



GenEpi-BioTrain

Introduction on foodborne pathogens and food side investigations in multi-country outbreaks

28 May 2024

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European Food Safety Authority

Intended Learning Objectives

Specific objectives of this session:

1. Learn about the food-side perspective of a foodborne outbreak
2. Learn about sources and type of food data
3. Learn the role of EFSA in the assessment of outbreaks

Outline

This session consists of the following elements

1. Introduction to the European monitoring system
2. Explanation of foodborne outbreak assessments
3. Examples of outbreaks investigations and related assessments

EUROPEAN MONITORING SYSTEM

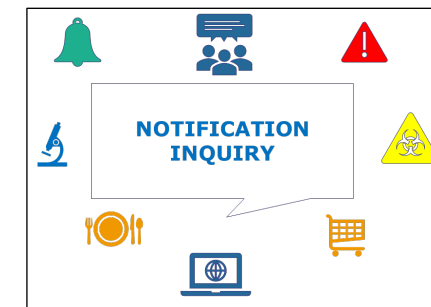
National epi-investigations point to a possible contaminated food

The public health authorities launch an alert in EWRS and exchange information on the type of disease and number of human cases in EPI-Pulse

The food authorities in the EU Member States make available the traceability data related to the suspected contaminated food in RASFF

EFSA and ECDC **monitor** and combine the data shared by national food safety and public health authorities to evaluate whether national incidents evolve into **multi-country outbreak**

ECDC and EFSA established a weekly **teleconference to discuss** relevant foodborne clusters and events



MULTI-COUNTRY FOODBORNE OUTBREAK ASSESSMENT

Criteria for a Joint Rapid Outbreak Assessment (ROA)

- When an outbreak of human cases of the same foodborne disease is identified in 2 or more EU MSs and is ongoing
- There is the suspicion of an exposure to common food that was EU traded
- There is an EpiPulse/EWRS notification and a RASFF notification

Role of EFSA

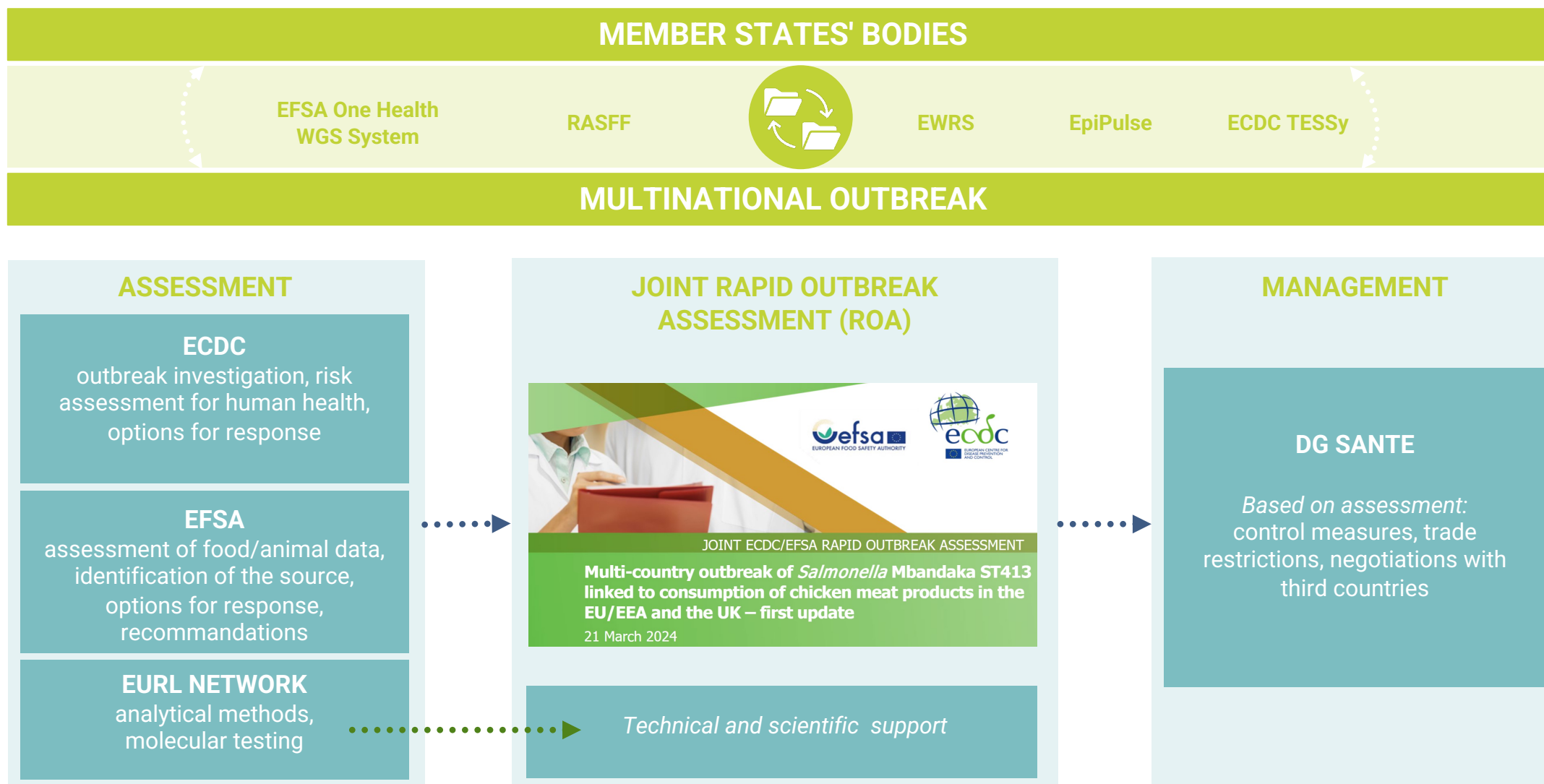
- Identify the contaminated food as vehicle of infection in the specific outbreak,
- Identify the point of contamination of the suspected food along the food chain,
- Identify the distribution of the suspected food to allow risk managers to implement control measures (e.g., recall, withdrawal)

Sources of data

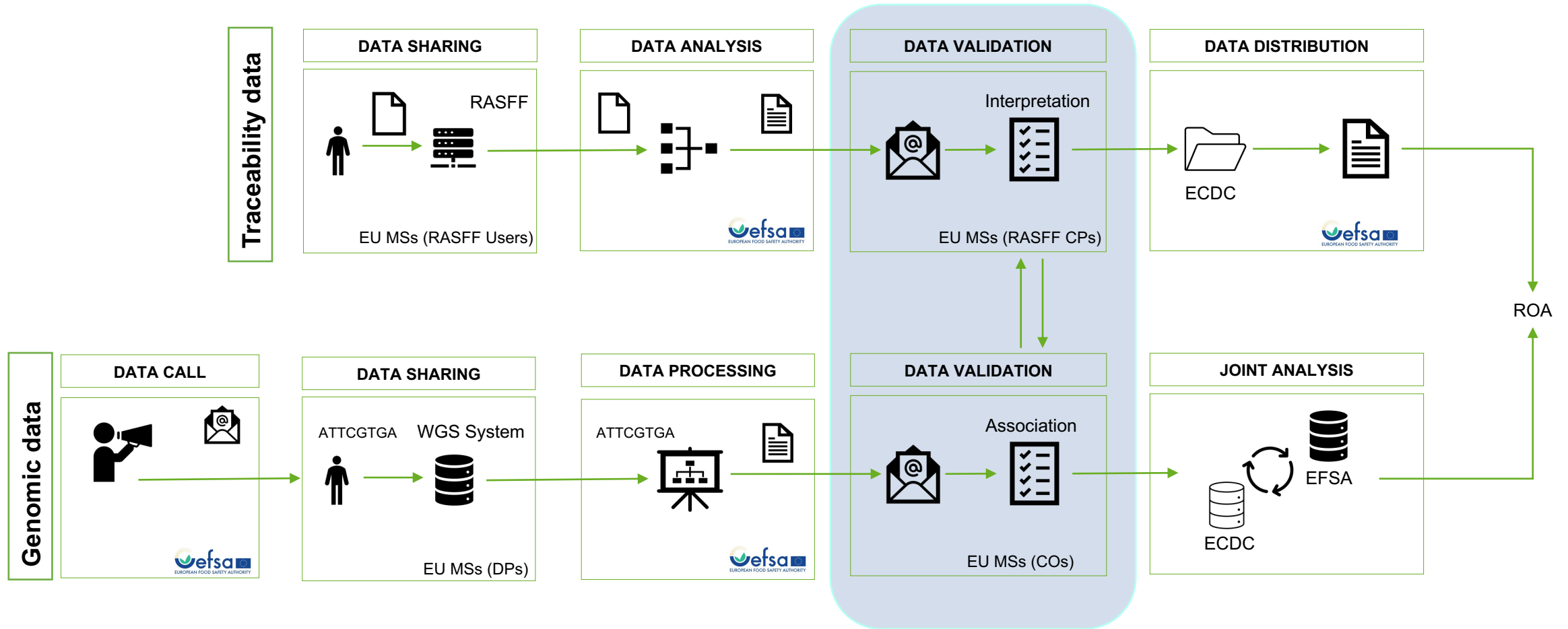
- | | | |
|--------------------------------------------|--------|----------------------------------------------------------|
| Public health (human) data |▶ | ECDC Epi-Pulse platform |
| Food traceability and microbiological data | •▶ | EC Rapid Alert System for Food and Feed (RASFF) platform |
| Genomic data on food |▶ | EFSA One Health WGS System |



CROSS SECTORAL WORKING ARRANGEMENTS



FOOD DATA: FLOW, ANALYSIS, AND VALIDATION



ROA REPORT: STRUCTURE AND REMITS

ECDC

EFSA

Abstract

Event background

Traceability, microbiological, and environmental food investigations

Epidemiological and microbiological investigations of human cases

Control measures

European whole genome sequencing analysis of human and non-human isolates

ECDC-EFSA risk assessment for the EU/EEA

Recommendations and options for response

Prevalence in humans

Prevalence in food

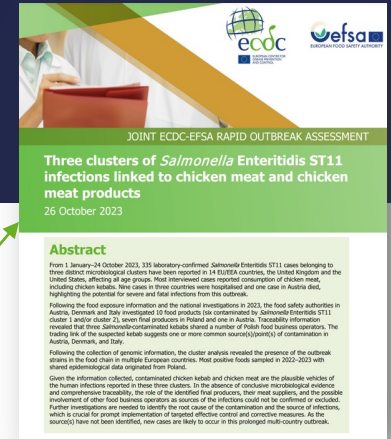


Figure 3. Number of confirmed *S. Virchow* ST16 cases, by country and quarter-year in five EU/EEA countries and the UK (n=209), 2017–2023, as of 16 March 2023

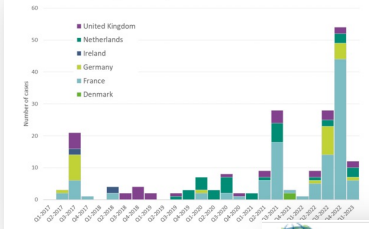


Figure 7. Single linkage tree with 5 AD cut off of 13 *S. Enteritidis* ST11 sequences in the cluster 1 (2023-FWD-00048), including four human isolates and nine non-human isolates

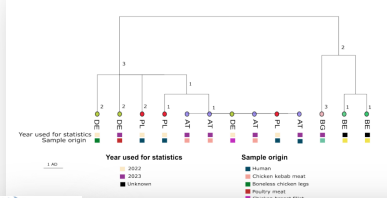


Figure A1. Reported *S. Enteritidis* cases in the EU/EEA from 2007 to 2022

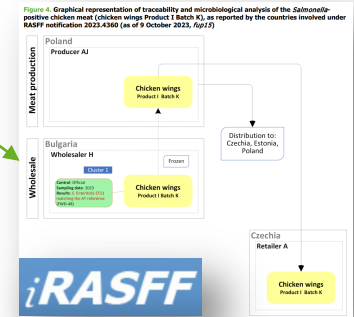
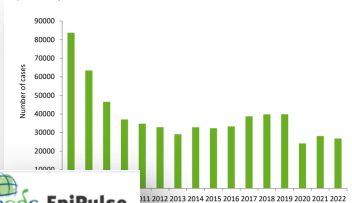
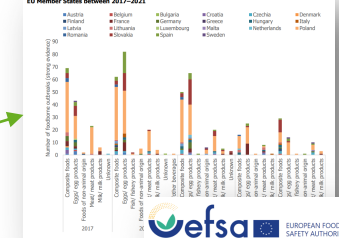



Figure A2. Number of strong-evidence foodborne outbreaks caused by *S. Enteritidis* and reported by EU Member States between 2017–2021



WHAT IS FOOD TRACEABILITY

Traceability is a risk-management tool which allows food business operators or authorities to withdraw or recall products which have been identified as unsafe.

EU's General Food Law entered into force in 2002 and makes **traceability compulsory** for all food and feed businesses.

 **RASFF Window**

SEARCHCONSUMERSTRACES

NOTIFICATION 2024.2820
Detection of Listeria in salmon

notified 9 APR 2024 by France | last update 10 APR 2024 EC validated

Reference	2024.2820
Subject	Detection of Listeria in salmon
Notification type	Food
Notification basis	Company's own check
Classification	Alert notification
Risk decision	Serious

Risk

Risk decision	Serious
Hazards observed	Not defined
Nb. persons affected	---
Symptoms / Illness	Unknown

Organisations
 France (n)(o)(op) Slovenia (d)(ffup)
(n) Notifying | (o) Origin | (d) Distribution | (op) Operator
(ffup) Flagged for Follow-Up | (ffa) Flagged For Attention

Date of notification 09-04-2024

Notifying country France

Product Smoked salmon

Product category Fish and fish products

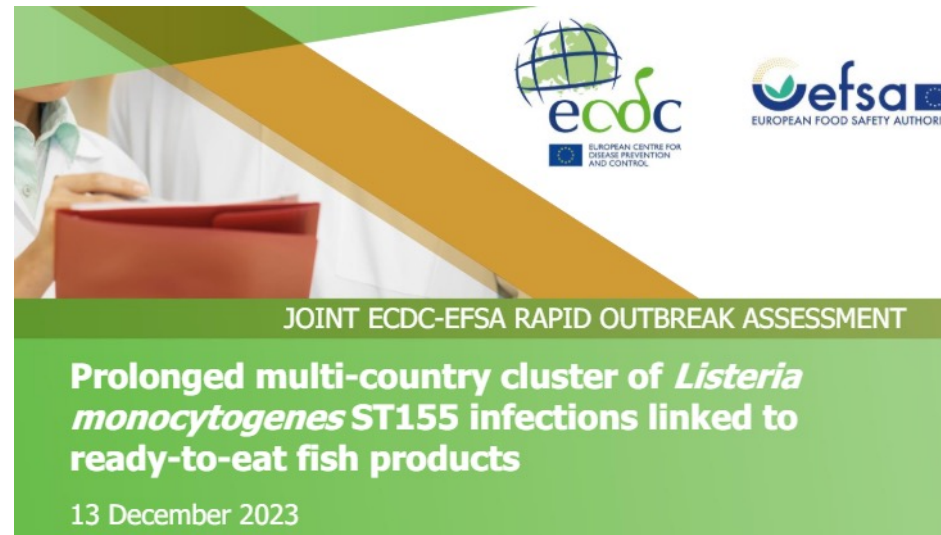
Measures taken

Country	Action	Product name	URL
France	Recall from consumer	Smoked salmon	None
France	Withdrawal from the market	Smoked salmon	None

The **Rapid Alert System for Food and Feed (RASFF)** was established to ensure the exchange of information between member countries to support swift reaction by food safety authorities in case of risks to public health resulting from the food chain. Its legal basis is Article 50 of Regulation (EC) N° 178/2002 also known as the General Food Law.



ROA REPORT: REAL CASE



Abstract

A genomic cluster of *Listeria monocytogenes* sequence type (ST) 155, serogroup IIa, infections has been identified in the European Union/European Economic Area (EU/EEA) and the United Kingdom (UK). Based on genomic similarity, the cluster can be divided into three sub-clusters, of which only cases due to sub-cluster 1 continue to be reported. Sub-cluster 1 is therefore the focus of this assessment, with 64 cases reported in five EU/EEA countries between 2016 and 2023, of which 17 were in 2022 and 2023 (one in Austria, one in Belgium, eight in Italy, six in Germany, and one in the Netherlands). It includes 10 fatal cases between 2019 and 2023. Sub-clusters 2 and 3 are historical, with 30 cases reported between 2011 and 2021. Based on case interviews, ready-to-eat (RTE) fish products have been implicated as vehicles of infection.

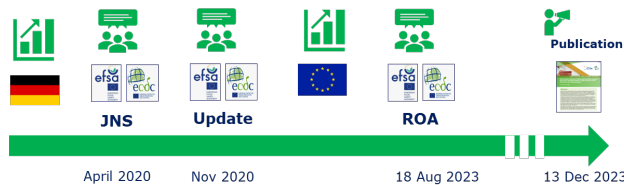
National food investigations, traceability, and genomic data identified 34 *L. monocytogenes* isolates from 12 fish products and one isolate from a fish processing environment within sub-cluster 1. Sequencing analysis identified a link with two processing plants in Lithuania. In 2022–2023, contaminated fish products from these plants had reached retail markets in Germany and Italy, but there was no information on the product distribution in the other three countries reporting cases. The recurrent detection of the sub-cluster 1 strain from marketed sealed RTE fish products revealed the persistence of the strain in one processing plant over eight years.

Further targeted investigation in the RTE fish production chain is needed to identify the point(s) of contamination. The interruption of the production of RTE fish products in one of the processing plants is likely to reduce infections, but until all sources and sites of contaminations are properly controlled new cases are expected to occur, particularly among vulnerable people (the immunosuppressed and those aged over 75 years).



Prolonged multi-country cluster of *Listeria monocytogenes* ST 155 infections linked to ready-to-eat fish products

EFSA-ECDC background



94 confirmed cases

9 EU/EEA n=93; UK n=1 (2011-2023)

- Most affected age group 75-84 –year olds
- 52 hospitalizations, 17 deaths

Geographical case distribution



https://en.wikipedia.org/wiki/European_Union

Characterization

L. monocytogenes serogroup **IIa**, clonal complex 155, **sequence type 155**, cluster type 1128 (Ridom, SeqSphere), L2-SL155-ST155-CT842/CT5098 (Pasteur scheme).

The strain is negative for LIPI3 and LIPI4



Prolonged multi-country cluster of *Listeria monocytogenes* ST 155 infections linked to ready-to-eat fish products

Food exposure

Germany:

Four of five interviewed cases reported consumption of **RTE fish products**

Italy:

Three of five cases reported consumption **RTE fish products**. A meningitis case in 2023 indicated the **brand**

Netherlands:

The one 2023 case reported consumption **RTE fish products**

EU case definition

A confirmed outbreak case in the genetic 'Omikron1' cluster:

A laboratory-confirmed *Listeria monocytogenes* case with disease onset on or after **1 January 2022**

AND

Fulfilling the following laboratory criteria:

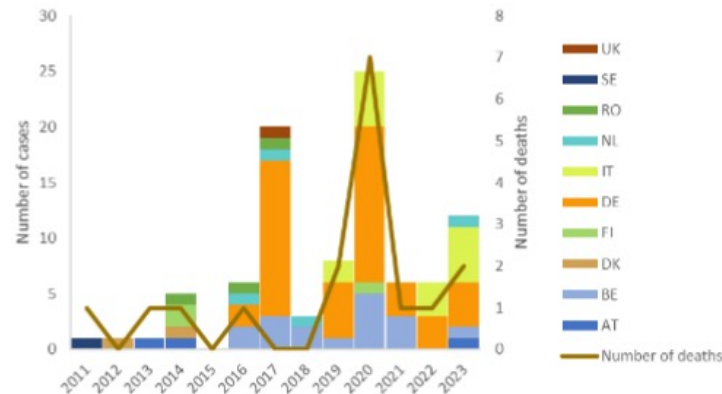
- clustering within **seven allelic differences** (ADs) by cgMLST in a centralised single-linkage WGS analysis, OR
- clustering within **seven ADs** by cgMLST in a national pipeline



Prolonged multi-country cluster of *Listeria monocytogenes* ST 155 infections linked to ready-to-eat food

Temporal case distribution

Figure 1. Number of all confirmed cases of *L. monocytogenes* ST155 and reported deaths in the 'Omikron1' cluster by country and year of statistics in nine EU/EEA countries and the UK (n=94), as of 5 December 2023



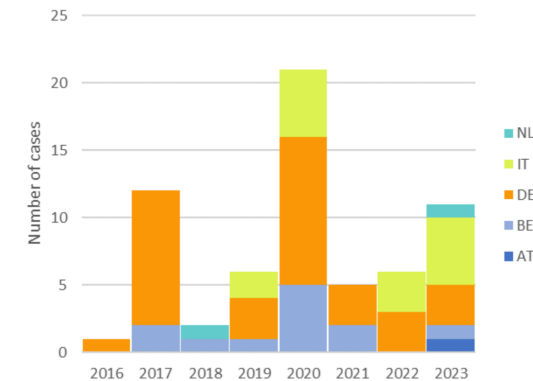
AT: Austria; BE: Belgium; DK: Denmark; FI: Finland; DE: Germany; IT: Italy; NL: the Netherlands; RO: Romania; SE: Sweden; UK: the United Kingdom.

Confirmed cases (n=94, 2011-2023)

EU genetic sub-cluster

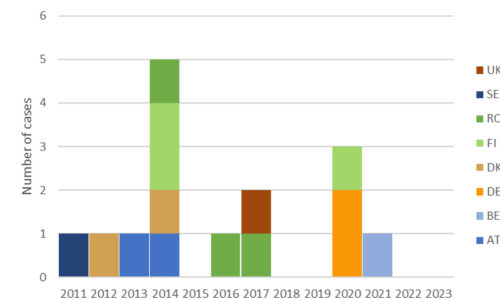
cut-off of **four ADs** in a single-linkage analysis among confirmed outbreak cases

Figure 3. Number of all confirmed cases of *L. monocytogenes* ST155 in the 'Omikron1' sub-cluster 1 by reporting country and year of statistics in five EU/EEA countries (n=64), as of 5 December 2023



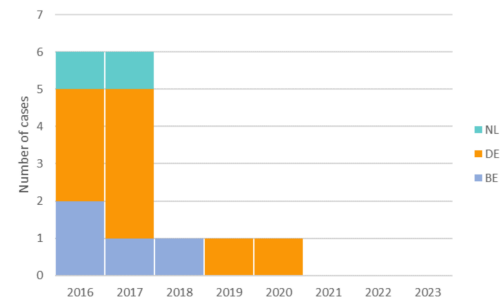
sub-cluster 1

Figure 4. Number of all confirmed cases of *L. monocytogenes* ST155 in the 'Omikron1' sub-cluster 2 by reporting country and year of statistics in seven EU/EEA countries and the UK (n=15), as of 5 December 2023



sub-cluster 2

Figure 5. Number of all confirmed cases of *L. monocytogenes* ST155 in the 'Omikron1' sub-cluster 3 by reporting country and year of statistics in three EU/EEA countries (n=15), as of 5 December 2023

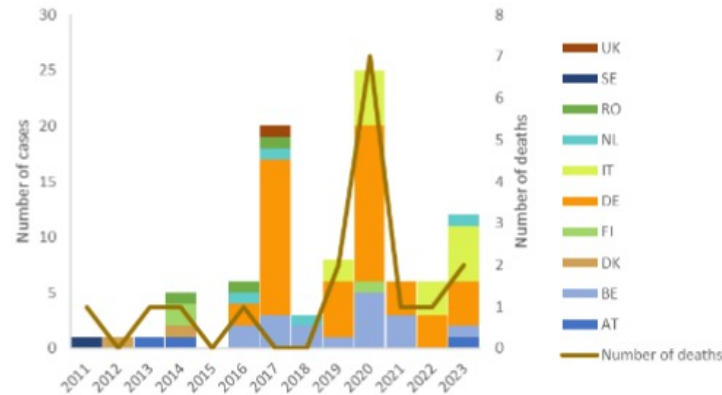


sub-cluster 3

Prolonged multi-country cluster of *Listeria monocytogenes* ST 155 infections linked to ready-to-eat food

Temporal case distribution

Figure 1. Number of all confirmed cases of *L. monocytogenes* ST155 and reported deaths in the 'Omikron1' cluster by country and year of statistics in nine EU/EEA countries and the UK (n=94), as of 5 December 2023



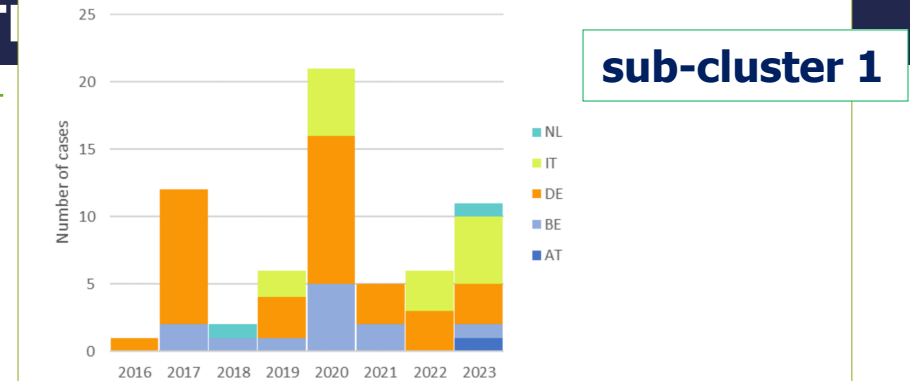
AT: Austria; BE: Belgium; DK: Denmark; FI: Finland; DE: Germany; IT: Italy; NL: the Netherlands; RO: Romania; SE: Sweden; UK: the United Kingdom.

EU genetic sub-cluster

cut-off of **four ADs** in a single-linkage analysis among confirmed outbreak cases

Confirmed cases (n=94, 2011-2023)

Figure 3. Number of all confirmed cases of *L. monocytogenes* ST155 in the 'Omikron1' sub-cluster 1 by reporting country and year of statistics in five EU/EEA countries (n=64), as of 5 December 2023



sub-cluster 1

n=64, 2016-2023

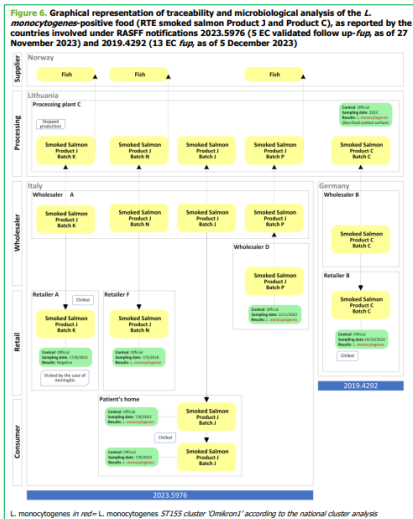
n=17, 2022-2023

EU case definition
≥ 1 January 2022

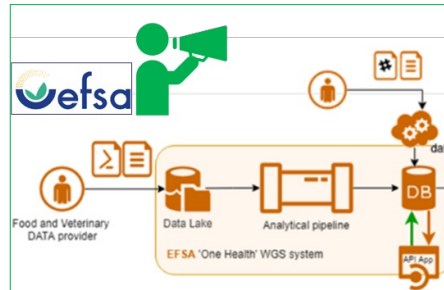


Prolonged multi-country cluster of *Listeria monocytogenes* ST 155 infections linked to ready-to-eat fish products

National investigation



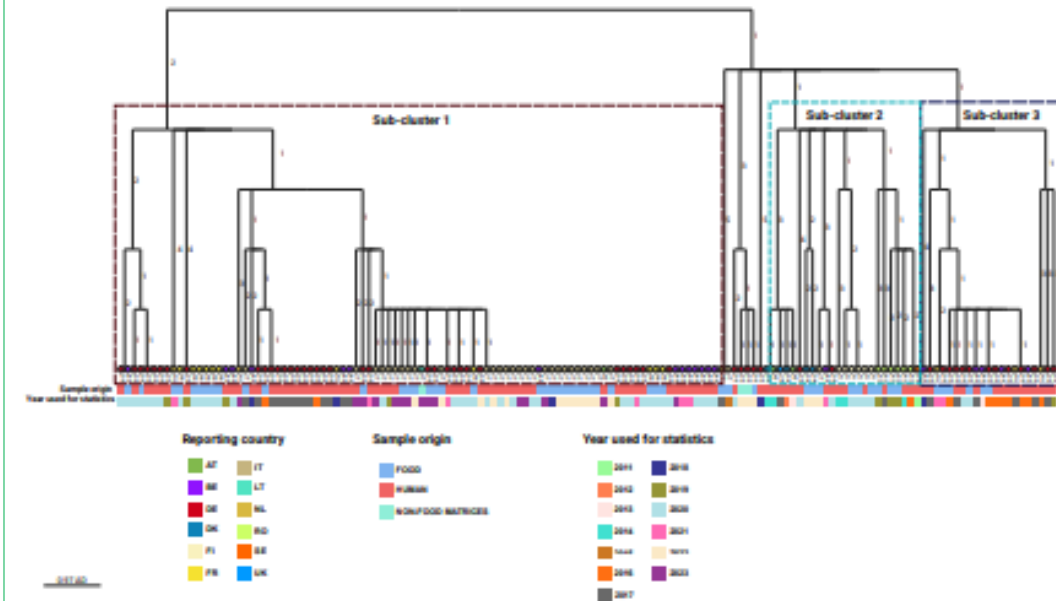
Call for genomic data



EU WGS cluster analysis

Overall, 144 human and non-human isolates

Figure 9. Overview of the three genetic sub-clusters of *L. monocytogenes* ST155 isolates in the cluster 'Omikron1' at a maximum four allelic differences in a single-linkage tree (n=144*), as of 5 December 2023



Subcluster 1:
34 non-human isolates:
12 fish products (only 6 with epi-data!)
1 processing environment



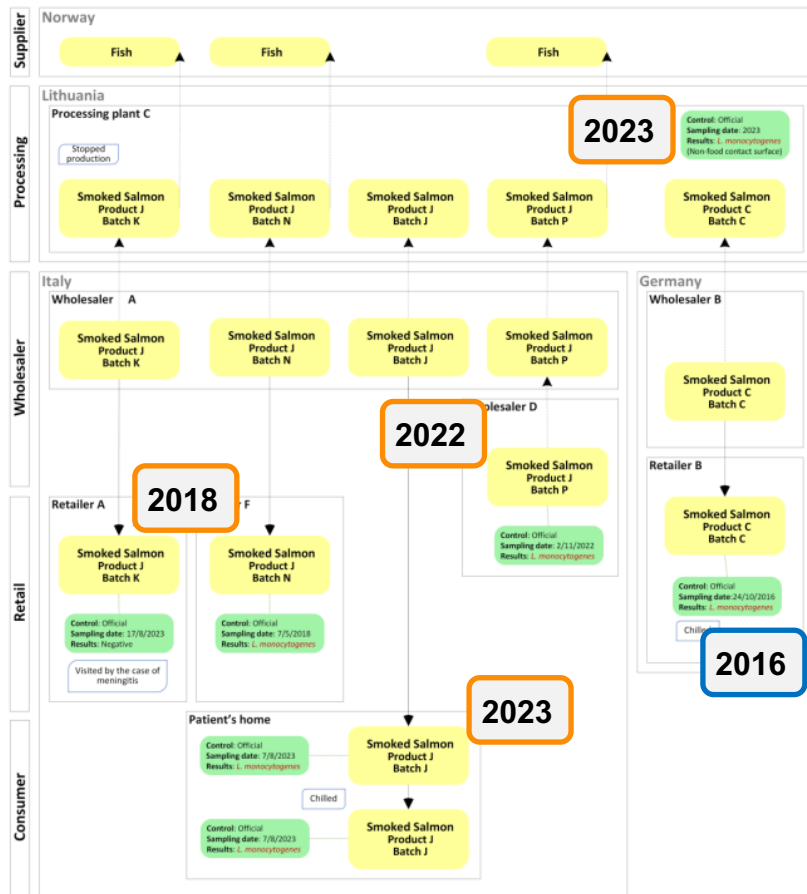
*Including one duplicate isolate from a case in Germany.

Available at: <https://microreact.org/project/5BrgNREs9rU2faXEPUVb5Z-roa2023-fwd-00023/listeriosisomikron1>

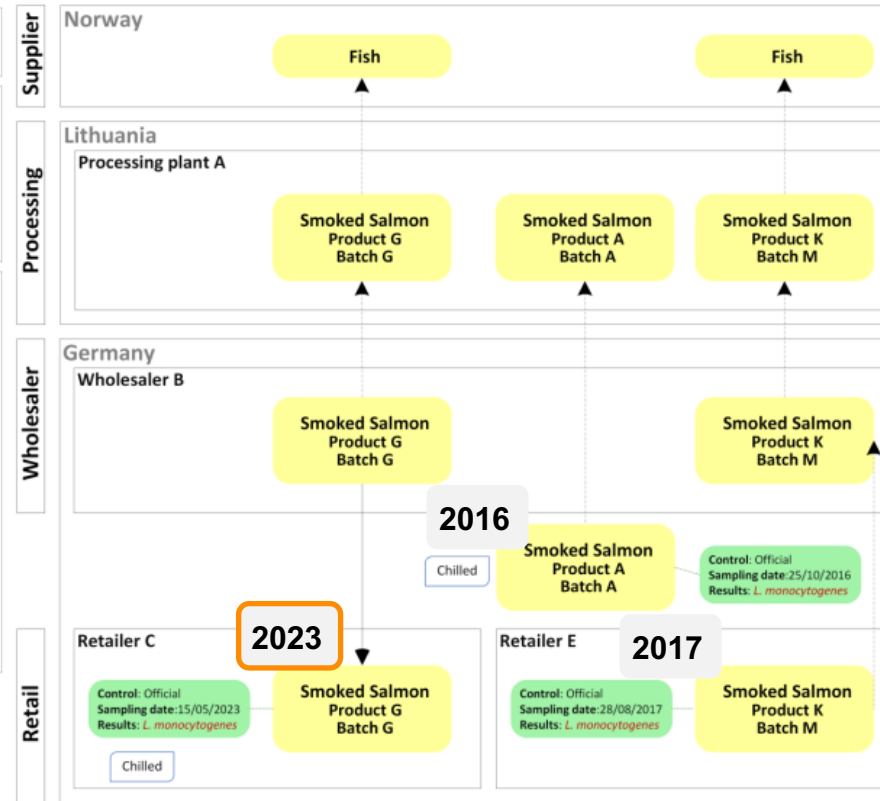


Prolonged multi-country cluster of *Listeria monocytogenes* ST 155 infections linked to ready-to-eat fish products

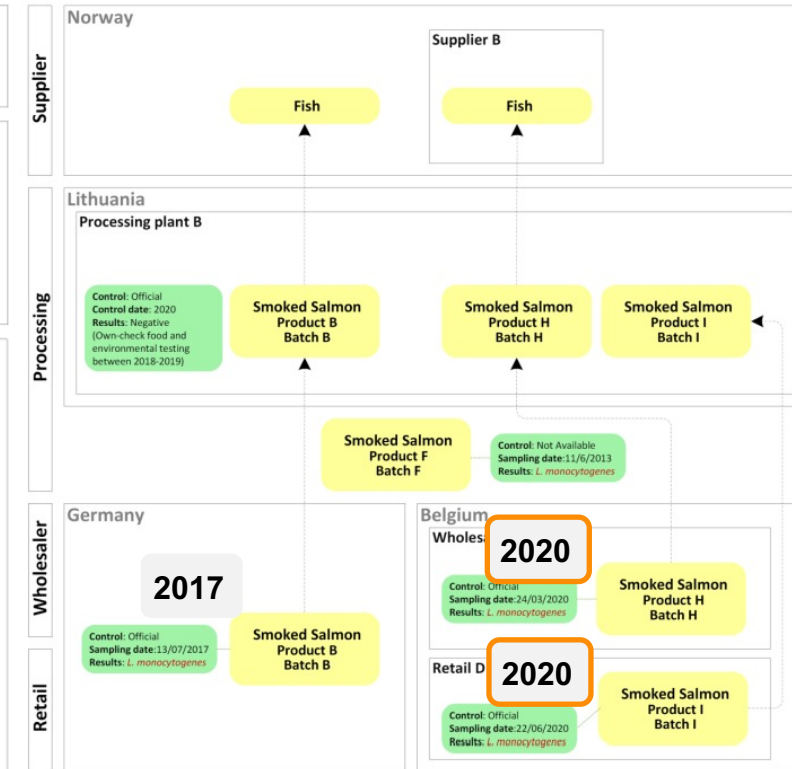
Lithuanian Processing Plant C



Lithuanian Processing Plant A



Lithuanian Processing Plant B



EFSA AND ECDC ASSESSMENT

A genomic **cluster of *Listeria monocytogenes* ST 155**, serogroup IIa, infections has been identified in the EU/EEA and the UK.

Based on genomic similarity, the cluster can be divided into three sub-clusters, of which **sub-cluster 1** is the only sub-cluster for which cases continue to be reported, with 64 cases in 2016-2023, and **17 cases in 2022-2023** (DE, IT, AT, BE, NL).

Within the active sub-cluster 1, there were 12 fish products and one environmental isolate. Out of 12, 6 RTE fish products were manufactured by **3 processing plants in Lithuania** (Plants A, B, and C).

Two active sources of contaminated fish products in Lithuania: Processing **Plant A** (2023) and Processing **Plant C** (2018-2023).

Contaminated fish products from these two processing plants had reached the retail market in **DE and in IT**, but there was no distribution information for **AT, BE, and NL** (reporting cases too)

The detection in 2023 of the sub-cluster 1 strain from a sealed RTE salmon product (fridge of the Italian case of meningitis) pointed towards the Processing **Plant C** as the **source of infection** for the case of meningitis in Italy.

The detection of the sub-cluster 1 strain from sealed RTE fish products in the EU countries and environmental samples revealed **the persistence of the strain** in at least the Processing **Plant C** over the years 2016–2023.

The **interruption of production** in Processing **Plant C** is likely to reduce the likelihood of infections but **new cases are expected to occur** in the EU/EEA countries, particularly among vulnerable persons (immunosuppressed and elderly), **until all the sources and sites of contaminations are properly controlled.**



RECOMMENDATIONS AND OPTIONS FOR RESPONSE

- Countries are encouraged **to share sequences of human *L. monocytogenes* isolates** with ECDC as part of the EU/EEA-wide WGS-enhanced listeriosis surveillance in the ECDC One Health WGS system.
- Countries are encouraged **to investigate exposure information**, when feasible, if new cases are reported, and to collaborate with food safety authorities to identify contaminated food products.
- Countries are invited **to share the sequence of the food *L. monocytogenes* isolates** linked to the present cluster either microbiologically (serotype or ST) or epidemiologically (e.g. suspected food items reported by human cases), **to share in RASFF the traceability information** related to those sequences, and to submit genomic data of *L. monocytogenes* isolates from any kind of food, feed, animal and related environment to the EFSA One Health WGS System
- Countries are invited to conduct and their investigations **to identify the point(s) of contamination and the origin of the contamination** upstream into the food production chain and to share the related outcome in RASFF
- Storing food at **refrigerator temperatures**, exercising **proper handling**, refraining from consuming food past its **expiration date**, and following the **labelling instructions** can further reduce the risk of infection.



Further reading



A Review of Significant European Foodborne Outbreaks in the Last Decade




Eleonora SARNO, Denise PEZZUTTO, Mirko ROSSI, Ernesto LIEBANA, Valentina RIZZI

Aim

This review includes descriptions of significant outbreaks that occurred in Europe in the last decade. Their relevance to public health is evaluated from the changes, improvements, and novelties that pushed toward building a safer food system in the European Union, certainly driven by the One Health approach.

Results

The three assessed outbreaks are displayed in the table below

Causative Agent / Food	Year	Significance	Improvements	Novelties
Monoclonal outbreak of <i>E. coli</i> infections associated with sprouted seeds				
Enterohemorrhagic <i>E. coli</i> (EHEC) O104:H4 	2011	Exposure to an emergent strain with unprecedented pathogenicity	Enforcement of the existing hygiene provisions for food of non-animal origin Development of new hygiene and best practices guidelines Revision of the molecular approach to assess the STEC pathogenicity	Joint ECDC-EFSA molecular typing database New tracing software developed: FoodChain-Lab
Monoclonal outbreak of listeriosis associated with frozen vegetables				
<i>L. monocytogenes</i> 	2015-2018	Unexpected (but certainly possible) combination of pathogenic <i>L. monocytogenes</i> and food	Development of non-binding guidelines on <i>Listeria</i> sampling strategies Assessment on the risk posed by <i>L. monocytogenes</i> in blanched and frozen fruits and vegetables (non-RTE)	WGS routinely use in multistate outbreaks Upcoming new EU system for WGS collection and analysis (One Health WGS system)
Persistent polyclonal outbreak of salmonellosis associated with contaminated eggs				
<i>Salmonella</i> Enteritidis 	2016-2020	Prolonged food incident with a persistent environmental component Epidemic clones with wide geographical distribution	Enforcement of corrective actions and monitoring	Bacterial genome sequencing and rapid sharing efforts

<https://doi.org/10.4315/JFP-21-096>

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Food incident preparedness and response

Last reviewed date: 17 April 2023 | 6 minutes read Share: X f in

The EU has among the highest food and feed safety standards in the world to protect consumers, animals, plants and the environment. Despite this, food and feed safety incidents are reported every year when products or ingredients in food and feed have failed to meet these standards and may pose a health risk for consumers. Incidents like these are sometimes the result of food fraud, inadequate controls or simply accidents or natural events that are difficult to control.

Contents

- Milestones
- EFSA's role
- EU framework
- Published on this topic



<https://www.efsa.europa.eu/en/topics/topic/food-incident-preparedness-and-response>

European Commission

Food, Farming, Fisheries

Food Safety

Home Food Animals Plants Horizontal topics

Home > Food > Rapid Alert System for Food and Feed (RASFF)

Rapid Alert System for Food and Feed (RASFF)

https://food.ec.europa.eu/safety/rasff_en



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