

Environmental Microbiological Monitoring in Food Industry and its benefits.



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General Background



- Foodborne diseases are an important **cause of morbidity and mortality**, and a significant impediment to socioeconomic development worldwide
- **Precise information** on the burden of foodborne diseases can adequately inform policy-makers and food producers/ industry to allocate **appropriate resources for food safety control and intervention efforts.**

General Background- Global picture



World Health
Organization

- For the global estimates, **thirty-one foodborne hazards causing 32 diseases:**
 - 11 diarrheal disease agents (1 virus, **7 bacteria**, 3 protozoa),
 - 7 invasive infectious disease agents (1 virus, 5 bacteria, 1 protozoan), 10 helminths
 - and 3 chemicals.
- Together, **the 31 hazards caused 600 million foodborne illnesses** and **420,000 deaths in 2010.**
- Major causes of foodborne deaths were ***Salmonella Typhi, Taenia solium, Hepatitis A virus, and aflatoxin.***

Source: WHO, 2015.

General Background- Regional situation

- The Arab countries of the **Gulf Cooperation Council rely heavily on food imports**. And here is the importance for food authorities and for food manufacturers to have the effective food controls and food safety management systems

- A wide spectrum of pathogenic microorganisms:
 - *Salmonella*,
 - *Staphylococcus aureus*,
 - *Escherichia coli*,
 - *Bacillus cereus*,
 - *and Shigella* was identified in contaminated food in Arab Countries (22 Arab Countries Middle East, GCC and North Africa)



Source: (Kamleh et al., 2012)

Risks in Food manufacturing Environment

Microorganisms can survive in food processing and handling environments... They are generally introduced into the food environment through raw materials, pests, air, water, and employees.

Various pathogenic microorganisms such as *E. coli*, *Listeria monocytogenes*, and *Salmonella* spp. have well-established histories of being potential contaminants in food-handling environments.

Hence, it is critical to have **the effective food safety management** systems to protect public health and to protect food industries/ Brands and.....the economies of the countries

Proper approach to food safety and Quality Assurance

- 1- Three main factors that should be taken in consideration
- 2- Proper risk assessment for proper risk management



- **Environment:** Facilities should follow proper sanitary design principles/ Proper Environmental Monitoring Program
- **People:** skilled workforce (QA + Ops+ SC) trained in highest food safety standards and their behavior
- **Food Safety management systems (Process based),** in all the food chain

Source: (Kamleh et al., 2014)

Lactalis to withdraw 12m boxes of baby milk in salmonella scandal....

37 cases of infants suffering salmonella after consuming the powder have been reported, 35 in France, one in Spain and another suspected case in Greece. A victims' association said this was the tip of the iceberg and the authorities were underestimating the number of cases



- “Traces of salmonella bacteria were picked up on a broom and a tile near drying equipment at the Craon factory in August and again in November. However, no general alarm was raised “because we had no element showing our products were affected”, Besnier said.

Environmental Monitoring Program (EMP)

'An environmental monitoring program not only verifies cleanliness and sanitation, it is a critical component for the protection of your brand'

- EMP is **an-going monitoring of microbiological levels** in food plants environment
- It's one of the most proactive food safety programs.
- The goals of an effective environmental monitoring program are:
 - 1) **to help verify effectiveness of Sanitation Standard Operating Procedures (SSOPs)**
 - 2) **Verify other preventative controls,**
 - 3) and mainly **to help prevent microbial contaminants from entering the product stream** by identifying and remediating problem areas.

Is there a standard program that can be implemented in all food industries??

- **Definitely NO!**
- **The solution is dependent on several factors** related to the products , the environment and the processes / technology such as:
 - *hygiene guidelines*
 - *Level of automation* in the manufacturing processes that limit human handling,
 - *the use historical profiles* of the microbiological environmental data. Therefore, regulatory



- As such, **a sampling plan** should be **based on the product and process risk evaluation** to realize and demonstrate that the food manufacturing to identify and eliminate any potential contamination and to comply with international standards and best practices

Source: Krzystof et al., 2018

How it should be done...

Proper Risk Assessment: Areas/ Air/ machines ..CCPs need to be identified

Selection of indicators or pathogenic based on historical data and scientific information microorganisms and their limits e.g
Air: TBC/ Yeasts and molds per cm²

Frequency of monitoring

Source: Krzysztof et al., 2018

How the scheme can be constructed.. Example

Criticality Index	Likelihood of impact on finished goods	Definition / Zones	Frequency
1	High Likely	Mixing and Filling Machines work places are sanitized daily	Daily
2	Likely	Packaging areas or areas in which final handling is performed	Weekly
3	Moderately Likely	Areas where process food is exposed to the environment	Fortnightly
4	Unlikely	Cold areas where little or no processing is performed	Monthly
5	Very Unlikely	Areas in which indirect exposure to prepared and packaged product is unlikely	Three Monthly
6	Highly Unlikely	Any are that is uncontrolled or where microbial contamination is very unlikely such as freezers.	Six Monthly

And then we can go further to drains or niche where micro can grow e.g. drains

Source: Microgen Bioproducts Ltd

TARGETS , CORRECTIVE ACTION & ACTION PLAN

The environmental monitoring program and the target/baseline are unique for each plant and for each type of products (high risk or low risk).

ENVIRONMENTAL MONITORING PROGRAM AND SAMPLING PLAN:

ZONE 1	Blenders, conveyors, utensils, work tables, filling nozzle etc.	WEEKELY	Total plate count, coliforms, yeast and molds
ZONE 2	Equipment framework, maintenance tools, drip shields, housings, etc.	WEEKELY	Total plate count, coliforms, yeast and molds, Pseudomonas Aeruginosa
		MONTHLY	Listeria spp., and Salmonella spp.
ZONE 3	Walls, floor, drains, air handling units, etc.	WEEKELY	Total plate count, coliforms, yeast and molds, Pseudomonas Aeruginosa
		MONTHLY	Listeria spp., and Salmonella spp.
ZONE 4	Office areas, locker rooms, maintenance room, etc.	MONTHLY	Total plate count, coliforms, yeast and molds, Listeria spp. and Salmonella spp.

Corrective Actions / mainly when pathogens results are positive!!!

1. Stop production in the affected line/area.
2. Hold particular product produced at that time.
3. Thoroughly examine the area, both visually and through *vector swabbing.
4. Breakdown production lines for inspection and take appropriate corrective actions (e.g., leakage, employee traffic, etc.).
5. Thoroughly clean affected site and swab site and adjacent areas/ zones
6. Increase sampling frequency (e.g., from weekly to daily) until three consecutive negative results are obtained.



CONCLUSION... BENEFITS OF EMP

- Provides information (source and concentration) about indicator organisms, spoilage organisms, and/or pathogens of concern in a timely manner, so that appropriate corrective actions can be initiated to prevent potential microbial outbreaks.
- Acts as an **early warning system for microbiological hazards** in both the production and post-production environment when well-developed and effectively implemented as an integral component of prerequisite programs.
- Validates the sanitation program and helps in determining the frequency required for cleaning and sanitation.

Most importantly deliver a safe product to consumers



THANK YOU...

Safe food saves life



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