



Nestlé Good food, Good life

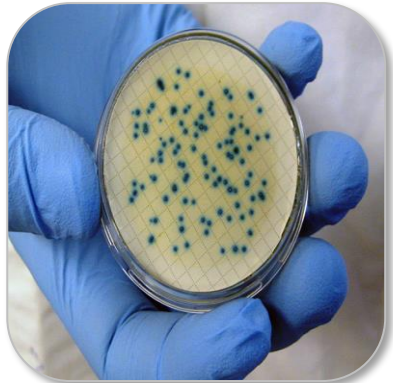
***Listeria* pathogen monitoring program**

FIAL *Listeria* workshop
Bern, November 3rd 2023



Food Safety risks in our industry

MICROBIOLOGY



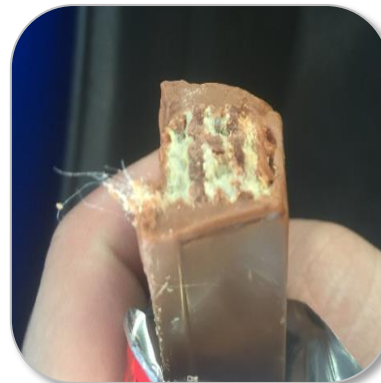
Listeria
Salmonella
E.Coli (STEC)

CONTAMINANTS



Pesticides
Persistent pollutants
Process Contaminants

FOREIGN BODIES



Metal, glass
Plastic, wood
Biological hazards
Hair

ALLERGENS



Agricultural practices
New plant proteins

REPUTATION



Mineral oils
Palm oil
Nano materials
Factory Hygiene

Management of microbiological risks



**Raw material
quality +
Microbial
specification**

+

**Controllable
kill step**

+

**Hygiene &
cleaning**

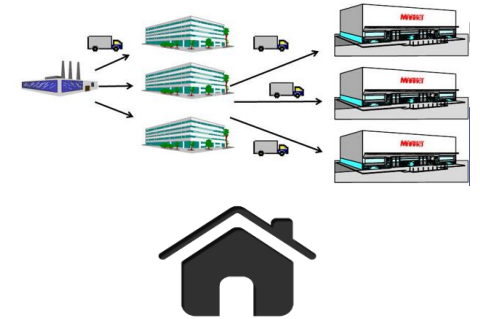
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Safe products

The mathematics of operational microbiology

H_0 = raw material load
 $\sum R$ = sum of reduction
 $\sum I$ = sum of increases
 FSO = food safety objective

$$H_0 - \sum R + \sum I \leq \text{FSO}$$



INPUTS + INCREASES – REDUCTIONS < EXPECTED OUTPUT



- Material risk assessment (HACCP) for each material
- Specification
- Inspection plan
- Data trending/SPC
- Leverage supplier mgmt
- In-factory material mgmt plan

- Risk-based
- Link to hygienic zoning plan and entry routines
- Indicators and target pathogen included
- E1/E2/E3-risk based
- Data trending

- Site selection targets harborage, growth, change
- Bias hygiene indicators
- **High frequency**
- Data trending
- SPC monitoring
- ex. 2StdDev actionable

- Specification
- Risk-based Inspection plan (parameters and frequency)
- Periodic intensified exam
- Planned response to non-conforming results
- SPC monitoring
- 2StdDev actionable

Pathogen Monitoring: why ?

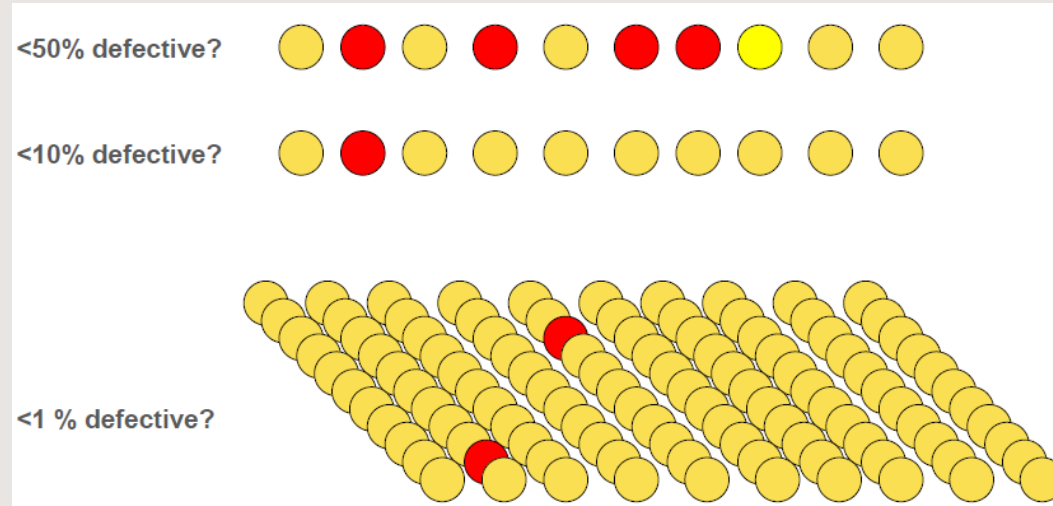
Testing for presence of pathogens or indicators



FAKE NEWS

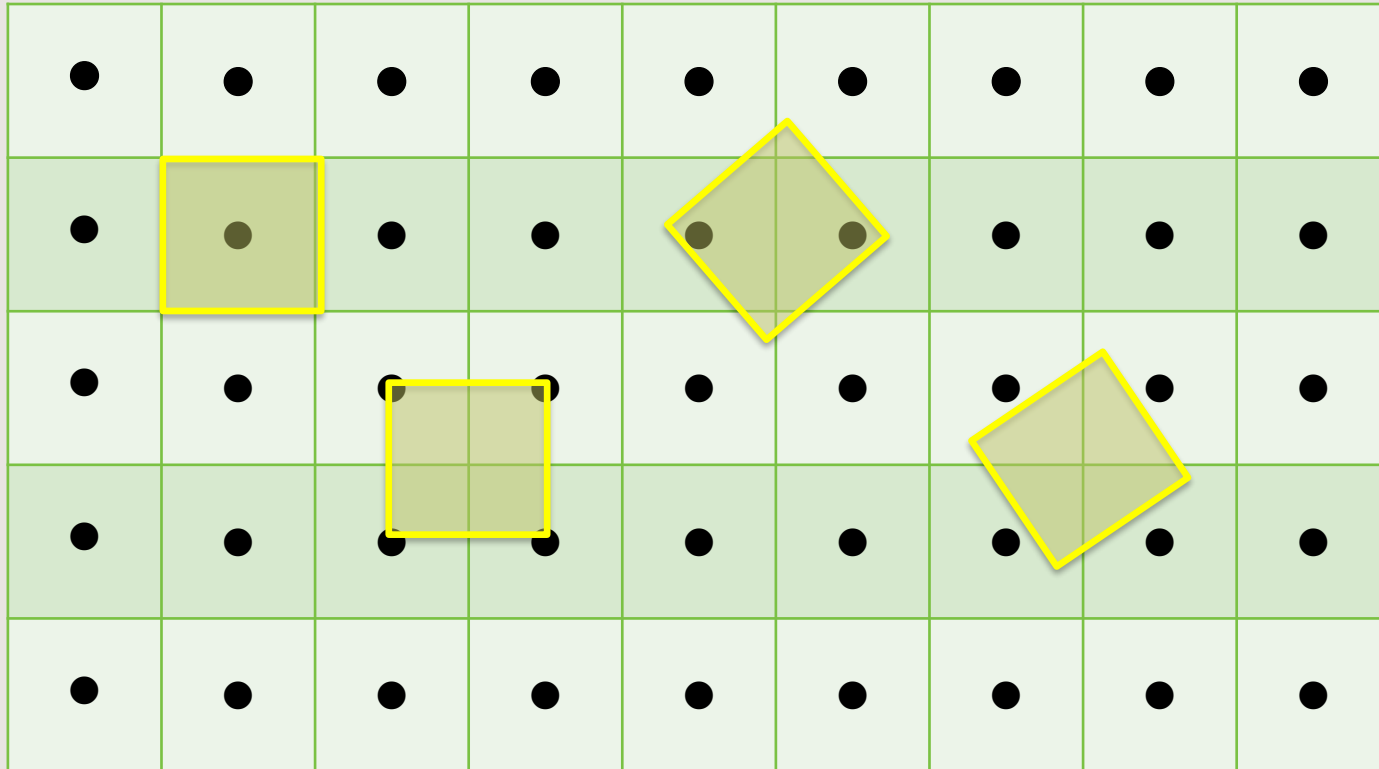
If the test is negative the batch is free of pathogens

Ability to detect is influenced by many things



- Microorganisms are not uniformly distributed
- Microbiological conditions change with time
- Microorganisms are dynamic
- Methods may not recover injured cells

Even if uniformly distributed, sampling may not capture the target



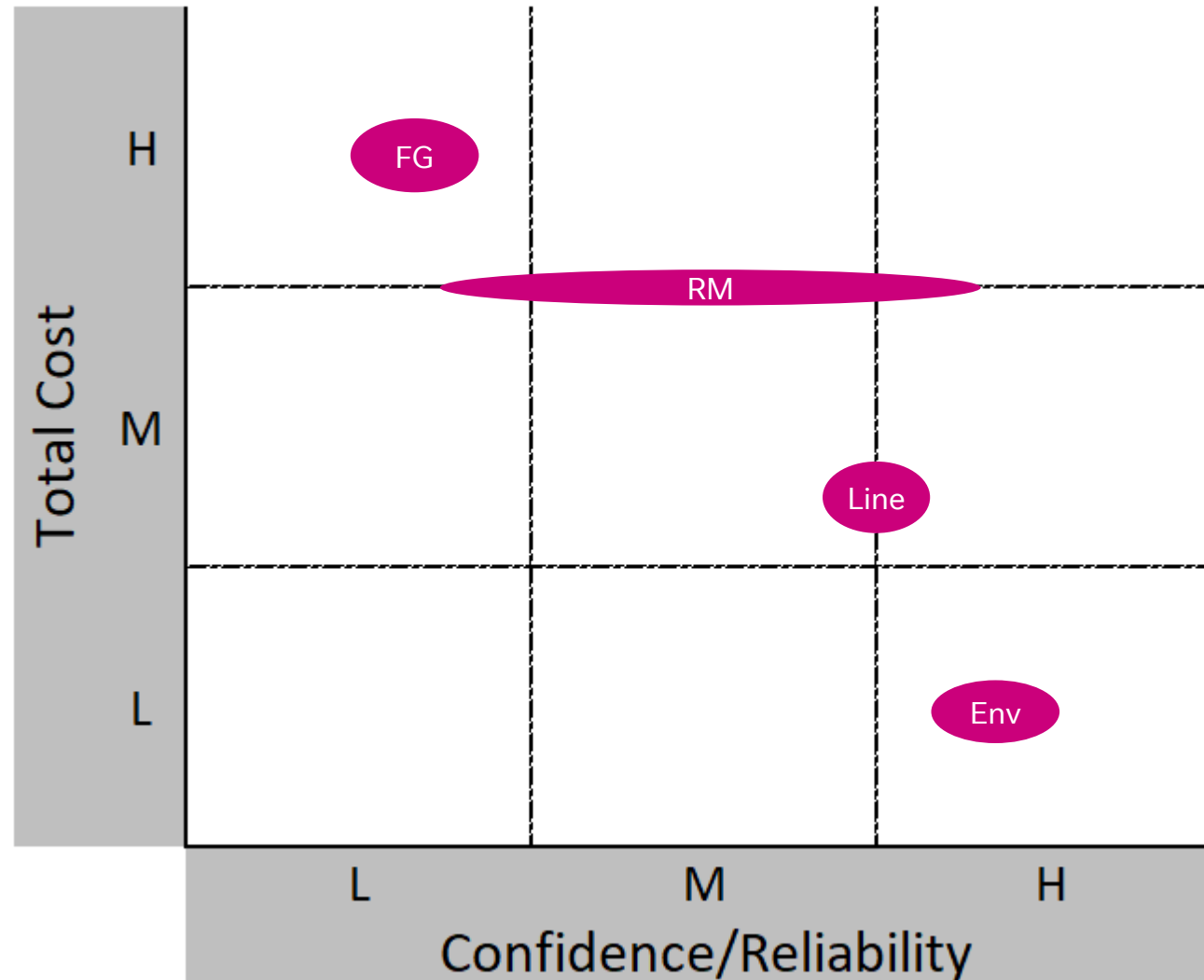
A sample may capture 1 cell

A sample may capture 4 cells

A sample may capture 2 cells

A sample may capture no cells

Does your testing program give you what it promises?



Cleaning validation vs Pathogen Monitoring

- Cleaning validation:
 - Samples taken **AFTER** cleaning;
 - Usually analyzed on Total Plate Count (TPC) & EBs
 - Could include *Lspp* for relevant categories
- Pathogen & Hygiene Monitoring:
 - Samples are taken **BEFORE** cleaning and during production;
 - Analyses on product relevant pathogen and hygiene indicators



Pathogens monitoring: why ?

Seek



React

Stop/Control



Trending



Corrections

Destroy

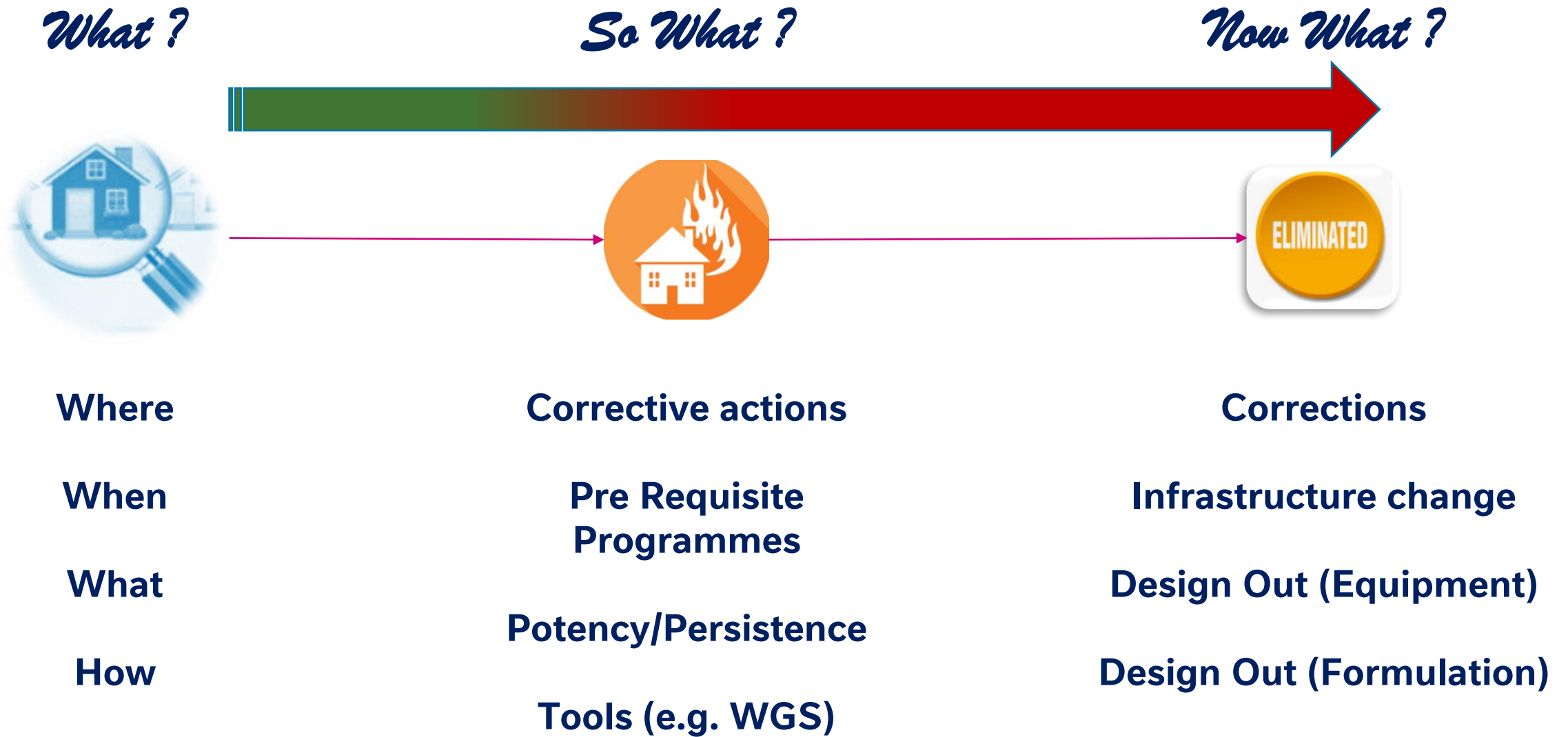


Corrective Actions



One size fits all ?

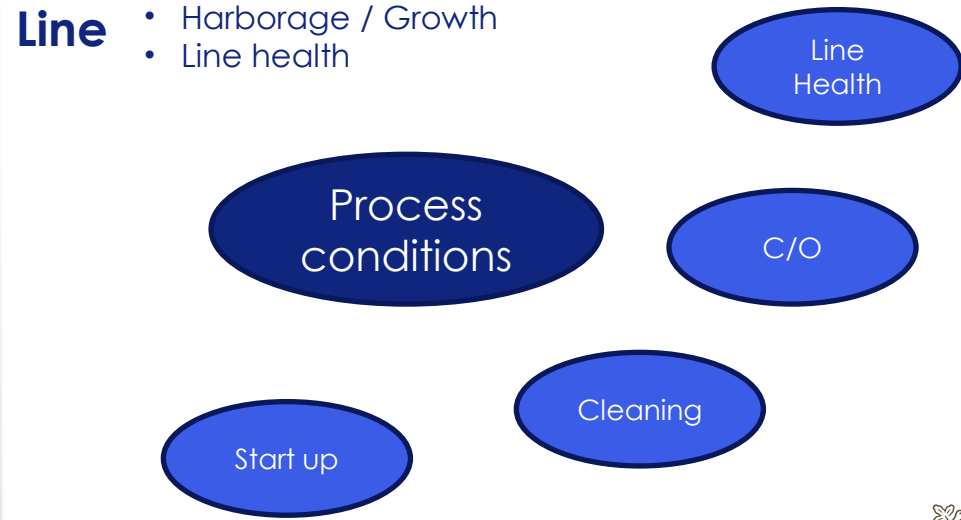
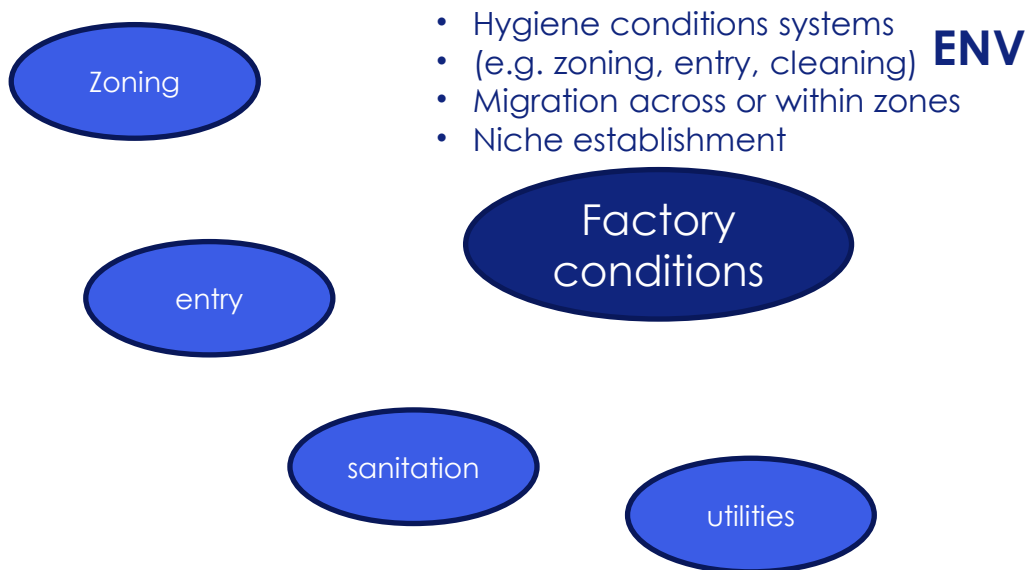
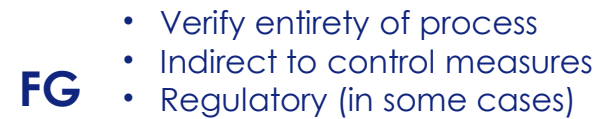
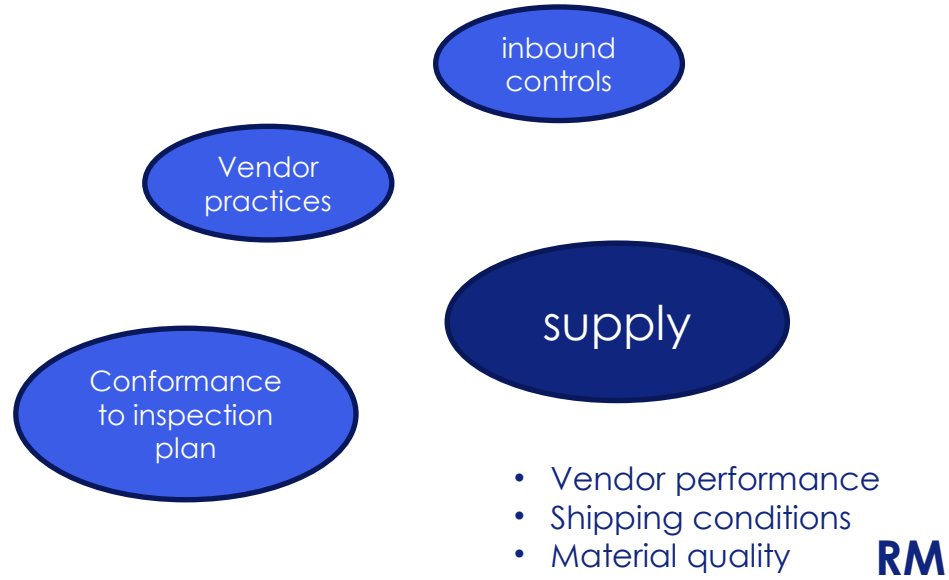
Pathogens monitoring helps Stop & Destroy



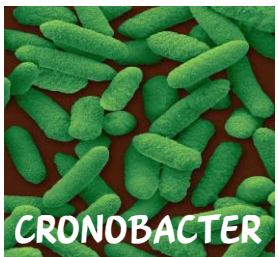
Mandatory elements of a pathogen monitoring program

Element	Mandatory element of the monitoring program
1	It must include samples of raw materials , processing environment , processing lines and finished products .
2	It must include the relevant pathogen(s) as well as the associated hygiene indicator(s) .
3	It must be designed to ensure effective source detection and include routine samples as well as investigative samples .
4	<p>Sampling sites for environmental and line samples must be defined according to:</p> <ul style="list-style-type: none"> • Product specificities • Factory zoning, cleaning method and characteristics of processing lines
5	It must be flexible and include different control levels to rapidly respond to abnormal results, to special or unusual events.
6	It must have a documentation system that allows for trend analysis of analytical results as well as immediate actions in case of deviations (data management).
7	It must be reviewed on a regular basis (at least yearly) to take into account obtained results, changes in the factory, and other updates etc.

1. It must include samples of RM, Env, Line, and FG



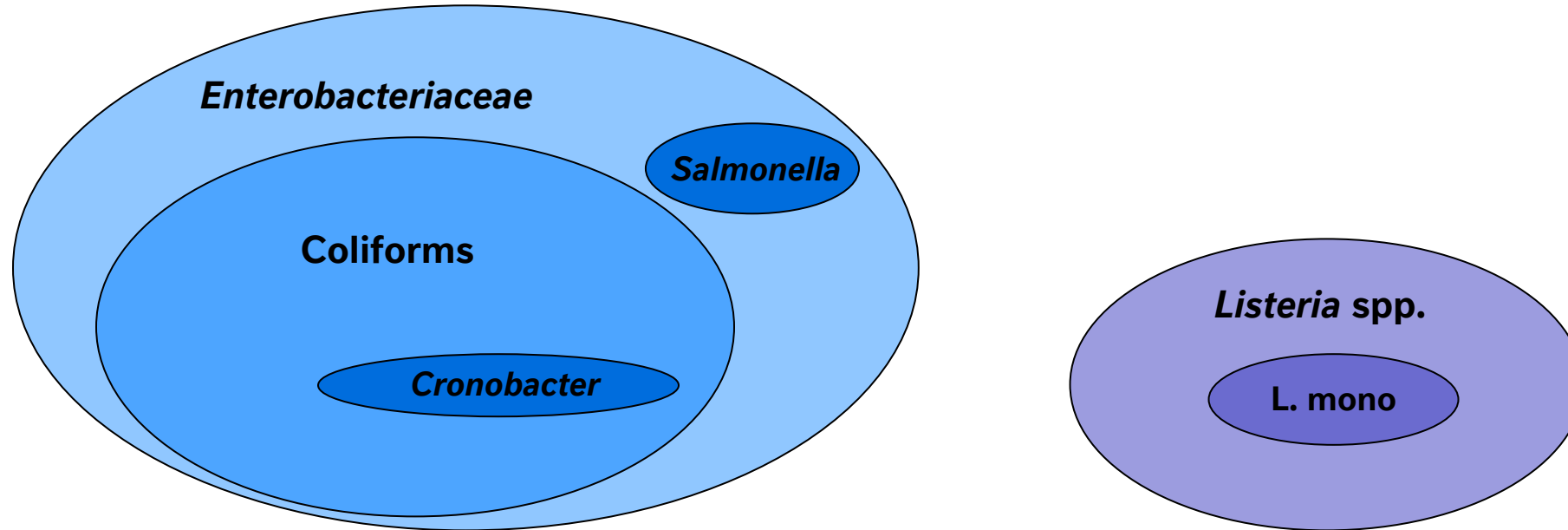
2. It must include the relevant pathogen(s) as well as the associated hygiene indicator(s)



<i>Salmonella</i>	Low Aw products, drier environments
<i>Cronobacter</i>	Low Aw products – specific to infant formula
<i>Listeria mono</i>	High Aw products, wet/cool environments

Other pathogens such as *B cereus*, *S aureus*, *C perfringens* may be considered but are generally not included in pathogen monitoring programs

2. It must include the relevant pathogen(s) as well as the associated hygiene indicator(s) as early warning



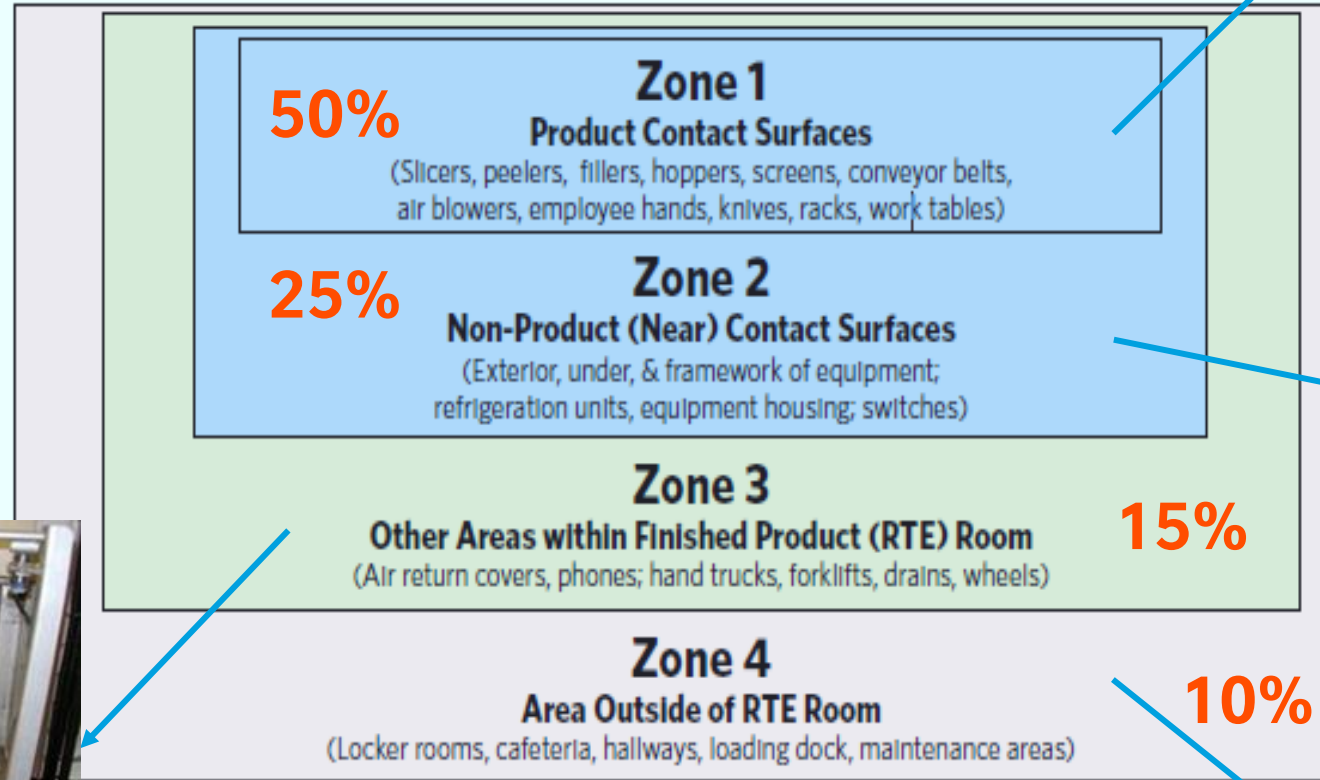
Also important...

Testing for indicators is fast and cheap, can often be done on site
Maximize the value of your 'analytical CHF'

3. It must be designed to ensure effective source detection



Where ?



Using Risk-based ratios between zones

3. It must include routine samples as well as investigative samples.



➤ Routine and Investigative Sample Points



Where

When

What

How

- Minimum 1x line/week (food contact); 2 x month (non-food contact)
- During Production... Not Immediately after cleaning

What if I never find Listeria ?

Start Doing the Lottery !!

4. Sampling sites must be defined according to: product specificities, factory zoning, cleaning method and characteristics of processing lines



Where

When

What

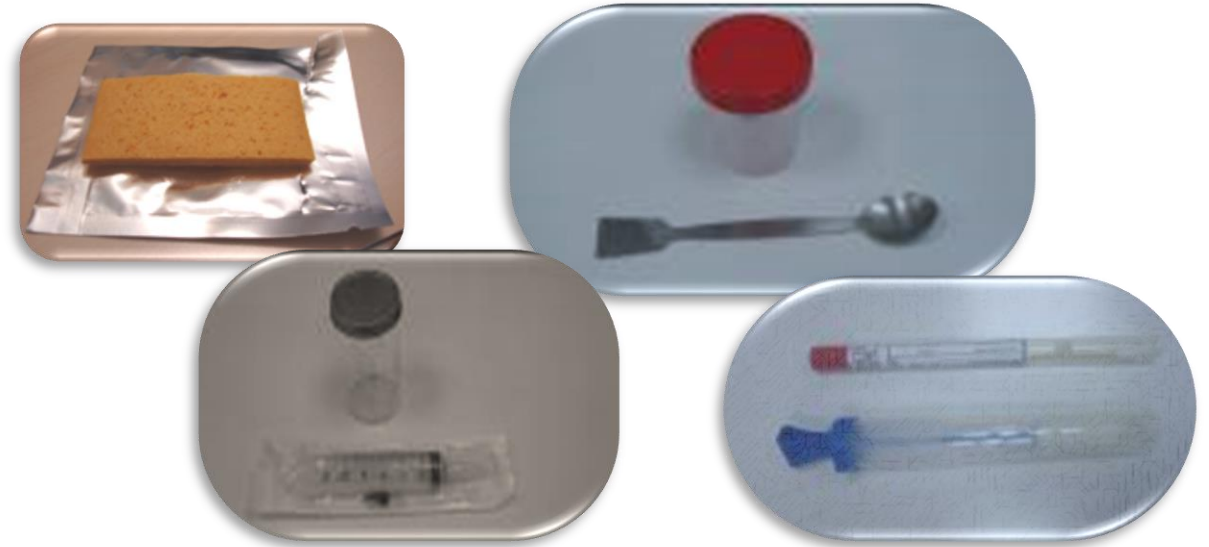
How

- Residues collected by scraping, scooping, swabbing or vacuum cleaners content.
- *L. spp.* versus *L. monocytogenes* ?... Do both
- Conditions that support *L. spp.* are indicative of conditions that would support *L. mono* growth
- *L. spp* enables early warning, reaction, corrective action and release decision
- Doing *L. mono* alone can mask *L. spp* background
- Confirm *L. spp* as *L. mono* (Zone 1 & 2)

4. The importance of sampling



**How to sample:
sampling tools**



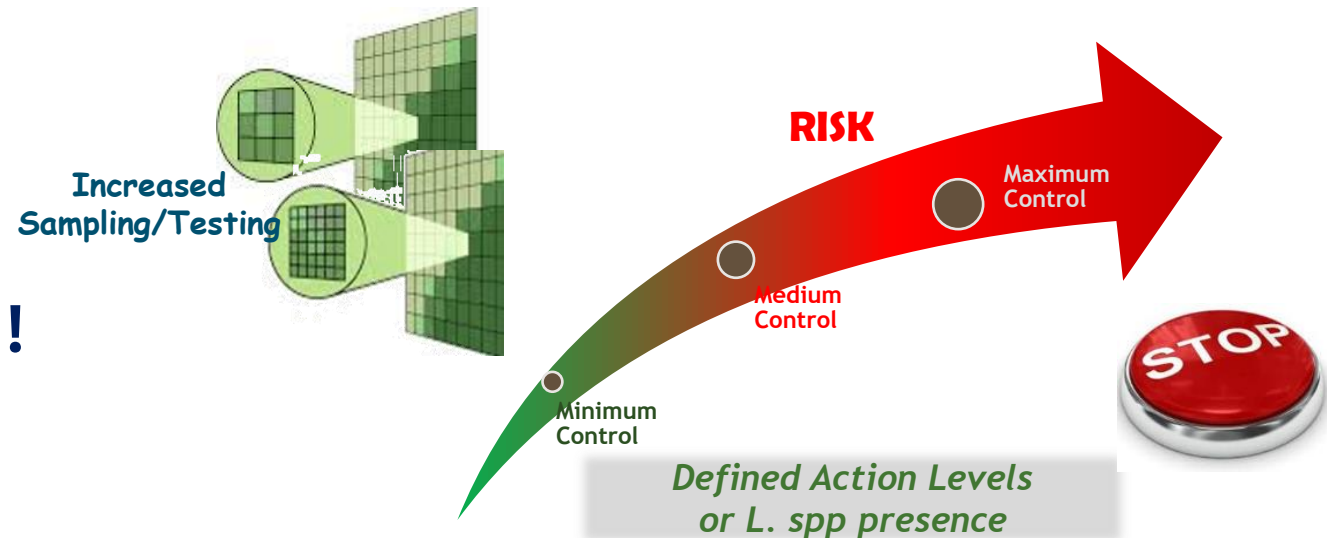
Where

When

What

How

**How to react:
when there is a
deviation / or not !**



Pathogens monitoring helps Stop & Destroy



5. It must be flexible and include different control levels to rapidly respond to abnormal results, to special or unusual events



Type	Samples / week		
	Min	Med	Max
RM	12	24	60
FP	4	16	36
Line	18	36	90
E1	8	16	40
E2	4	16	32
E3	1	2	5

Where

- *L. mono* in environment: move to medium

When

- *L. mono* in product or product contact: move to maximum

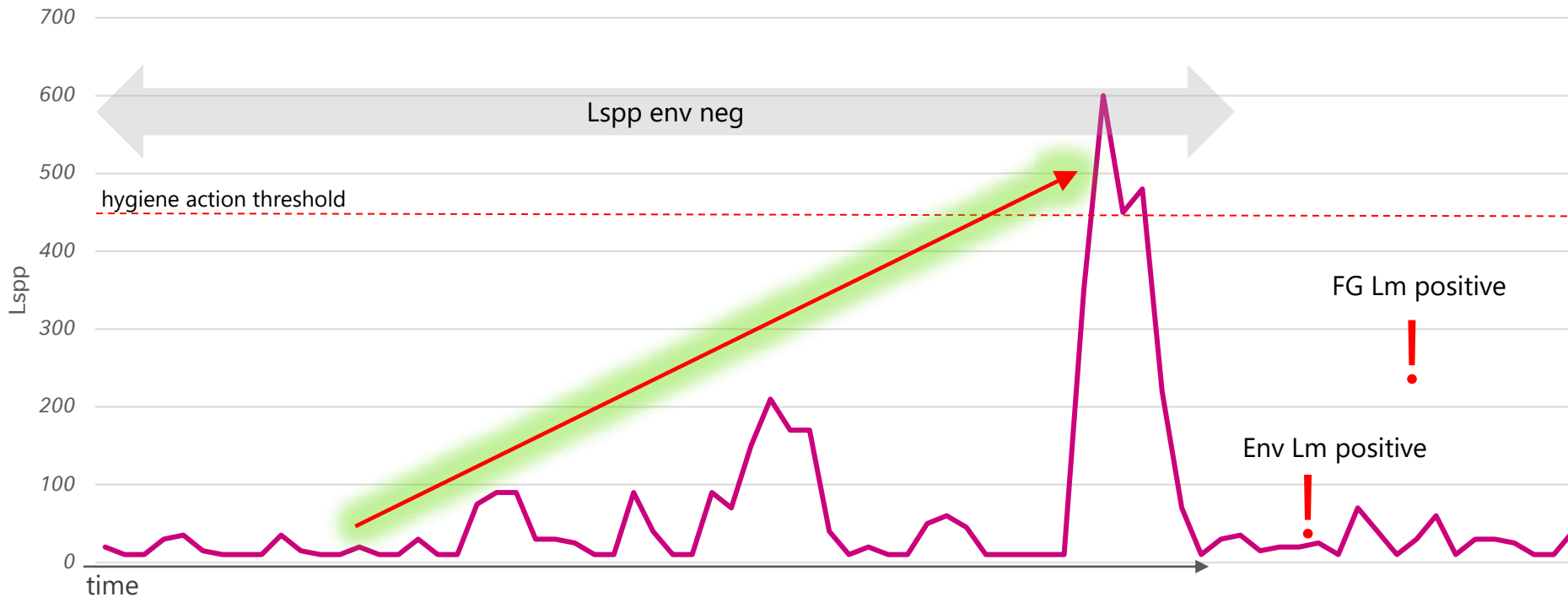
What

- Hygiene deviations, heavy maintenance activities, new equipments or processing lines, increasing trends in hygiene data: move to medium

How

- Rules, nb of samples, duration at each level has to be adapted to product risk (growth / no growth), contamination levels (pos, <10cfu/g, >100cfu/g)

6. Documentation system that enables data management & trend analysis



Typical....

- ✓ Not seeing the change
- ✓ Reactionary response (non-normal actions)
- ✓ False success
- ✓ Selection for Lm to thrive

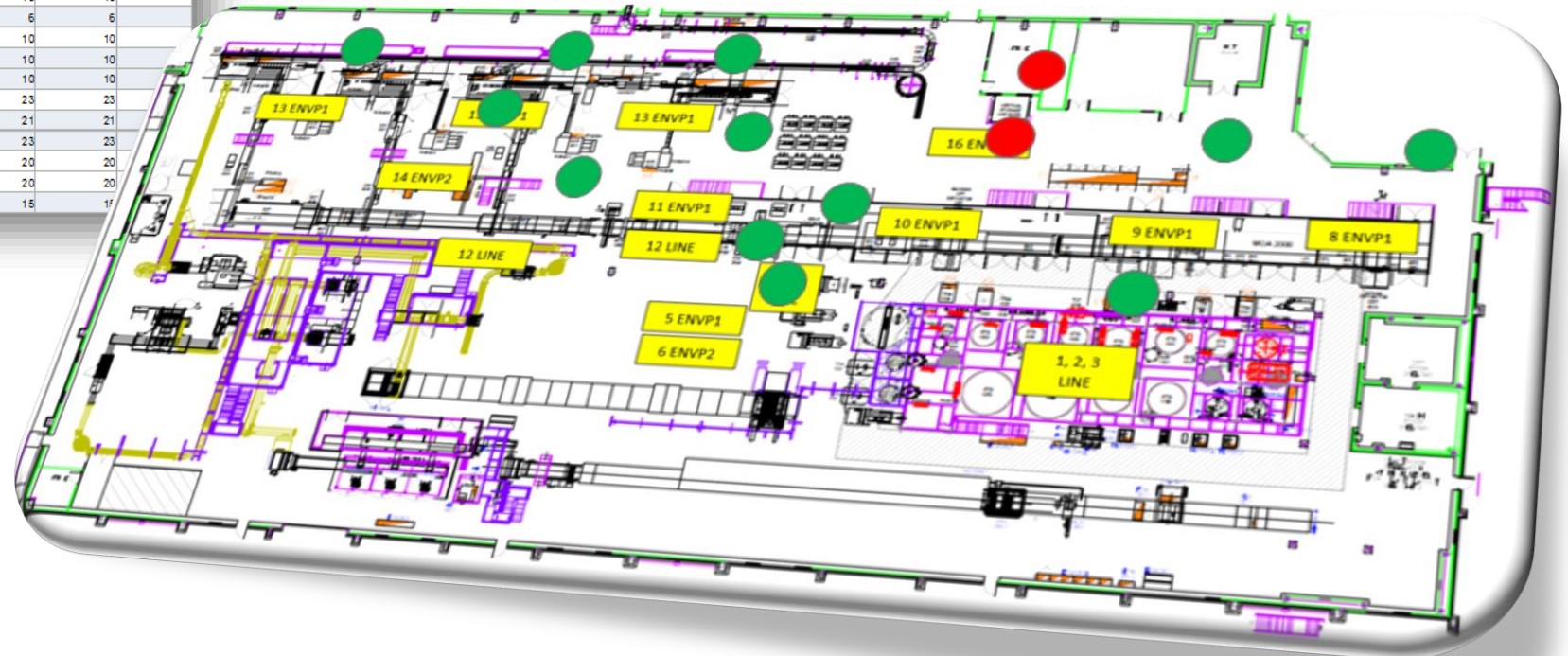
6. Documentation system that enables data management & trend analysis

7. Review on regular basis (min yearly)

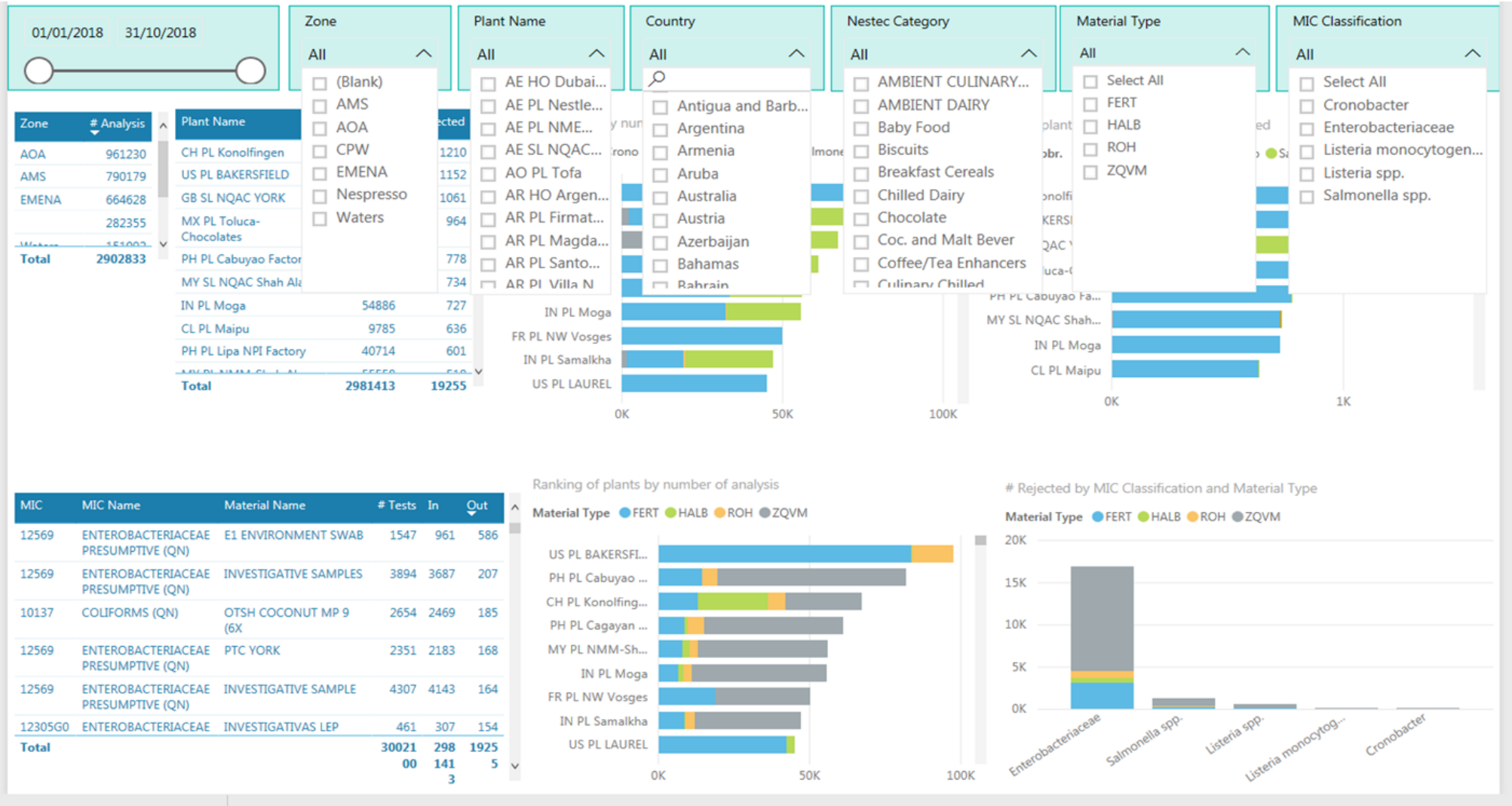
From Excel Rows

Material	Material description	Operation short text	MC Classification	Insp Method search fil	Total count	Count accept	Count reject
5500 4840	ENV AERO	E1 Catchtray at MOP3050 S EB	Enterobacteriaceae	LI-00.757	17	17	
5500 4840	ENV AERO	E1 Catchtray at MOP3050 S EB	Salmonella spp.	LI-00.801-1	17	17	
5500 4840	ENV AERO	E1 Conveyor CAV3010 S EB	Salmonella spp.	LI-00.801-1	6	6	
5500 4840	ENV AERO	E1 Conveyor CAV3020 S EB	Salmonella spp.	LI-00.801-1	7	7	
5500 4840	ENV AERO	E1 Shell deposit for catchtray S EB	Salmonella spp.	LI-00.801-1	6	6	
5500 4840	ENV AERO	E1 Sleeve trolley S EB	Enterobacteriaceae	LI-00.757	23	23	
5500 4840	ENV AERO	E1 Sleeve trolley S EB	Salmonella spp.	LI-00.801-1	24	24	
5500 4840	ENV AERO	E1 Winkworth filter S EB	Enterobacteriaceae	LI-00.757	15	15	
5500 4840	ENV AERO	E1 Winkworth filter S EB	Salmonella spp.	LI-00.801-1	18	18	
5500 4840	ENV AERO	E2 Dep Plate Trolley S EB	Enterobacteriaceae	LI-00.757	6	6	
5500 4840	ENV AERO	E2 Outside of sleeve S EB	Salmonella spp.	LI-00.801-1	7	7	
5500 4840	ENV AERO	E2 Vacuum Cleaner Nozzle S EB	Salmonella spp.	LI-00.801-1	6	6	
5500 4840	ENV AERO	FIN AERO 1 S EB APC	Enterobacteriaceae	LI-00.757	10	10	
5500 4840	ENV AERO	FIN AERO 1 S EB APC	Salmonella spp.	LI-00.801-1	6	6	
5500 4840	ENV AERO	FIN AERO 1 S EB APC	Total Count	ISO-4833-1:2013	10	10	
5500 4840	ENV AERO	FIN AERO 2 S EB APC	Enterobacteriaceae	LI-00.757	10	10	
5500 4840	ENV AERO	FIN AERO 2 S EB APC	Total Count	ISO-4833-1:2013	10	10	
5500 4840	ENV AERO	LINE Blue tool EB	Enterobacteriaceae	LI-00.757	23	23	
5500 4840	ENV AERO	LINE Sleeve SVR1010 S EB	Enterobacteriaceae	LI-00.757	21	21	
5500 4840	ENV AERO	LINE Sleeve SVR1010 S EB	Salmonella spp.	LI-00.801-1	23	23	
5500 4840	ENV AERO	LINE Sleeve SVR1011 S EB	Enterobacteriaceae	LI-00.757	20	20	
5500 4840	ENV AERO	LINE Sleeve SVR1011 S EB	Salmonella spp.	LI-00.801-1	20	20	
5500 4840	ENV AERO	LINE Sleeve SVR1020 S EB	Enterobacteriaceae	LI-00.757	15	15	

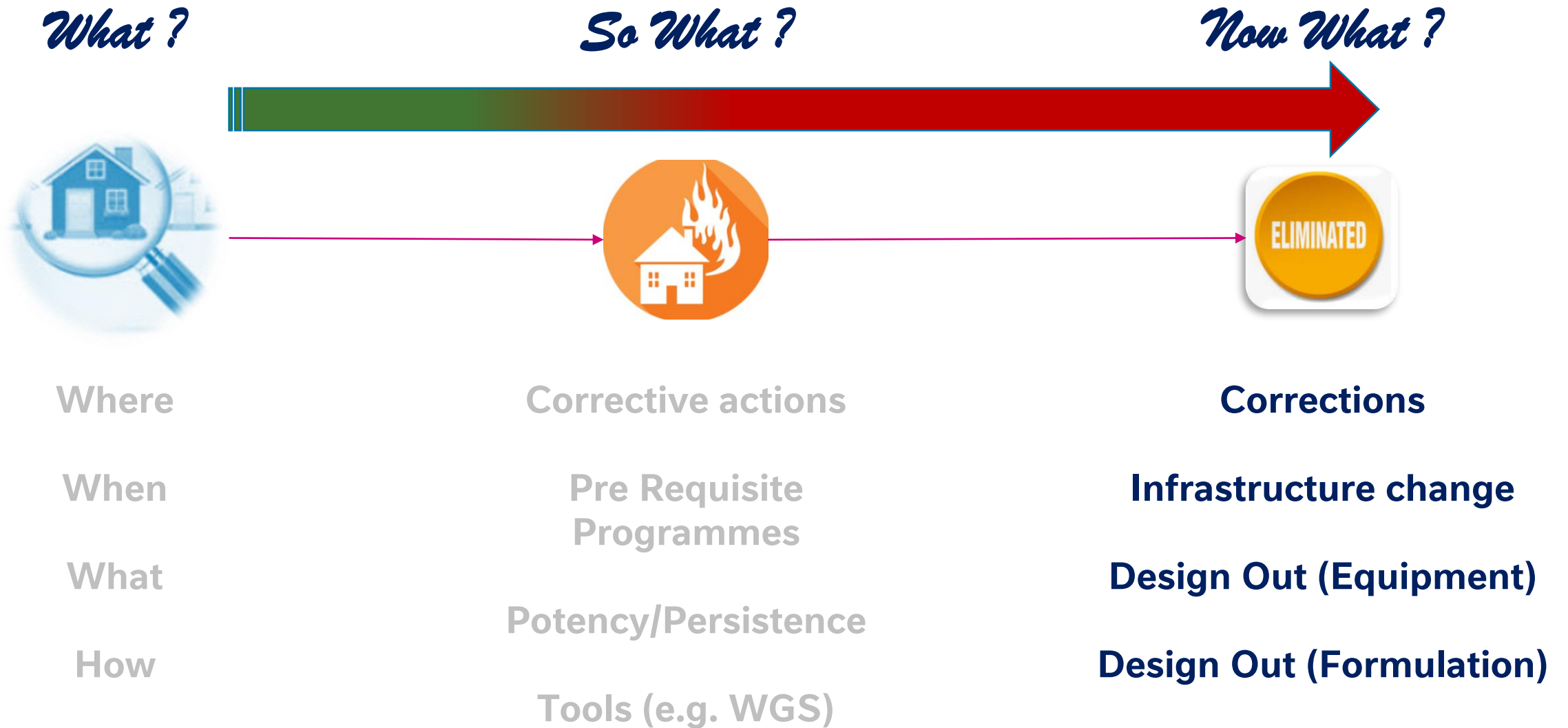
To visual Displays



7. Review on regular basis (min yearly) & benchmark across similar factories/Design/technologies



Pathogens monitoring helps Stop & Destroy



Pathogen monitoring program is the verification of the effectiveness of hygiene control measures

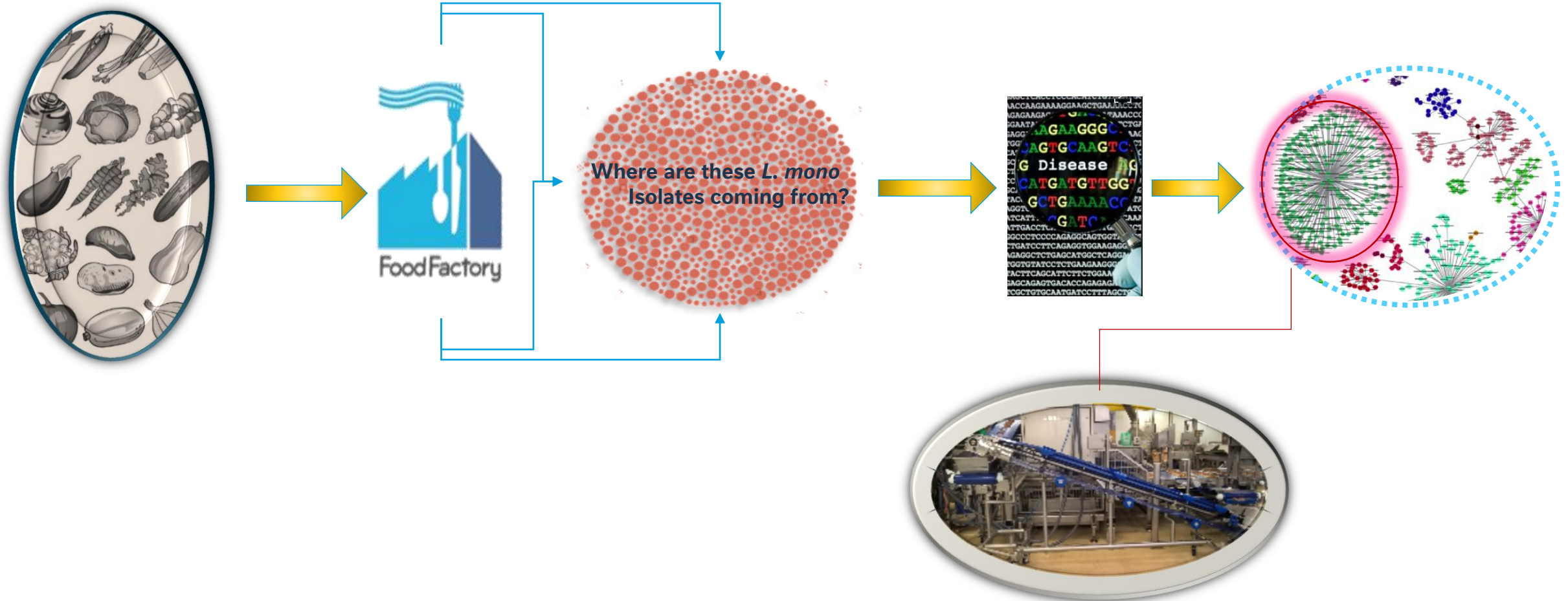


*there are additional PRPs

Is my Cleaning Method Effective?



Persistent or Transient *L. mono*... using WGS

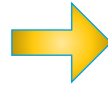


Application examples

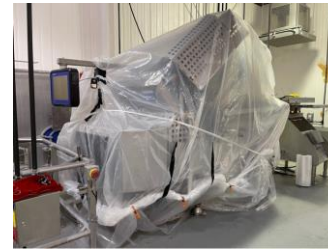
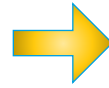
**WGS @
Identifies
Equipment with
Listeria
Harbourage**



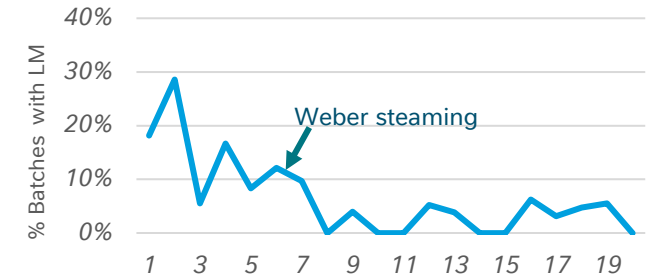
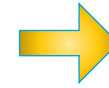
Listeria detected in Weber equipment



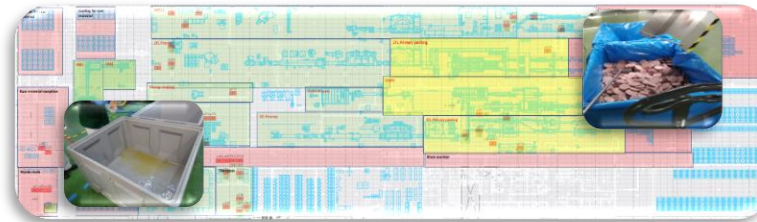
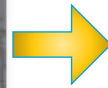
Listeria from Weber same as FP isolates



Weber steaming Introduced

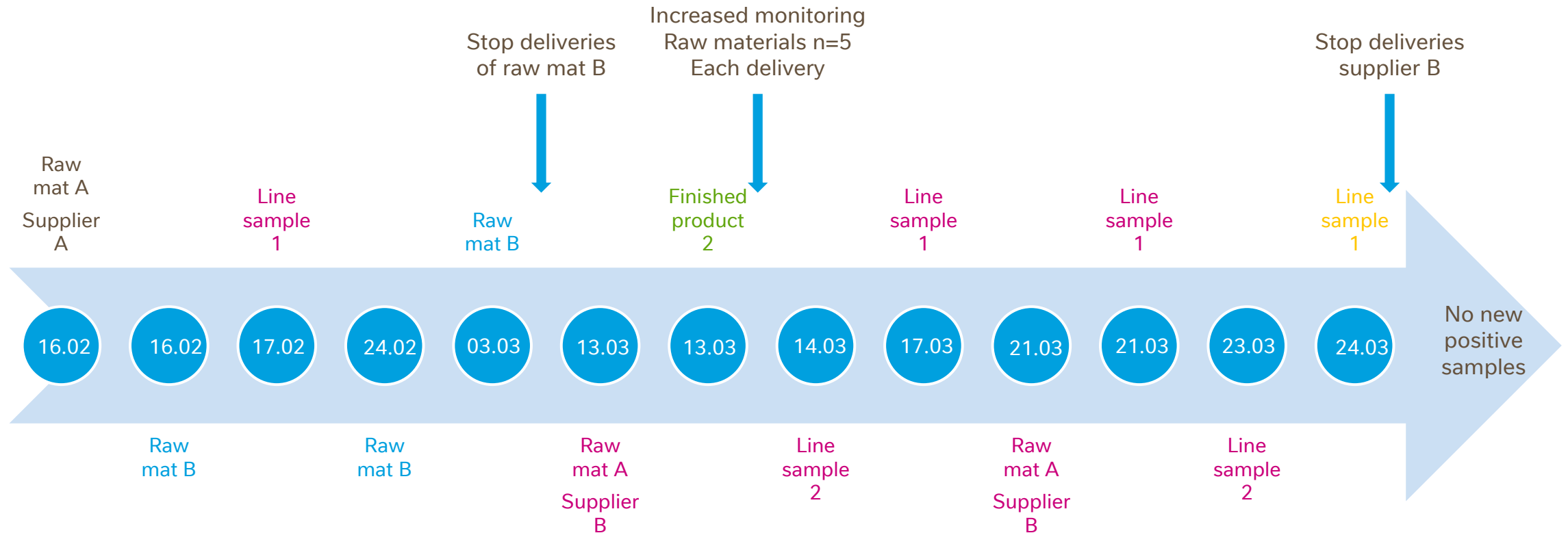


**WGS Identifies
Trolleys as
Listeria vehicles**



- **Dedicated trolleys**
- **Improved Trolley Design**
- **Dedicated Trolley cleaning dock**

Application example



Investigations and root causes:

- Raw mat B: contamination of one minor ingredient
- Supplier B: blocked dust aspiration

Key learnings:

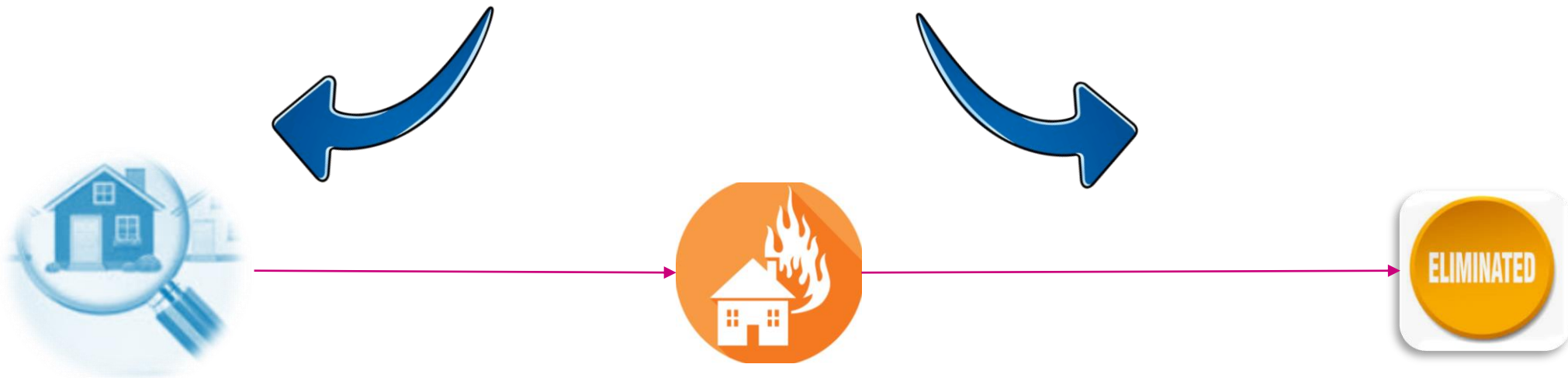
- Quantitative testing performed by some suppliers is not sufficient to allow to detect low Lm contamination levels
- EB not always present in case of hygiene deviation: use Lspp+Lm
- WGS allows to identify origin of Lm (supplier / factory)

Summary

The Listeria monitoring program has to be customized to match facility / technology / regulatory environment

A well designed pathogen monitoring will get you

From Here to Here



Thank you!





Nestlé

Good food, Good life