



BIOMÉRIEUX

# ELEVATE YOUR ENVIRONMENTAL MONITORING PROGRAM WITH AUGMENTED DIAGNOSTICS

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PIONEERING DIAGNOSTICS

# WHY ENVIRONMENTAL MONITORING?

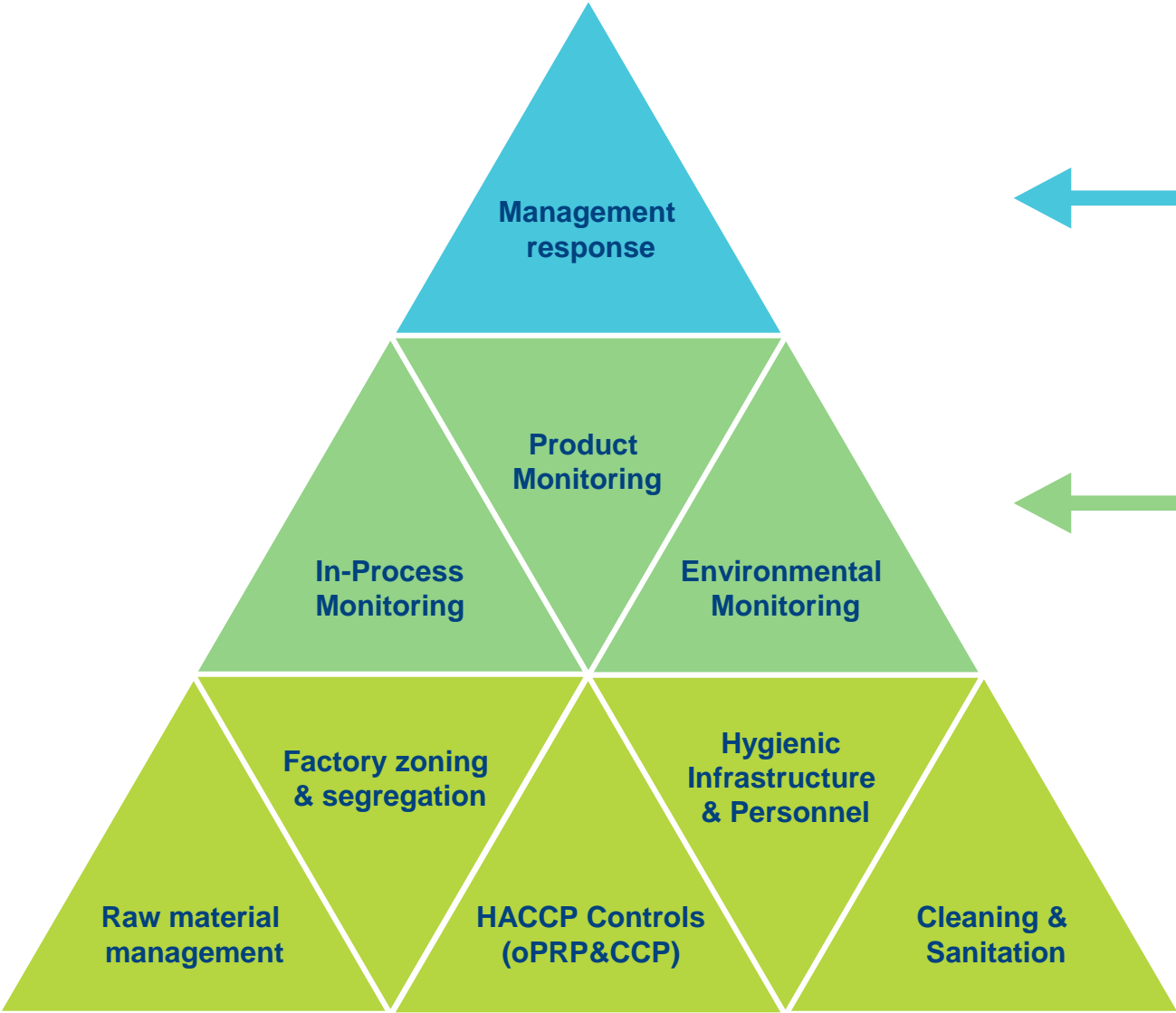
*Continuous Improvement*

Augmented Diagnostics

*Verification*

Diagnostics

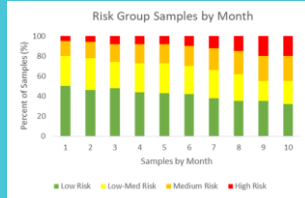
*Controls*



# EMP ECOSYSTEM

Need: Do better over time

▶ **ADAPTIVE SAMPLING (PREDICTIVE MODEL)**



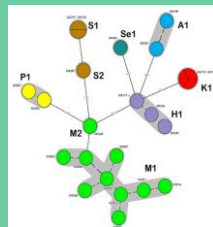
Need: Clear, actionable EMP

▶ **EMP eLEARNING**



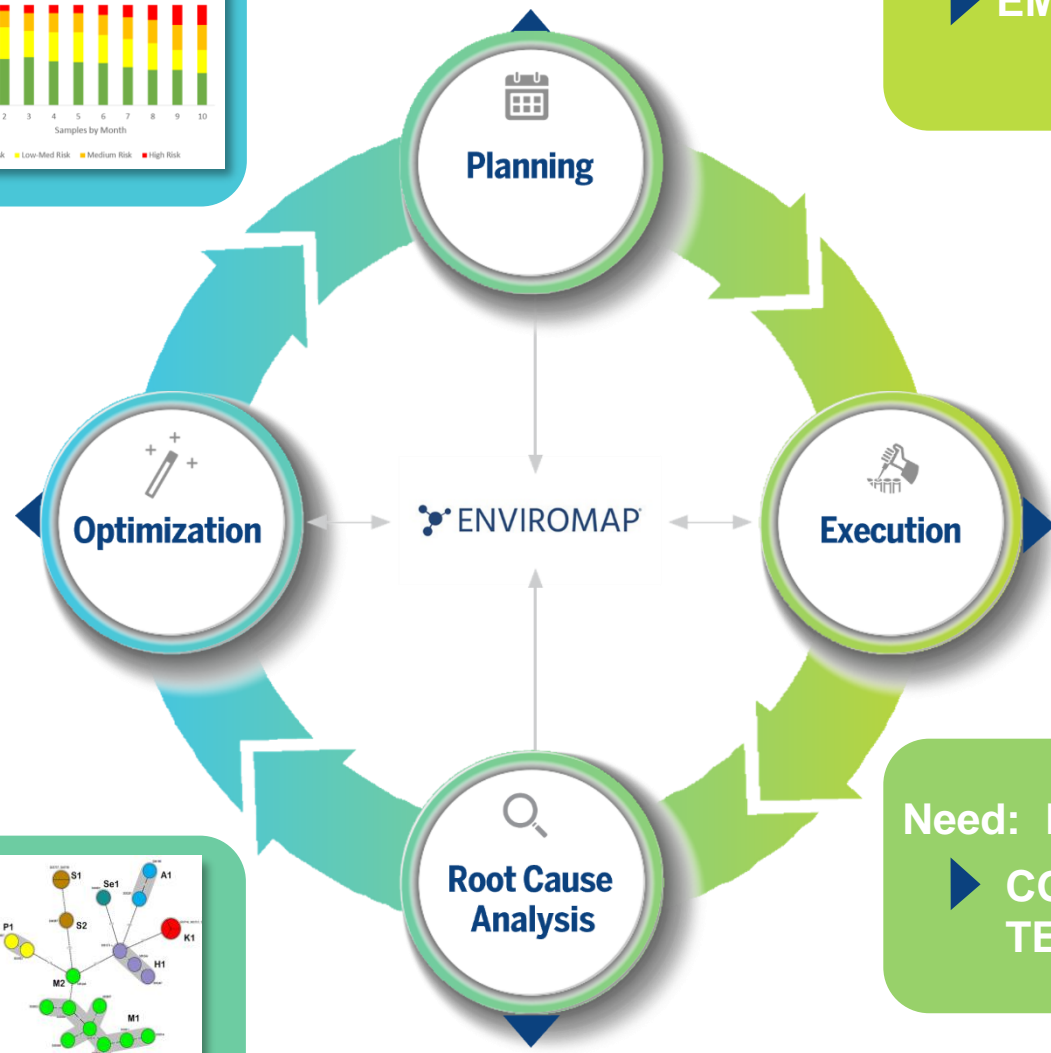
Need: Help solving the problem

▶ **PATHOGEN MAPPING (GENOMICS)**



Need: Do things right everyday

▶ **CONNECTED ROUTINE TESTING SOLUTIONS**



# WHY DIGITALIZE EMP?



## Faster time to action

Information available in real time  
Detect problems earlier with trending  
Automated CAPA



## Time and cost savings

Automated scheduling, CAPA, reporting  
Faster and easier employee training  
Reduces labor, production down-time and  
water/chemicals usage



## Better execution

Ensure EM plan is executed as intended  
Standardization across plants and  
employees  
Audit readiness

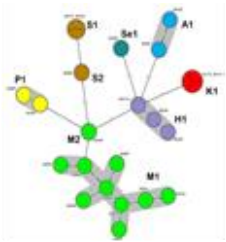
# PATHOGEN MAPPING

(ROOT CAUSE ANALYSIS)



# EM ROOT CAUSE ANALYSIS TOOLS

## PATHOGEN MAPPING (Whole Genome Sequencing)



Is it the same issue or is it something new?  
(Relationships)



Where does it come from and how does it spread?  
(Transmission)



Why is it persistent?  
(Resistance)

## GENE-UP TYPER (Multiplex PCR)



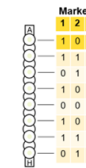
Sample



PCR



Positive



Molecular barcode



Match?

LYNX group L11548 (9 samples in 106)

Sample ID	Sample date	Sample source	Product	Sampling point	Site
Demonstrat_1	4/1/2012	Finished product	Cheese		B
Demonstrat_2	4/1/2012	Finished product	Cheese		B
Demonstrat_3	4/1/2012	Environment	Package		B
Demonstrat_4	4/1/2012	Finished product	Cheese		B
Demonstrat_5	4/1/2012	Raw material			A
Demonstrat_6	4/1/2012	Raw material			B
Demonstrat_7	4/1/2012	Raw material			A
Demonstrat_8	4/1/2012	Environment	Package		A
Demonstrat_9					

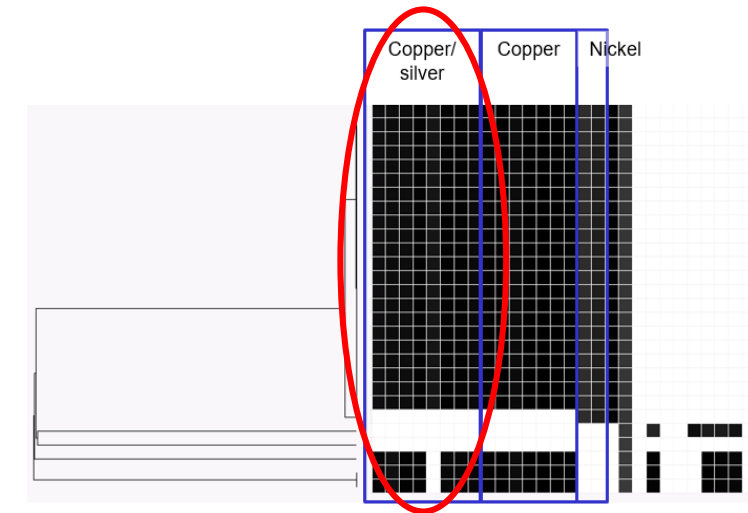
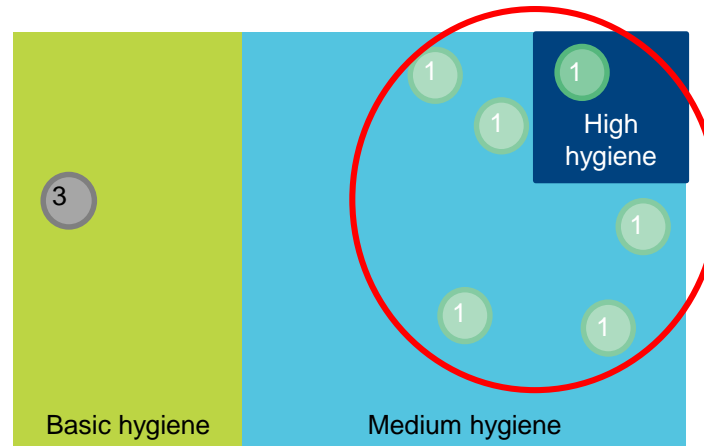
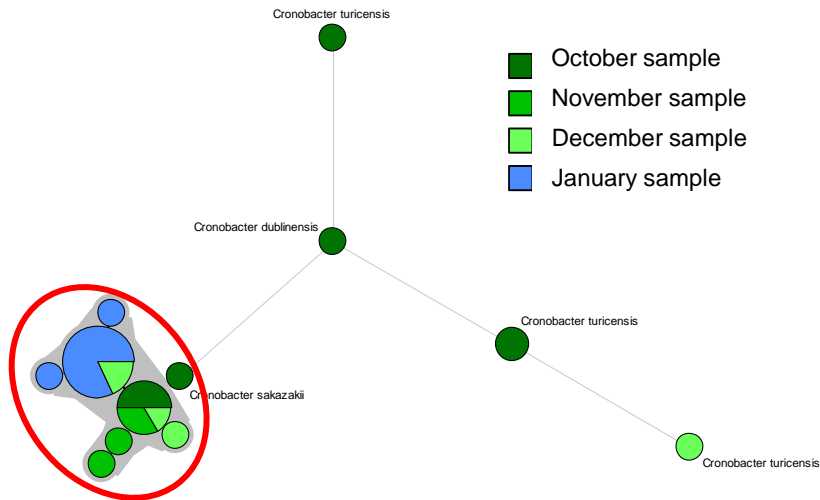
Gene-UP TYPER database

# USE CASE: CRONOBACTER IN INFANT FORMULA

WHAT?

WHERE?

WHY?



2 weeks of production capacity back (~\$6M gain)  
More effective cleaning/sanitation, water quality management

# BETTER VISUALIZATION = CLEARER ANALYSIS

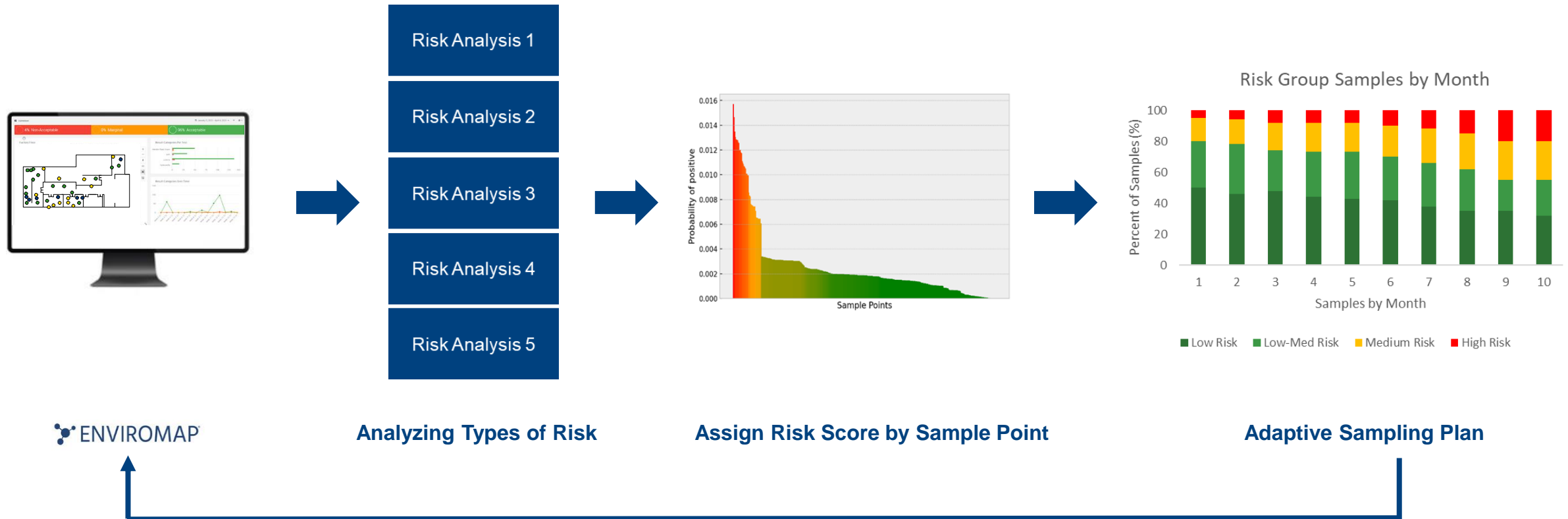




# ADAPTIVE SAMPLING (OPTIMIZATION)



# ADAPTIVE SAMPLING PLAN BASED ON RISK SCORES



ENVIROMAP

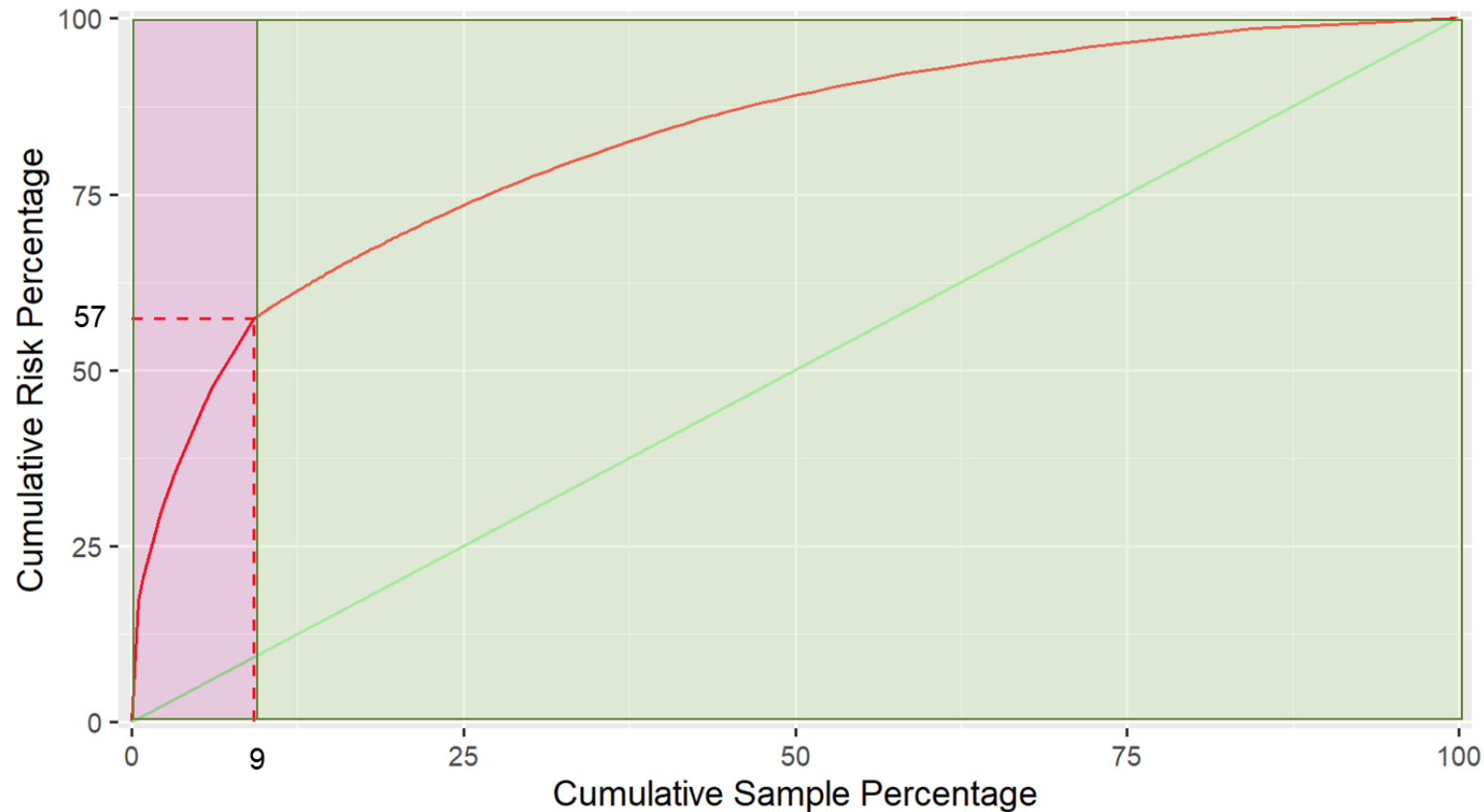
Analyzing Types of Risk

Assign Risk Score by Sample Point

Adaptive Sampling Plan

# EXAMPLE: SALMONELLA IN DRY PROCESSING ENVIRONMENT

Adaptive Sampling Cumulative Risk Curve, applied to Sampling Areas



## Potential actions

- Shift more sampling towards higher risk points
- Fixed schedule vs Random sampling
- Guide RCA and potential CAPA actions

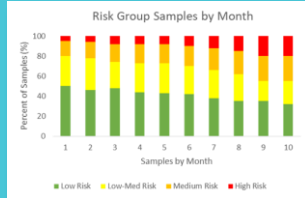
## Benefits

- Find pathogens earlier
- Improvement of Food Safety controls over time

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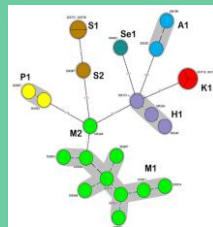
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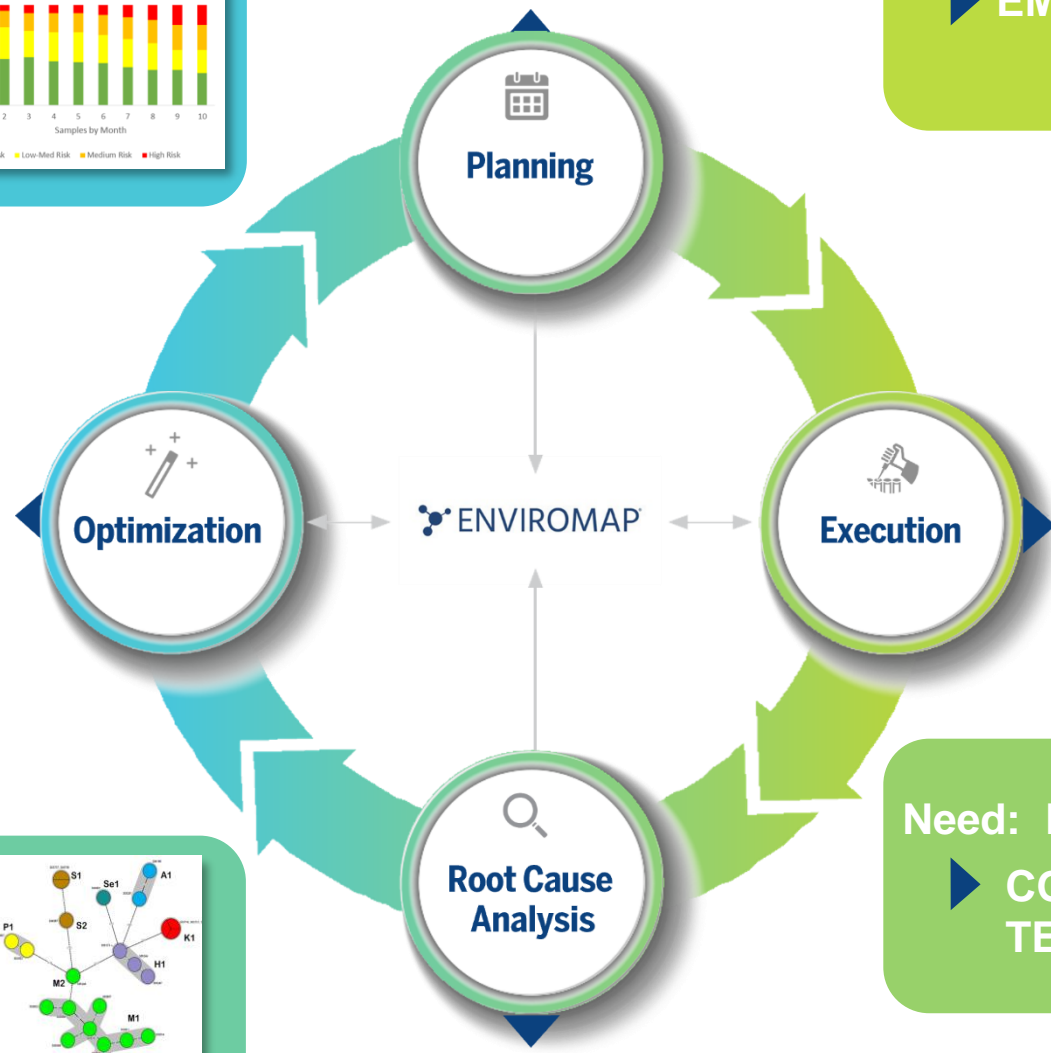
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