



Nestlé

Good food, Good life

AllforQuality

Our foundation for trust

Whole Genome Sequencing (WGS)

Practical Use vs. Implementation Concerns

Intisar Khan
Head of Food Safety
Nestlé



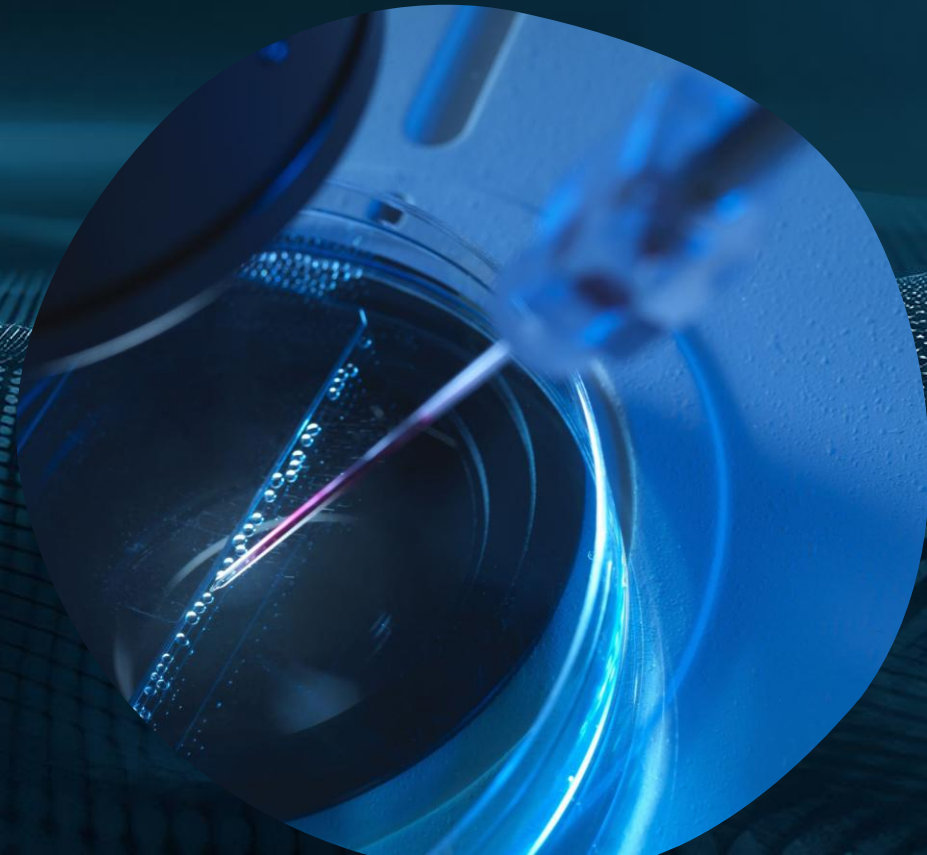


Nestlé Good food, Good life

AllforQuality
Our foundation for trust

Evolution of Microbiological Tools for Contamination Investigation.

**Advancements in detecting
&
Analyzing microbial
contamination**





Nestlé Good food, Good life

AllforQuality
Our foundation for trust

Evolution of Microbiological Investigation Tools

From Detection → Understanding → Prediction



Microscopy
Pre-1950s



Biochemical
1950–80s



PCR
1980–2000s



WGS
2000–2015



Metagenomics
2015–Now



AI/Digital
Future



Nestlé Good food, Good life

AllforQuality

Our foundation for trust



WGS is a key food safety tool for pathogen source tracking.

Limitations: strain shipment, slow TRT, complex interpretation, standard standardization & legal uncertainty.



Nestlé Good food, Good life

AllforQuality

Our foundation for trust

WGS Fingerprint gives Food Industry Invaluable Information



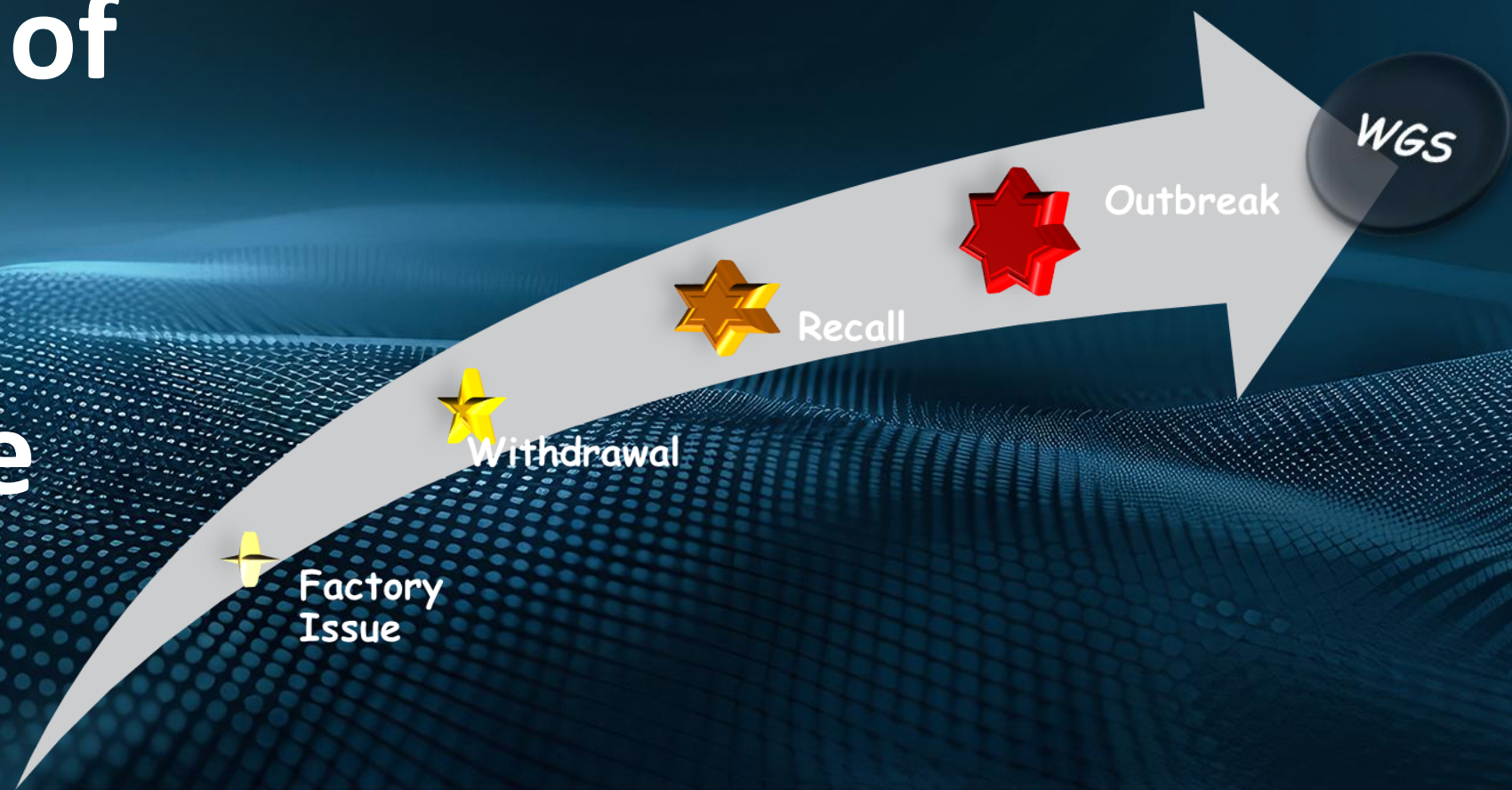


Nestlé Good food, Good life

AllforQuality

Our foundation for trust

WGS is Part of Tool Box for Proactive & Preventative Food Safety





Nestlé Good food, Good life

AllforQuality

Our foundation for trust

Why use Whole Genome Sequencing ?

Salmonella
isolated from proficiency
test



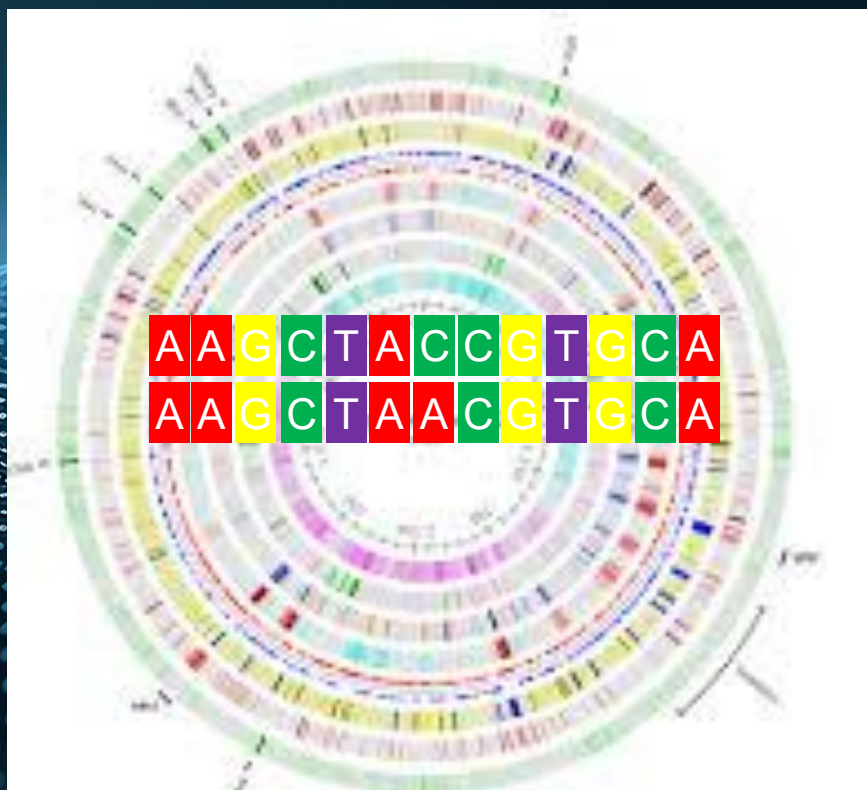
Isolate X

Salmonella
Isolated from product



Isolate Y

Was there a lab contamination?



WGS has sufficient discrimination power to allow linking of isolates and conclude it was a lab contamination



Nestlé Good food, Good life

AllforQuality

Our foundation for trust

Source tracking Between Factories, Continents and Suppliers





Nestlé Good food, Good life

AllforQuality

Our foundation for trust



Use of WGS – Real Examples with Timeline

WGS enables precise source attribution, faster decisions, and transition to predictive food safety

 2005–2015 	Context			
 Listeria – Frozen Vegetables (EU)	Multi-country outbreak, long-term contamination	Matched clinical isolates to plant; identified persistent strain	Targeted shutdown; outbreak contained	Environmental reservoirs missed by traditional tools
 Salmonella – Peanut Butter (USA)	Complex supply chain outbreak	Confirmed linkage between plant, food, and patients	Enabled precise recall and regulatory action	Establishes WGS as standard for outbreak confirmation
 Cronobacter – Infant Formula	Rare but severe infant infections	Compared clinical vs environmental strains	Distinguished real contamination from unrelated events	Enables evidence-based decisions in critical, low-frequency risks
 <i>E. coli</i> – Leafy Greens	Recurrent outbreaks with unclear origin	Linked cases to farms/watersheds	Shifted controls upstream (water, agriculture)	Extends visibility beyond factory → full value chain



Nestlé Good food, Good life

AllforQuality

Our foundation for trust

WGS : Gold standard for outbreak investigation



Lab error behind false Salmonella finding in Finland

Newsweek

GO AD-FREE

Login

News

Food Recall

Canada

California

Salmonella

Food Poisoning

Bacteria

Symptoms

FDA

Green Onion Recall Canceled Due to False Positive for Salmonella

Published Nov 26, 2024 at 6:01 AM EST

Updated Nov 27, 2024 at 4





Nestlé Good food, Good life

AllforQuality

Our foundation for trust

enabling precise source tracking, faster decisions, and stronger prevention strategies across the value chain.



Challenge	Before WGS	With WGS
Outbreak linkage	Uncertain	Genome-confirmed
Root cause	Hypothesis-driven	Evidence-based
EMP	Indicator-based	Strain tracking
Risk management	Reactive	Predictive



Nestlé Good food, Good life

AllforQuality

Our foundation for trust

EFSA Scientific Colloquium
Summary Report

20

1506-1508-2240

USE OF WHOLE GENOME SEQUENCING (WGS) OF FOOD-BORNE PATHOGENS FOR PUBLIC HEALTH PROTECTION

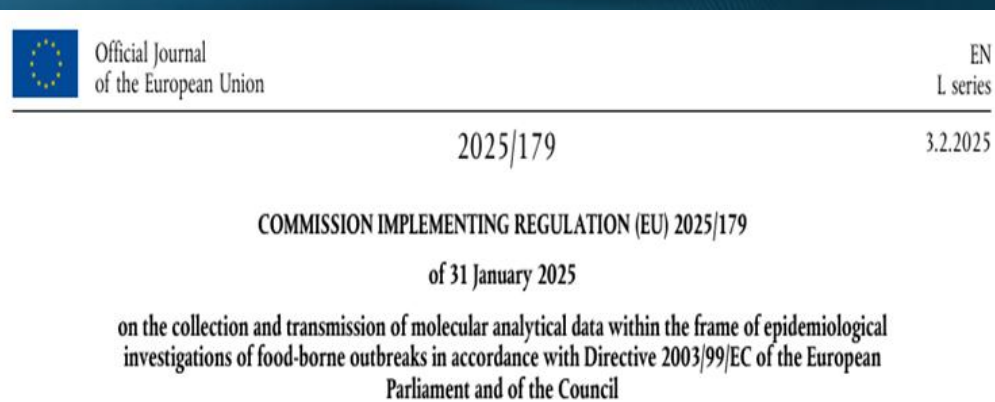
16-17 June 2014, Parma, Italy



Regulatory and Legal Implications

Legal uncertainty remains one of the biggest constraints

In the EU, [Commission Implementing Regulation (EU) 2025/179]() establishes rules for WGS data collection and transmission during food-borne outbreak investigations, applying from 23 August 2026.



3. Where available, food and feed business operators shall submit to the competent authority, upon its request, the isolates of the pathogens referred to in paragraph 1 and the related results from WGS from their own investigations when associated or suspected to be associated with an outbreak, together with the associated data referred to in Article 2(2).



Nestlé Good food, Good life

AllforQuality

Our foundation for trust

Science, Databases and Strong Recommendations to Use WGS by FDA

Using Science to

Find the Sources of Outbreaks

Using Science to Find the Sources of Foodborne Illness Outbreaks

Every year, millions of Americans get sick from eating food contaminated with pathogens, like harmful bacteria, parasites, viruses, etc. To stop the spread of outbreaks, the U.S. Food and Drug Administration (FDA), together with federal, state, and local partners, is increasingly using whole genome sequencing to track down sources of food contamination. Applying this technology to food safety, something pioneered by FDA and the SequenceTrakr network, helps public health investigators identify contaminated foods and figure out how the pathogens entered the food supply.

Step 1: Collect Pathogen Samples

Medical professionals collect samples from the people who get sick.

Investigators from FDA, the U.S. Department of Agriculture (USDA), state, or local agencies collect samples from food.

Federal, state, or local investigators collect samples from production facilities, restaurants, farms, or other locations where food is handled.

Step 2: Identify Pathogens through Whole Genome Sequencing

Federal and state scientists use whole genome sequencing to reveal the order of the chemical building blocks that make up a pathogen's DNA. By identifying the genomic sequences of each pathogen collected, investigators can tell the difference between even the most closely related pathogen strains.

Living organisms, from bacteria to human beings, are made of cells. Each cell contains DNA. Deoxyribonucleic acid, which is a biological instruction set for the organism to develop, function, and reproduce, and makes each organism unique.

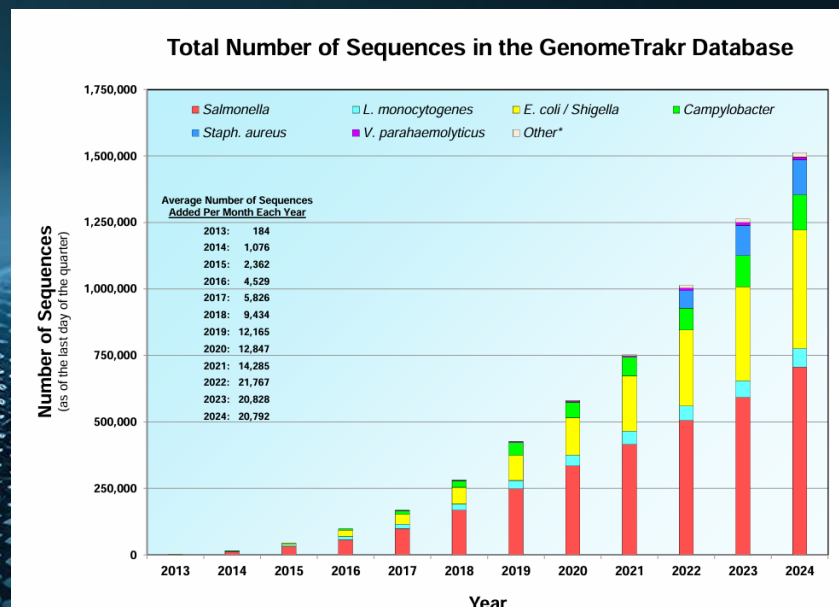
Step 3: Compare Genomic Sequences

Scientists from FDA, USDA, the Centers for Disease Control and Prevention (CDC), and the states compare the genomic sequences from the pathogens found in food and from places the food was handled, to the pathogens from people who got sick, to see if there is an identical or very close match. These comparisons at the genetic level can precisely and quickly identify common illnesses, foods, and locations where a given pathogen has been found.

Action

When illnesses are linked to a contaminated food or food handling environment, FDA, its federal, state, and local partners, and the food industry work to prevent more people from becoming sick. Meanwhile, investigators continue their work to understand exactly where and how the pathogen got into the food supply so steps can be taken to keep the contamination from happening again.

FDA/CDR



**U.S. FOOD & DRUG
ADMINISTRATION**

March 8, 2023

environmental or product sample. In reviewing product testing plans and EMPs, FDA investigators noted that some facilities do not use technologies such as **WGS** to investigate pathogen isolates to help determine the root cause. Samples collected during some of our investigations identified more than one strain of *Cronobacter* spp. within the same facility. **FDA strongly recommends using WGS (and the public database of genomes available at the National Center for Biotechnology Information) to analyze and investigate any pathogen isolated from a production environment or product.** The data from this analysis can provide the most complete information available to identify and implement appropriate and effective corrective actions.



Nestlé Good food, Good life

AllforQuality

Our foundation for trust

Food business operators already use WGS successfully

- Distinguish related from unrelated isolates during root-cause investigations
- Identify persistent versus transient strains in environmental monitoring
- Support more targeted corrective actions in factories.

Wider uptake still depends on overcoming technical and organizational barriers

- Turnaround time
- Lack of harmonized sequencing and interpretation standards
- Dependence on external providers
- Limited in-house bioinformatics capability
- Financial constraints linked to testing, validation, data storage, and specialist expertise.

Companies also remain concerned regarding the data

- May be used disproportionately or interpreted without sufficient epidemiological context
- Creating unintended regulatory action or reputational harm
- Matched sequences matches are treated as definitive evidence rather than one element of a broader investigation.



World Food Safety Day

7 June
2026

**From burden
to solutions
safe food everywhere**



#WorldFoodSafetyDay



AllforQuality
Our foundation for trust