e.g Salmonella, ecoli, Cholera, Typhus) to food and cause allergic reactions.

Category II - Indicators of Insanitation

- This category includes pests whose presence in food or in the environment of food processing or storage areas is an indication of insanitary conditions.
- These pests are considered medium-priority pests and are divided into four groups: Opportunistic pests, Adventive pests, Obligatory pests, Parasites and predators.

Category III - Incidental Pests

- Low-priority pests because they pose no health hazard and are not indicative of insanitation. Nevertheless their presence in food would be unacceptable.

Classification of Pests

Three categories of pests

Category I – Vectors

- E.g. Mouse, Rat, Cockroach, House Fly (high number), Pharaoh Ant

Mondelēz International

Classification of Pests

Three categories of pests

Category II – Indicators of Insanitation

- E.g. Moth – Beetles – Fruit flies – Drain flies

Mondelēz International

Classification of Pests

Three categories of pests

Category III – Incidental Pests

- E.g. Bees – Butterfly – Birds

Mondelēz International

Rodent Characteristics

House Mouse

A family of 6 mice in a plant can grow to 50-60 mice in only 90 days.

Source: http://www.belllabs.com/

Can slip through a 0,5 cm opening

Rodent Characteristics

Norway Rat

Can slip through a 1,25 cm opening

Source: http://www.belllabs.com/

Rodent Characteristics

Roof Rat

Can slip through a 1,25 cm opening

Rodent Characteristics

Rodent:	Norway Rat	Roof Rat	House Mouse
Scientific Name:	Rattus norvegicus	Rattus rattus	Mus musculus
colour:	Brownish Red	Dark Grey	Black, Dusty Grey
Average Weight:	280-480g	225g	20g
Length:	30-45 cm	33-43 cm	15-18 cm
Body:	Thick body, Blunt nose	Thin body, Pointed nose	Small head & body
Sexual Maturity:	2-3 months	2-3 months	1-1,5 months
Gestation Period:	23 days	22 days	19 days
No. of Young:	6-12 per litter	6-8 per litter	5-6 per litter
No. of litters:	Ave. 4-7 per year	Ave. 4-6 per year	Ave. 8 per year
Diet:	Meats, fish, grains, almost anything	Fruit, Vegetables seeds, Grains	Grains, Cereals meats, fish, ect.
Average Daily Food:	28-85g food	28g food	3g food
Water Consumption:	28ml water	28ml water	1.5ml water
Length of adult life:	18 months	18 months	15-18 months
Faeces:	Blunt ends	Pointed ends	Pointed ends
Nests:	Burrows, 28-135 meters from foods & water	Trees/Rooftops 30-90 meters from food & water	Corners 3-9 meters from food & water

Rodent Characteristics

General Behaviour

1. Rodent are nocturnal
    - Rodents typically eat at night.
    - Daytime activity is a sign of high level of infestation.

2. Feeding habits
    - Commensal rodents are omnivorous (eat everything) and opportunistic (adaptable on the current situation) foragers
    - Rats hoard enough food that will last for weeks.
    - Rodents hoard food in places where they feel comfortable to feed

3. Hierarchy
    - There is a hierarchy that rodents develop where the more dominant rodents get to feed first and receive the best nesting areas.
    - If enough food is available and harborage areas exist, less dominant rodents can also survive.

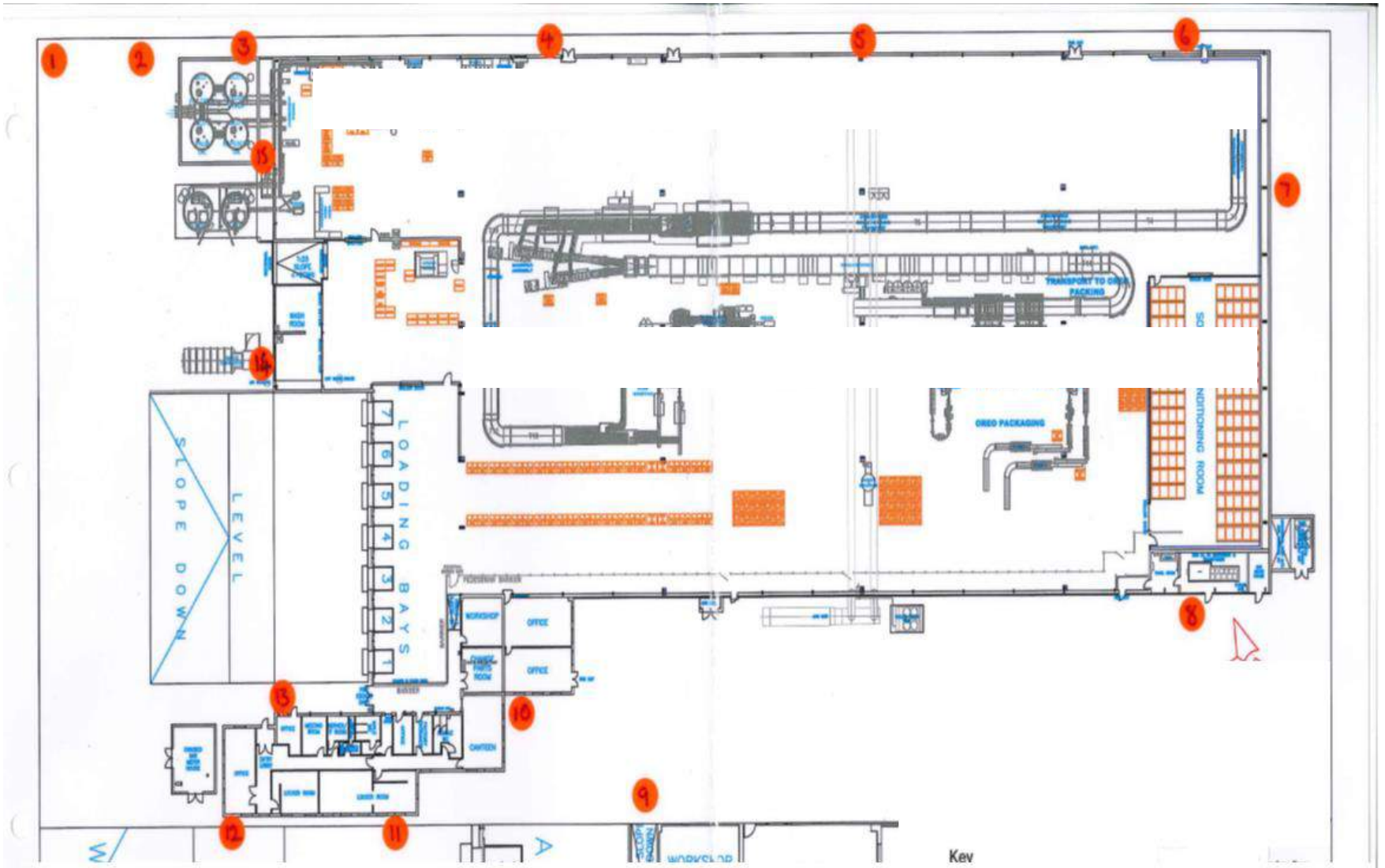
Rodent Characteristics

- Mouse
  - Prevalent and exist in all climates
  - Lives indoor and outdoor
  - No water needed!
  - Curious
  - Adaptable
  - Nocturnal (active by night)
  - Omnivorous (eat everything)
  - Eats at 30 different places per day
  - Run along walls and cross a room only for getting food or in stressful situation

Rodent Characteristics

- Rats
  - “Neophobic” (afraid to new situations)
  - extremely adaptable and prolific (highly reproductive)
  - Consume a lot of food once they feel comfortable
  - Nocturnal (active at night)
  - Omnivorous (eat everything)
  - Hierarchical family
    - The A rat (dominant male) and B rat (female) are very hard to eliminate by non-toxic control measures. The C rats (young rats) acting as ‘scouts’ and will warn the rest of the family in case of any risk and danger.
  - Good climbers and swimmers
  - When running, rats can jump horizontally up to 1 meter. Otherwise they can vertically jump nearly 0,5 meter.
  - Rats can fall 5 stories levels without harming themselves

Scenario Rodent



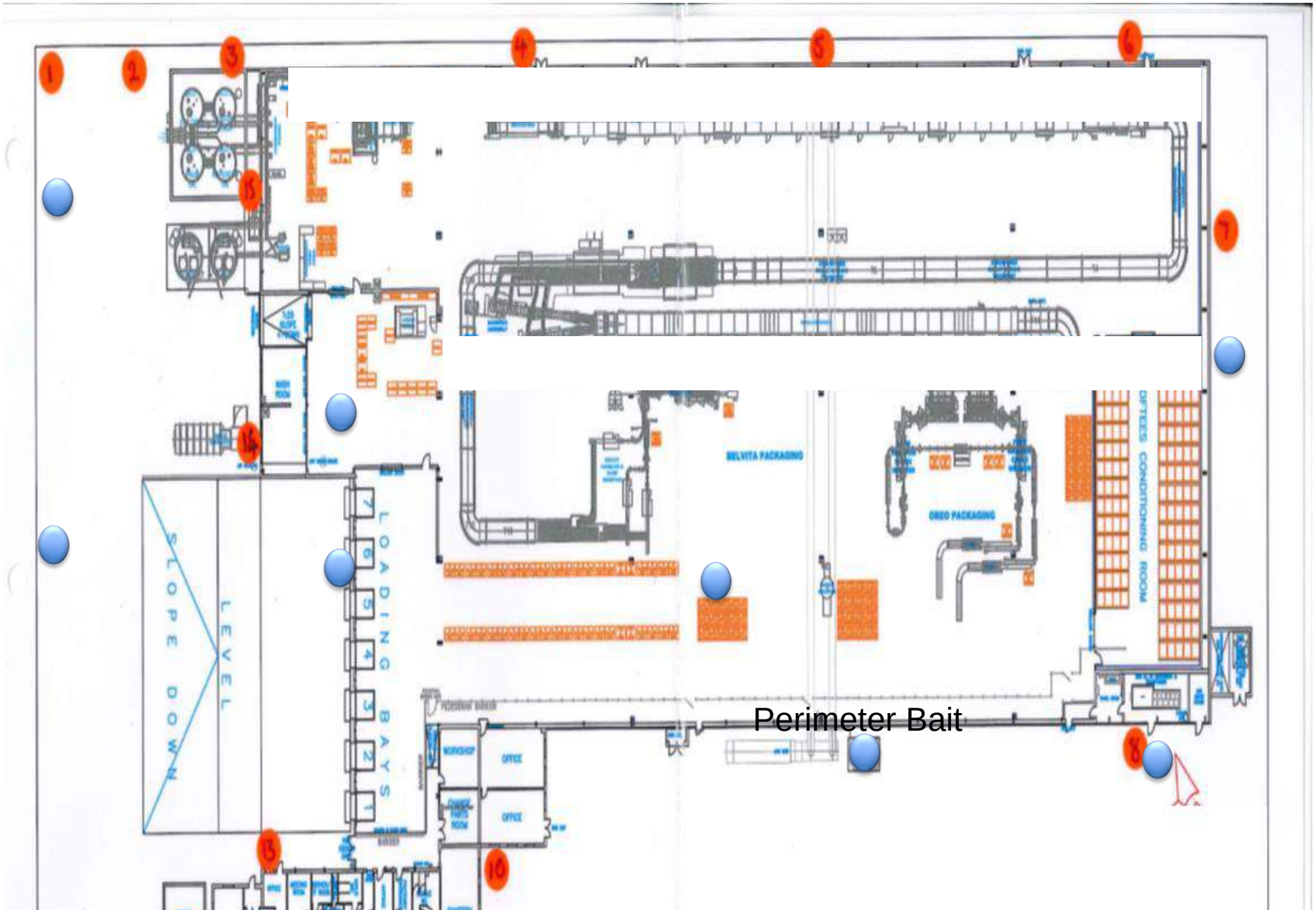
Scenario Rodent

Mondelēz International

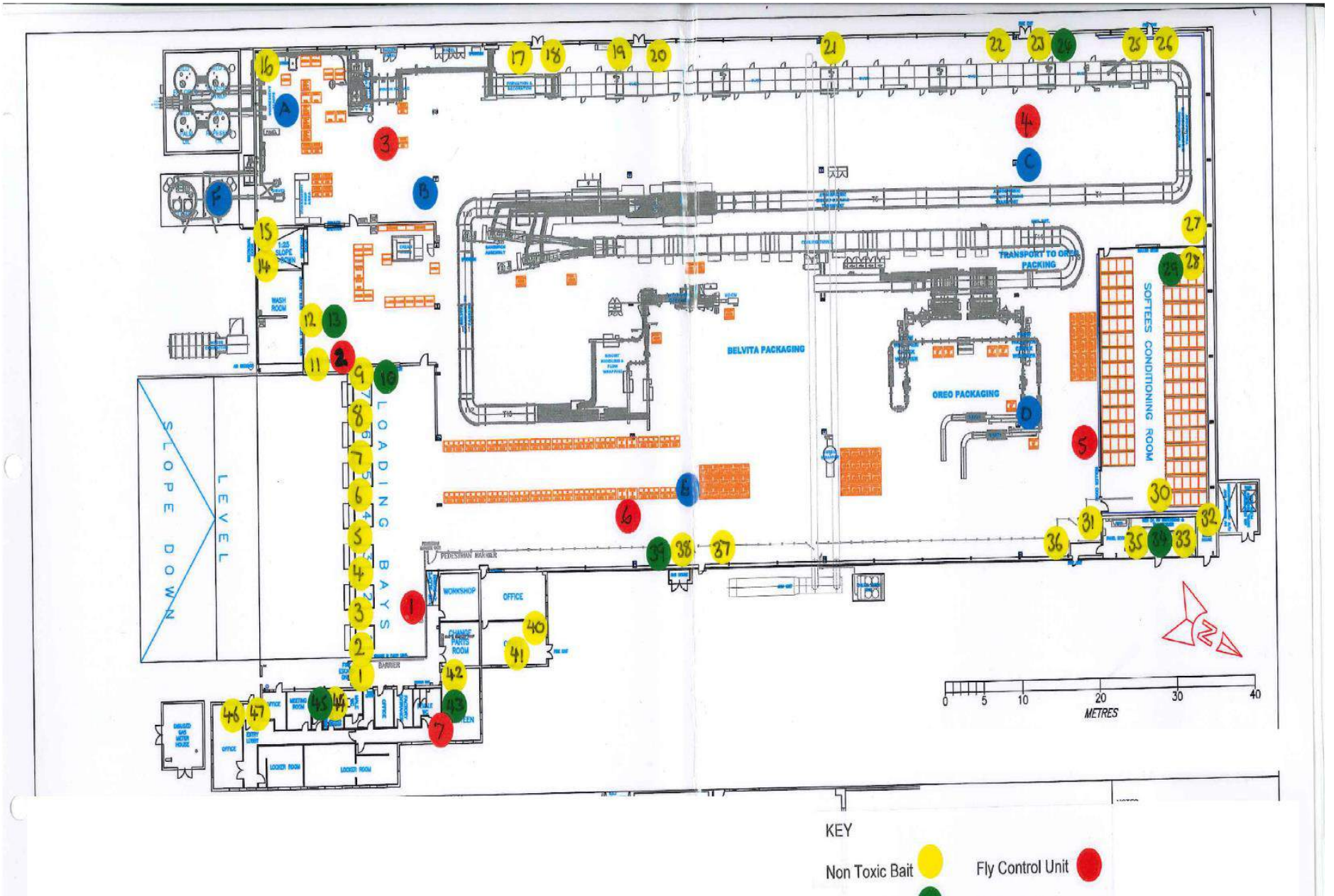
Scenario Rodent

Mondelēz International

Scenario Rodent



Scenario Rodent



Scenario Rodent

Main Insects in Food industry

Vinegar Flies (small Fruit Flies)

Moth (Cacao)

Beetles (Flour Tribolium, Skin Beetle)

Drain Flies

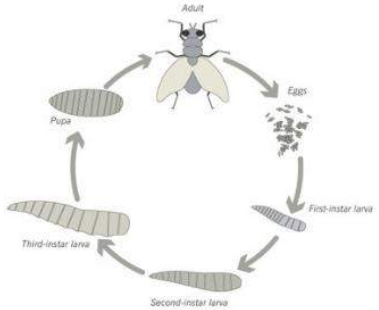
Cockroach

Ants

Mondelēz International

Flies and Midges

(Diptera)



- It can only ingest liquid food → They spit on the dry food to make it liquid.
- This feeding mechanism results is food contamination with pathogens and spoilage organisms.

Flies

(Musca domestica, Fannia canicularis)

- From egg to Imago in around 2-3 weeks (depends on temperature)
- Diurnal (active during daylight)
- Prefered places for hatchery are compost piles, farms (excrements), waste areas but also any kind of meat
- The eggs die at temperatures below 8ºC. At 12ºC the female fly cannot produce any eggs.
- Able to fly distances of 30 km / 18 miles

Image source: www.ehow.com

Image source: Novartis

Fruit Fly

(Drosophila Melanogaster)

- Females can lay up to 400 eggs, larvae can hatch in about one day.
- Prefer fermented and molder substances, larveas needs microorganism (Bacteria, Yeast, Fungi)
- Common in drains, under tiles and similar situation

Image source: howtoeliminatefruitflies.com

CORRECTIVE ACTIONS

- **IMPROVING CLEANING**
- Sanitize drain and use insecticide
- insect protection screen at the windows
- Special fruit flies's trap, produced by Agrisense in UK which are also attractive for wasps and bees.

Drain fly
(Psychodidae)

- From egg to Imago 7-28 days (depends on temperature and food)
- Lifetime of an adult around 2 weeks
- Very common in drains and stagnant water
- Nocturnal (on the wall during the day)
- Bad flyer
- The larvae development only takes place in a gelatinous film of organic material, e.g. in siphons. (dirty drains)
- The larvae feed on algae, fungi and bacteria in sewage and organic sludge
- The adults feed on polluted water

Larvae

CORRECTIVE ACTIONS

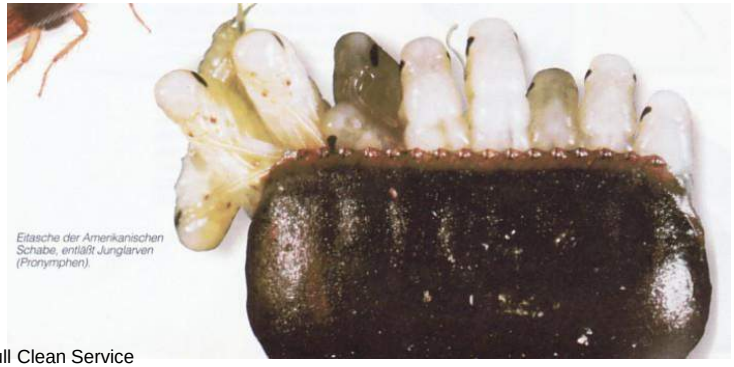
- Clean pipes and drains thoroughly to remove accumulated slime.
- Pouring hot water down the drain may provide short-term control.
- Do not pour insecticides down drains to kill drain flies. It's not effective due to the slime.
- http://www.draindomain.com/drain%20flies.html

Cockroach (German, Oriental, American)

(Blattella Germanica / Blatta orientalis / Periplaneta americana)

- Hemimetabolie : Egg-Nymph-Imago
- Nocturnal (usually active in the dark only)
- Very fast moving 1.3 m/sec and very sensitive (10.000 sensory nerves on antenna)
- The female produces around 4-8 oetheken (egg capsules)
- 1 Oetheken (egg capsule) consist of around 30-40 eggs (1female / 240 descendants)
- The egg capsule (oethek) is extremely resistant against any pesticide and able to develop autonomously.

Orientalische Schabe beim Abwerfen des Eipaketes.



Eitasche der Amerikanischen Schabe, entläßt Junglarven (Pronymphen).

Image source: KS Full Clean Service

Cockroach (German, Oriental, American)

(Blattella Germanica / Blatta orientalis / Periplaneta americana)

- The Nymph hatches after 1 month (25ºC) to 2.5 weeks (30ºC)
- Cockroaches prefer to live where there is food, high temperatures and moisture.
- No preference for specific foods
- Stops its activity below 4ºC and die at temperatures above 42ºC
- Survives without any food for around 40 days
- Blatta orientalis are not able to climb!
- Cockroaches can enter areas through the drain. Therefore Warehouses can also be entered.

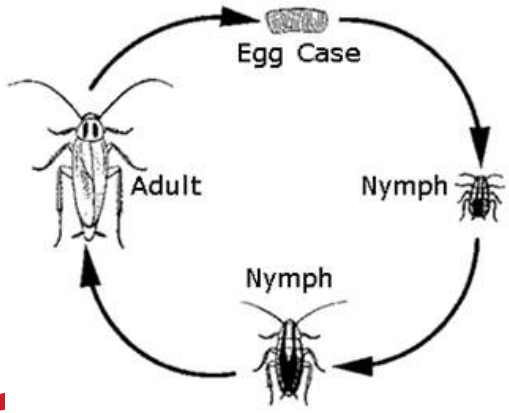
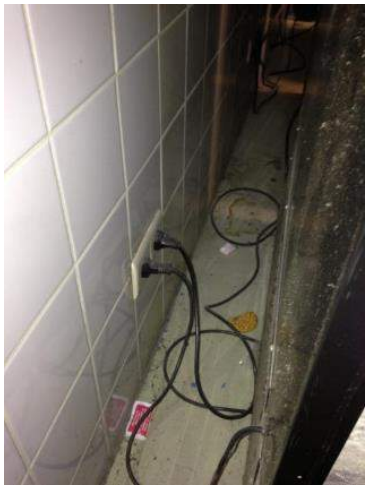


Image source: cockroach pictures.com



http://www.youtube.com/watch?v=Rpu0ebHd1hk

Corrective Actions

Trap Placement for Cockroach

- Avoid water access and product accumulation
- Use adapted monitoring traps; attractive glue traps for roach are available
- Trap Placement for Cockroach
  - Boric acid is one of the most effective cockroach control agent.
  - The key to successful control with baits is proper placement.
  - Bait trays should be placed in all areas where cockroaches are seen, or with high probability of infestation, like hand wash basins, sinks, refrigerators, trash containers, inside cabinets, drains, battery-charging station, …
  - Roach traps have a sphere of effective influence of 1.5 m.
  - An electrical cabinet is the perfect biotope; quiet, warm, dark and direct access by the cable routing to any food source.
  - It's absolutely crucial that the traps stations are positioned flush into corners or up against edges.
  - Spraying around bait stations with other insecticides or cleaning agents shall not be done, as this could deter roaches from taking the bait.
- Also, moths (male and female) are attracted by cockroach traps due to the water.

Corrective Actions

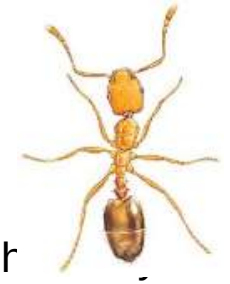
Source: Thomas Voigt

Cockroach glue trap

Floor Cleaning machine with a trap

Pharaoh Ants

(Monomorium pharaonis)



- Holometabolie : Egg, Larva, Pupa, Imago
- From egg to Imago in around 40 days
- The optimal developmental conditions are at about 27ºC and 80% h
- Colonies are close to warm areas (also switchboxes) but enter also cooling rooms for foraging
- One colonie can have up to 2000 Queens those create there own colonies later and be able to infest a side very quickly
- Like to build colonies in electrical installations like switch boxes
- The "house ant" feed there queen and larves with spit of the food. Pharaoh ants are equipped with gland and therefore the workers are dying before they can feed the others.

Source: http://pestcemetery.com/how-to-tell-a-thief-ant-from-a-pharaoh/

Pharaoh Ants

(Monomorium pharaonis)

- Prefer food which contains protein like fish, meat, eggs, insects… but also excrements (others prefere carbohydrate)
- The problem for the food industry is the possibility to transfer pathogens like Clostridium, Salmonella, Pseudomonas…
- Difficult to elimate because the pharaoh ant avoid places with dead conspecific
- Ensure that the right type of baits are used (protein based)
- http://www.youtube.com/watch?v=QJcVChsoFL4

Source: http://pestcemetery.com/how-to-tell-a-thief-ant-from-a-pharaoh/

Mondelēz International

Corrective Actions

Eliminating Pharaoh Ants

1. Determine where the pharaoh ants are located (often found near sources of water and in warm areas)
2. Avoid spraying and dusting, as these methods of pest control will only cause pharaoh ant colonies to scatter
3. Figure out what the pharaoh ants are using as food source, as this information is needed to select the right bait. All ants need carbohydrates, fat and sugars to survive. Pharaoh ants prefers proteins.
4. Choose a slow-acting bait to ensure that the ants can bring it back to the nest.
    - Bait gel (E.g. Maxforce Quantum gel (protein and carbohydrate based)
5. If ants don't take the bait offered to them there might be two reasons
    1. it might be the wrong type.
    2. the ants do not need food at the moment.
6. Eliminate any competing food source, as the ants will be attracted by the food and not by the bait.

Insect Monitoring

Mondelēz International

Insect monitoring

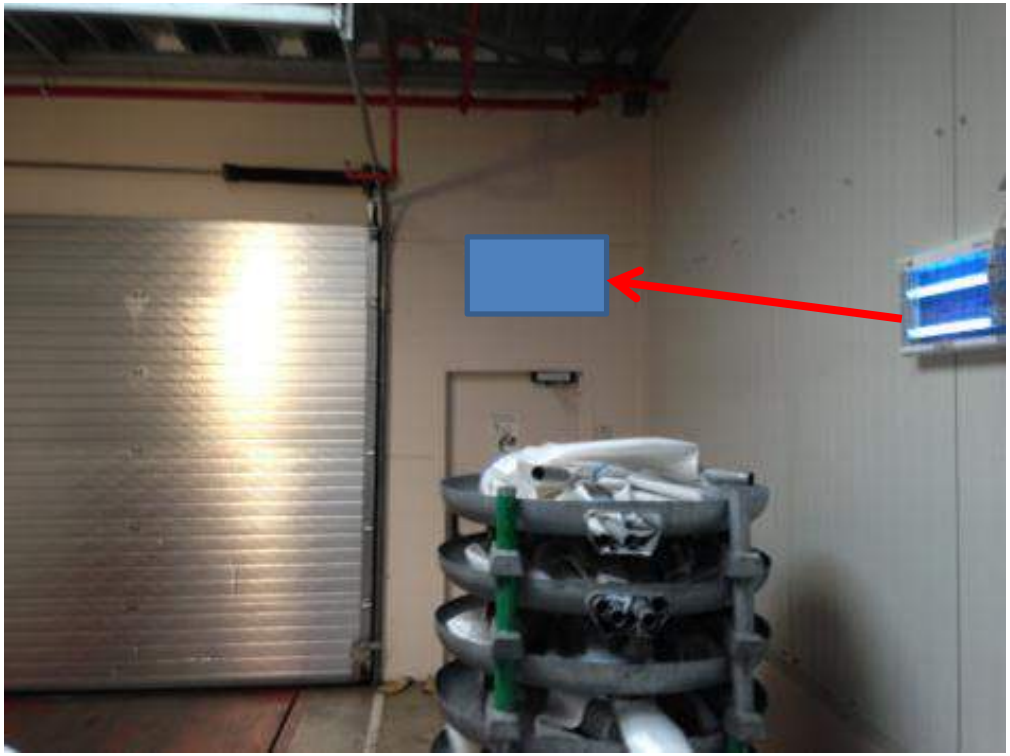
Insect light traps :

- The ILTs shall be placed in such a way that they do not attract insects entering the plant.
- The position of ILTs shall avoid any contamination of the product due to dead insects.
- From each point in the plant one ILT must be visible.
- Insects should be able to easily fly to the ILT’s therefore the placing near air blowers, air curtains or air conditioning shall be avoided.
- Yellow glue trap will increase the attraction.
- The position of the units shall ensure that the flies are caught before they can enter critical areas.
- To ensure the best effectiveness of the ILT’s they should not be in competition to other light sources like windows.

Insect monitoring

Insect light traps :

Is this the best location?



Insect Monitoring

Pheromones used for pest control

- Sexual pheromones for textile moths
- Sexual pheromones for food moths (Plodia interpunctella, Ephestia kuehniella, Ephestia elutella) - work on a long distances (operating range ~ 10 meter / 390 inches)
- Sexual pheromones for beetles (5 different pheromones) - work on short distances (operating range ~ 2m / 78 inches)
- Aggregation pheromone for cockroaches (male and female)

Source: Thomas Voigt

Insect Monitoring

Other bait substances and possibilities that are available for pest monitoring

- Bait substance based on the **Food smell** to attract
  - female moths,
  - beetles,
  - mice and rats

Corrective Actions

Measures to Control Infestation

Typical issues often observed

- Issues
  - Product accumulation
  - Stagnant water
  - Dirty drain
  - No P-trap
  - Direct access from exterior

- Corrective actions
  - Increase cleaning frequency
    - Drain
    - PEC & PIC
  - Close open access and use windows screen
  - Increased number of well placed bait traps
  - Heat treatment
  - Fumigation

Mondelēz International

Measures to Control Infestation

Recommended action levels:

Flies

- Action limit shall be defined based on the annual average and the seasonal effect

Moth

- Reaction required > 5 / month / Trap
- Heavy infestation level > 10 / month / Trap

Cockroach

- Low (0-5) / month / Trap
- Medium (6-10) / month / Trap
- High(>10) / month / Trap

Beetles

- Low (0-5) / month / Trap
- Medium (6-10) / month / Trap
- High(>10) / month / Trap

Heat treatment

Insects

- Tempertures between >45 ºC for a defined period of time let denature the body proteins of the insects.
- Effective against all type of insects in every life-stage (Egg, Larvea, Pupa, Imago)
- A constant Temperature of 50-60ºC is applied without damaging any equipment

http://www.youtube.com/watch?v=O8Fh4tm0v-4 (heat treatment)

Image source: ThermoNox

Insect Treatment

- Definitions of the different chemical treatments required:
  - FUMIGATION
    - Fumigants form a gas that will kill insects and rodents.
    - Gas has a high penetration of any surface e.g. big pack, grain of wheat
    - District Office must approve the treatment
    - Fumigants handled by professionals only (licensed and certificate)
    - Permitted for organic product treatment
    - List with approved fumigants available (residue free)
  - FOGGING
    - Fogging machines use large volumes of air at pressures to transform liquid into droplets that are dispersed into the atmosphere.
  - Other Pesticides applications
    - Aerosol
    - Dust
    - Smoke

Follow the product instructions

Mondelēz International

Thank you very much!

Questions & Answers

Mondelēz International