

Hygienic practices for Listeria control in food factories

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TABLE 2 Reported hospitalisations and deaths due to zoonoses in confirmed human cases and food-borne outbreak cases in the EU, 2024.

Disease	Surveillance data on human cases (source: ECDC)											Food-borne outbreaks (source: EFSA)							
	Confirmed human cases	Hospitalisations					Deaths					Outbreaks	Cases	Hospitalisations and proportion of hospitalised cases		Deaths and case fatality rates			
		Status available		Reporting MSs ^a	Cases and proportion of hospitalised cases		Outcome available		Reporting MSs ^a	Deaths and case fatality rates				N	N	N	%	N	%
		N	%		N	%	N	%		N	%								
Campylobacteriosis	168,396	64,488	38.3	16	15,262	23.7	103,090	61.2	16	76	0.07	314	1420	101	7.1	0	–		
Salmonellosis	79,703	37,567	47.1	16	16,337	43.5	47,870	60.1	18	116	0.24	1238	10,164	1823	18.3	17	0.17		
STEC infections	11,738	3956	33.7	19	1411	35.7	8147	69.4	22	25	0.31	31	158	19	12.2	0	–		
Listeriosis	3041	1762	57.9	17	1715	97.3	1929	63.4	19	301	15.6	38	210	149	72.3	17	8.1		
Echinococcosis	984	425	43.2	14	193	45.4	604	61.4	16	3	0.50	0	0	0	–	0	–		
Brucellosis	273	132	48.4	12	82	62.1	176	64.5	13	2	1.1	0	0	0	–	0	–		
Tuberculosis caused by <i>M. bovis</i> , <i>M. caprae</i>	171	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0	–	0	–		
Trichinellosis	102	50	49.0	7	19	38.0	52	51.0	8	0	–	6	67	35	52.2	0	–		
Rabies	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		

Abbreviations: –, % not calculated; NA, not applicable, as information is not collected for this disease.

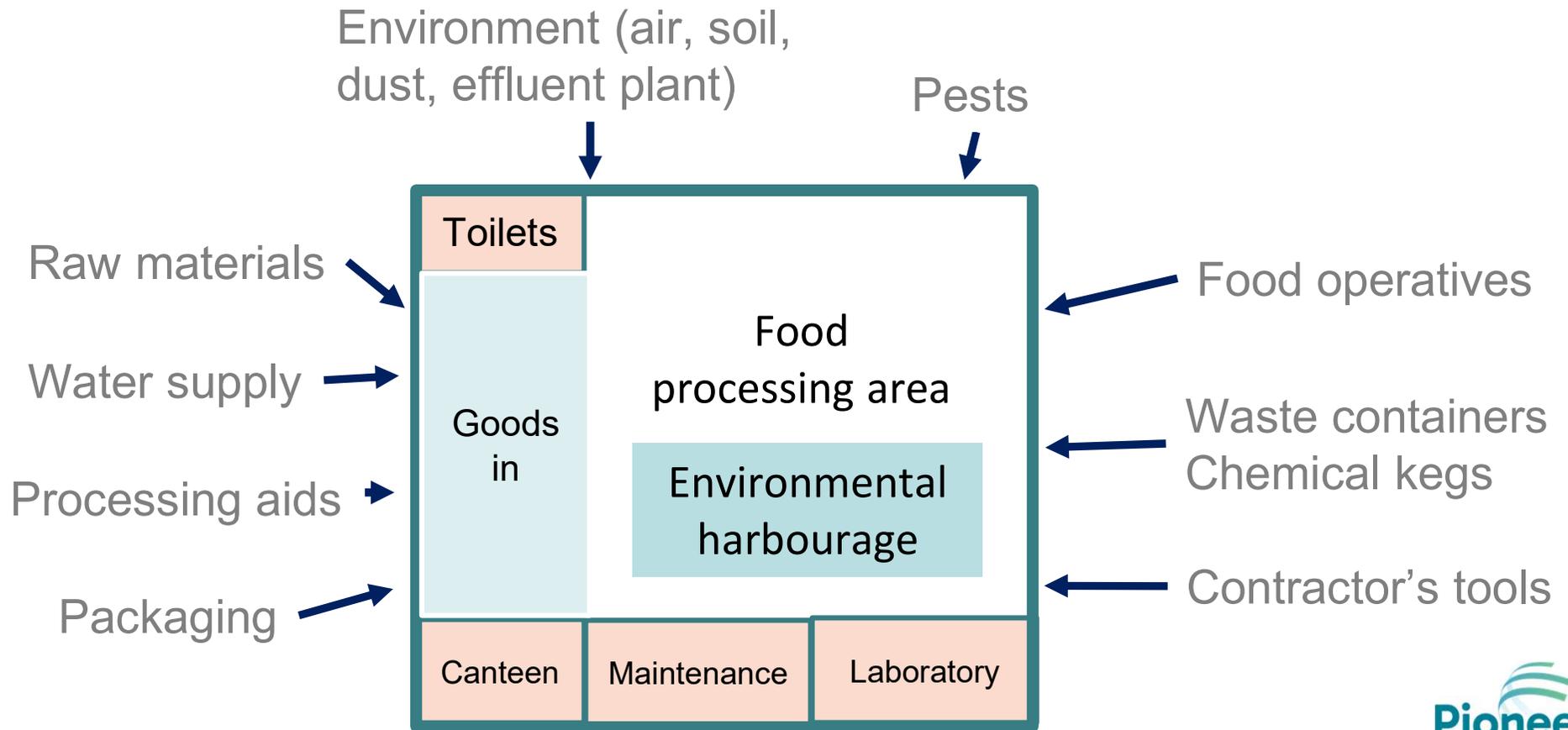
^aNot all countries provided data for all diseases.**TABLE 32** Summary of *Listeria monocytogenes* statistics relating to invasive human infections and major RTE food categories, EU, 2020–2024.

	2024	2023	2022	2021	2020	Data source
Humans						
Total number of confirmed cases	3041	2952	2780	2363	1887	ECDC
Total number of confirmed cases/100,000 population (notification rates)	0.69	0.67	0.63	0.54	0.43	ECDC
Number of reporting MSs	26	27	27	27	27	ECDC
Infection acquired in the EU	2062	1697	1508	1255	1286	ECDC
Infection acquired outside the EU	14	8	10	5	5	ECDC
Unknown travel status or unknown country of infection	965	1247	1262	1103	596	ECDC
Number of outbreak-related cases	210	133	296	106	123	EFSA
Total number of outbreaks	38	19	35	24	17	EFSA

The European Union One Health 2024
Zoonoses Report

<https://www.ecdc.europa.eu/en/publications-data/european-union-one-health-2024-zoonoses-report>

Listeria sources in manufactured foods



Listeria sources – raw materials

- Field position – tress, water, roads
- Weather conditions – rain, drought, dust
- Irrigation
- Animal waste
- Field workers
- Crop variety?
- Crop age
- Harvesting equipment – between crops /farms
- Containers/crates
- Vehicles
- Storage temp
- Cross-contamination
- Packhouse

PEER-REVIEWED ARTICLE

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Fresh Produce Harvesting Equipment – A Review of Cleaning and Sanitizing Practices and Related Science

**Pioneering
Safe Food**

Listeria sources - people



Review

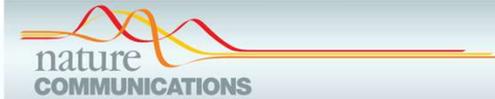
Asymptomatic Carriage of *Listeria monocytogenes* by Animals and Humans and Its Impact on the Food Chain

Dagmar Schoder^{1,2,*}, Claudia Guldemann³ and Erwin Märtlbauer⁴

Foods **2022**, *11*(21), 3472; <https://www.mdpi.com/2304-8158/11/21/3472>

in increased *L. monocytogenes* colonization of the gut [88]. Additionally, occupational groups encountering animals, feces and meat and those who undergo work-related exposure to the bacterium are anticipated to be at an increased risk of asymptomatic infection. For example, the cumulative prevalence of *L. monocytogenes* in hand swabs from farm workers and hand and clothes swabs from abattoir workers was 16% and 6%, respectively [83,86], which is higher than the average prevalence typically found in fecal samples from healthy people (Table 3).

83. Tahoun, A.; Abou Elez, R.M.M.; Abdelfatah, E.N.; Elsohaby, I.; El-Gedawy, A.A.; Elmoslemany, A.M. *Listeria monocytogenes* in raw milk, milking equipment and dairy workers: Molecular characterization and antimicrobial resistance patterns. *J. Glob. Antimicrob. Resist.* **2017**, *10*, 264–270. [[CrossRef](#)] [[PubMed](#)]
86. Akkaya, L.; Alisarli, M.; Cetinkaya, Z.; Kara, R.; Telli, R. Occurrence of *Escherichia coli* O157: H7/O157, *Listeria monocytogenes* and *Salmonella* spp. in beef slaughterhouse environments, equipment and workers. *J. Muscle. Foods* **2008**, *19*, 261–274. [[CrossRef](#)]



ARTICLE

<https://doi.org/10.1038/s41467-021-27069-y>

OPEN



Listeria monocytogenes faecal carriage is common and depends on the gut microbiota

Lukas Hafner^{1,8}, Maxime Pichon^{2,3,7,8}, Christophe Burucoa^{2,3,7}, Sophie H. A. Nusser¹, Alexandra Moura^{1,4}, Marc Garcia-Garcera^{5,9} & Marc Lecuit^{1,4,6,9}

Nature Communications, 12 Article No. 6826 (2021)

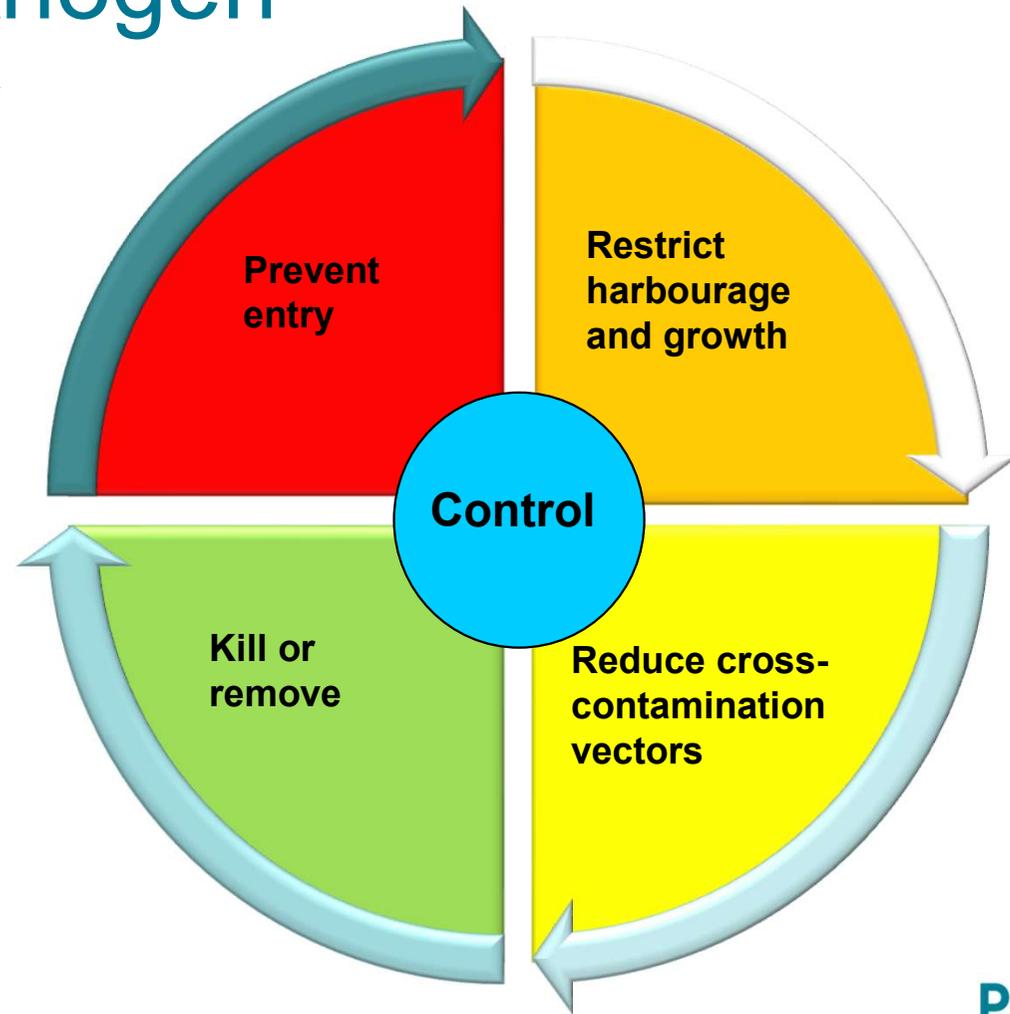
Lm is also detected in 10% of human stool samples from an independent cohort of 900 healthy asymptomatic donors.



Environmental pathogen control philosophy



2010
Salmonella and dry foods



Responsibilities

Senior Management Support



Technical

Prevent entry

Restrict harbourage and growth

Engineering



Control

Kill or remove

Reduce cross-contamination vectors

Production



Hygiene



2014
Listeria in RTE



Management Plan

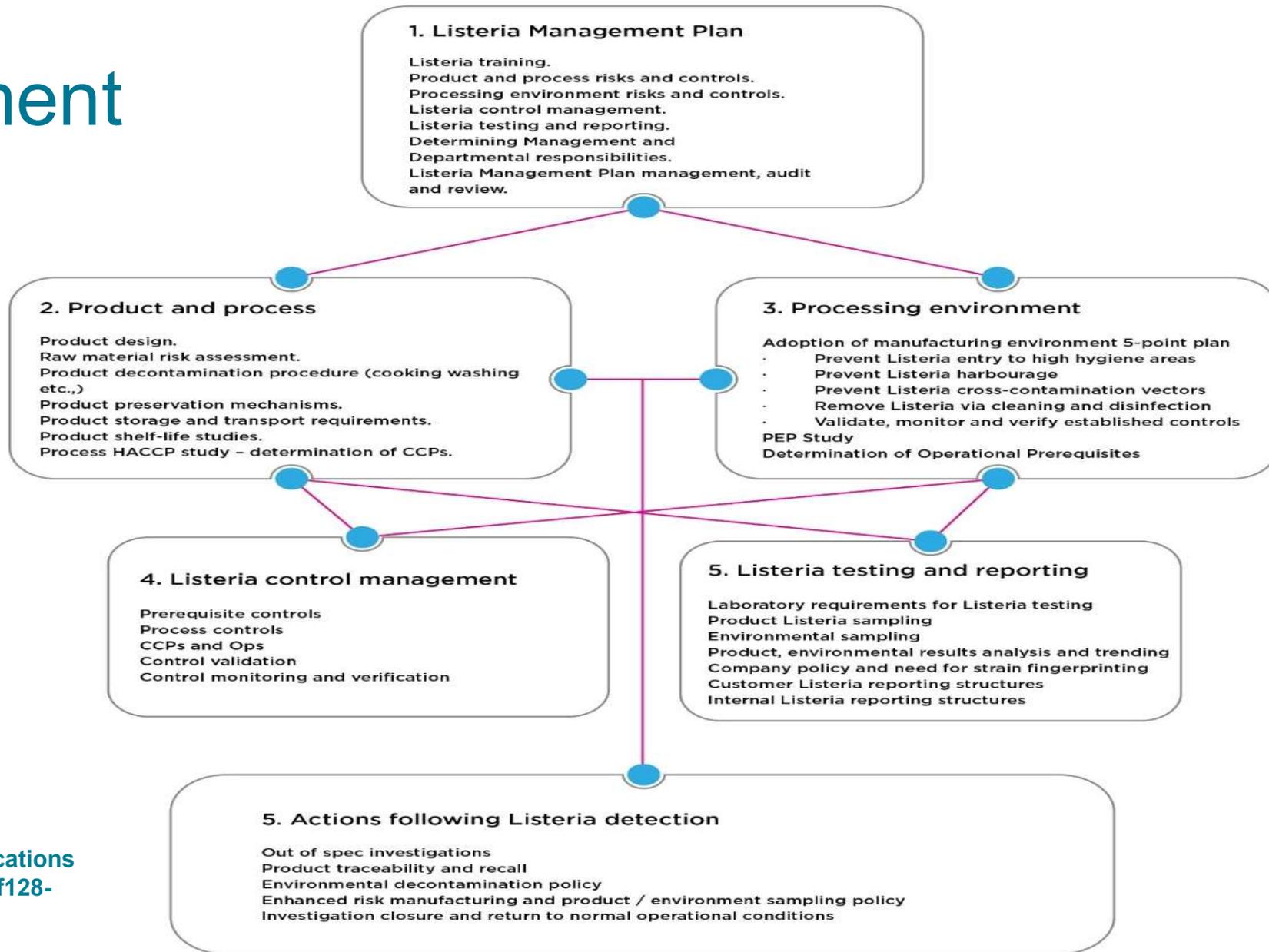


Practical control of *Listeria* in food production



2022

<https://www.campdenbri.co.uk/publications/publication.php?publicationId=8634f128-fc88-ec11-93b0-002248006e03>



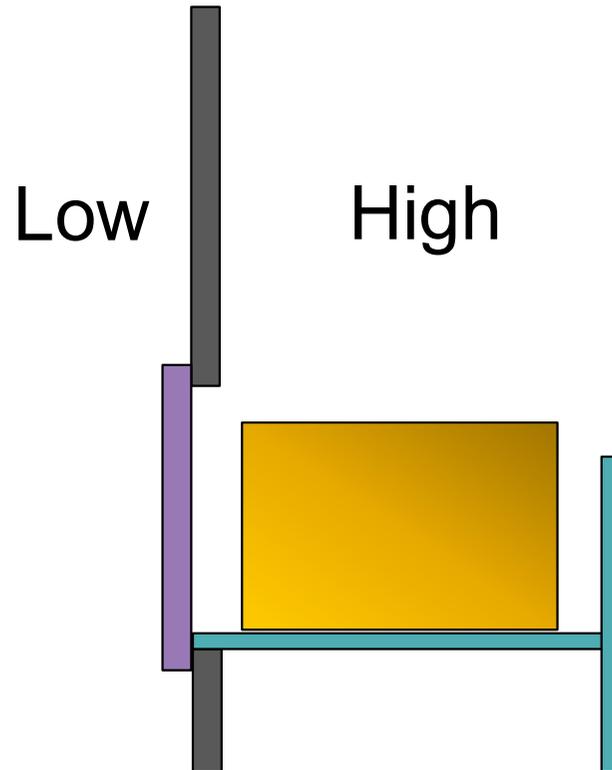
Persistence of microbiological hazards in food and feed production and processing environments

EFSA Panel on Biological Hazards (BIOHAZ) | Konstantinos Koutsoumanis | Ana Allende |

- *Listeria monocytogenes*, *Salmonella enterica*, *Cronobacter sakazakii* most relevant pathogens associated with persistence
- Currently not possible to identify universal markers (e.g. genetic determinants) for this trait
- Primary causes are: -
 - Poor barrier controls
 - Poor hygienic design
 - Poor cleaning and disinfection
- If persistence is suspected, 'a seek and destroy' policy should be adopted

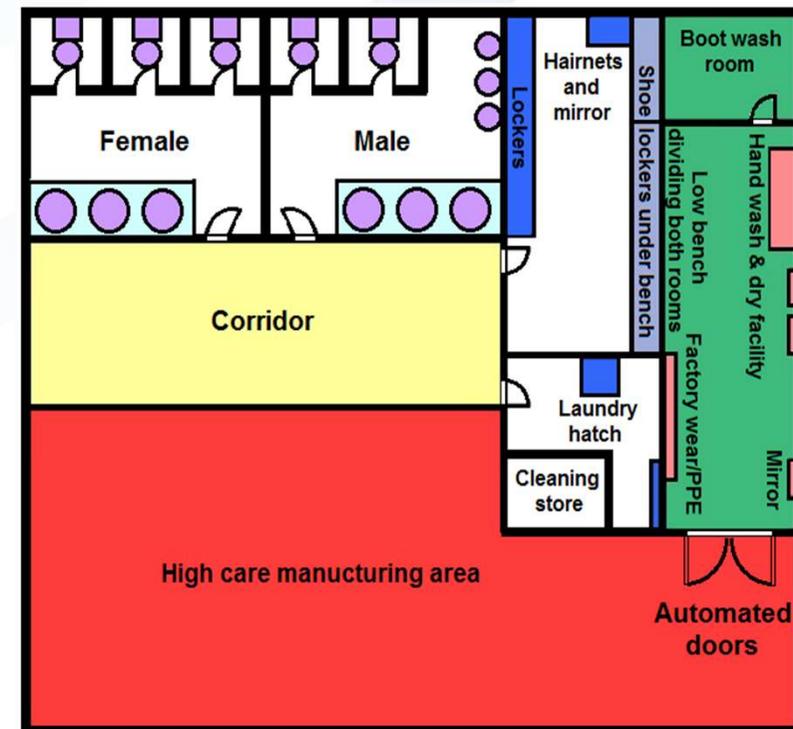
High hygiene barriers

- Product (pasteurisation or decontamination)
 - Utensils etc.
 - Packaging
 - People
 - Services
 - Air
 - Solid and liquid waste
-
- Risk assess required barriers
 - Cross-barrier decontamination CIC

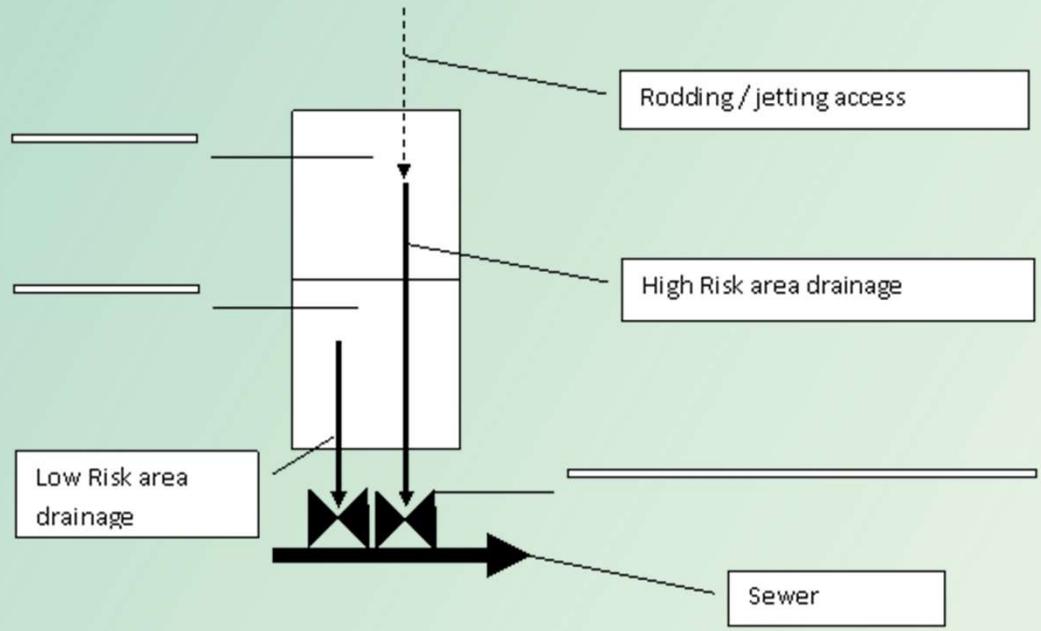
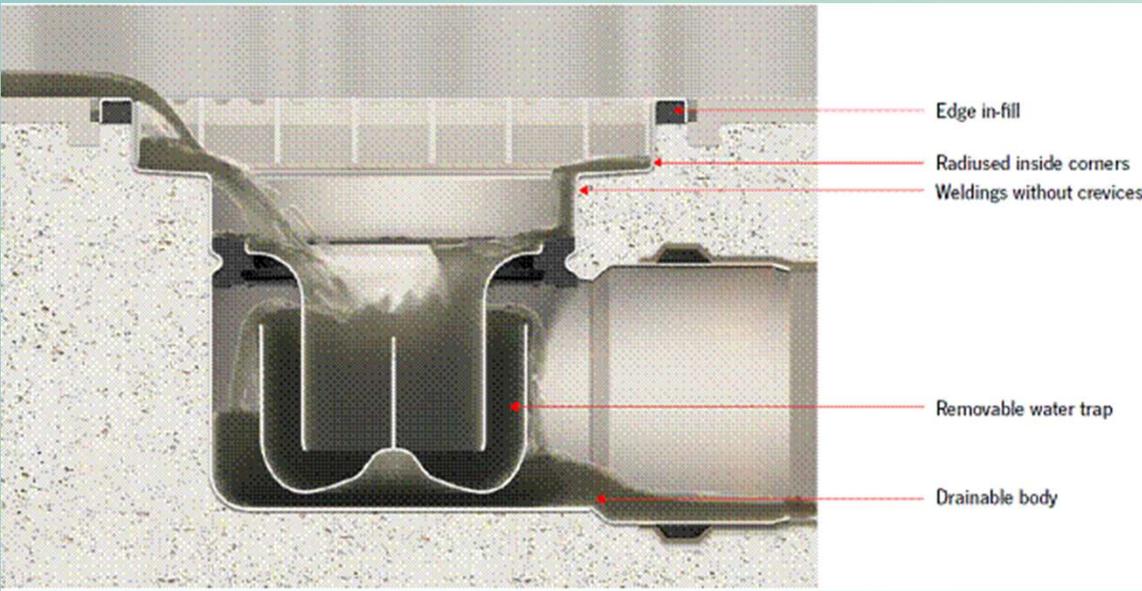
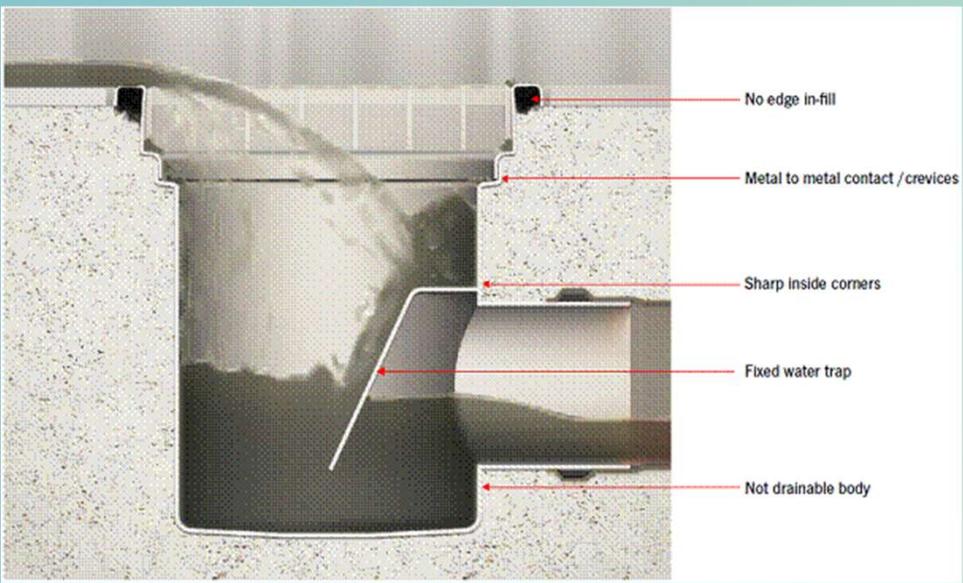


Listeria sources - people

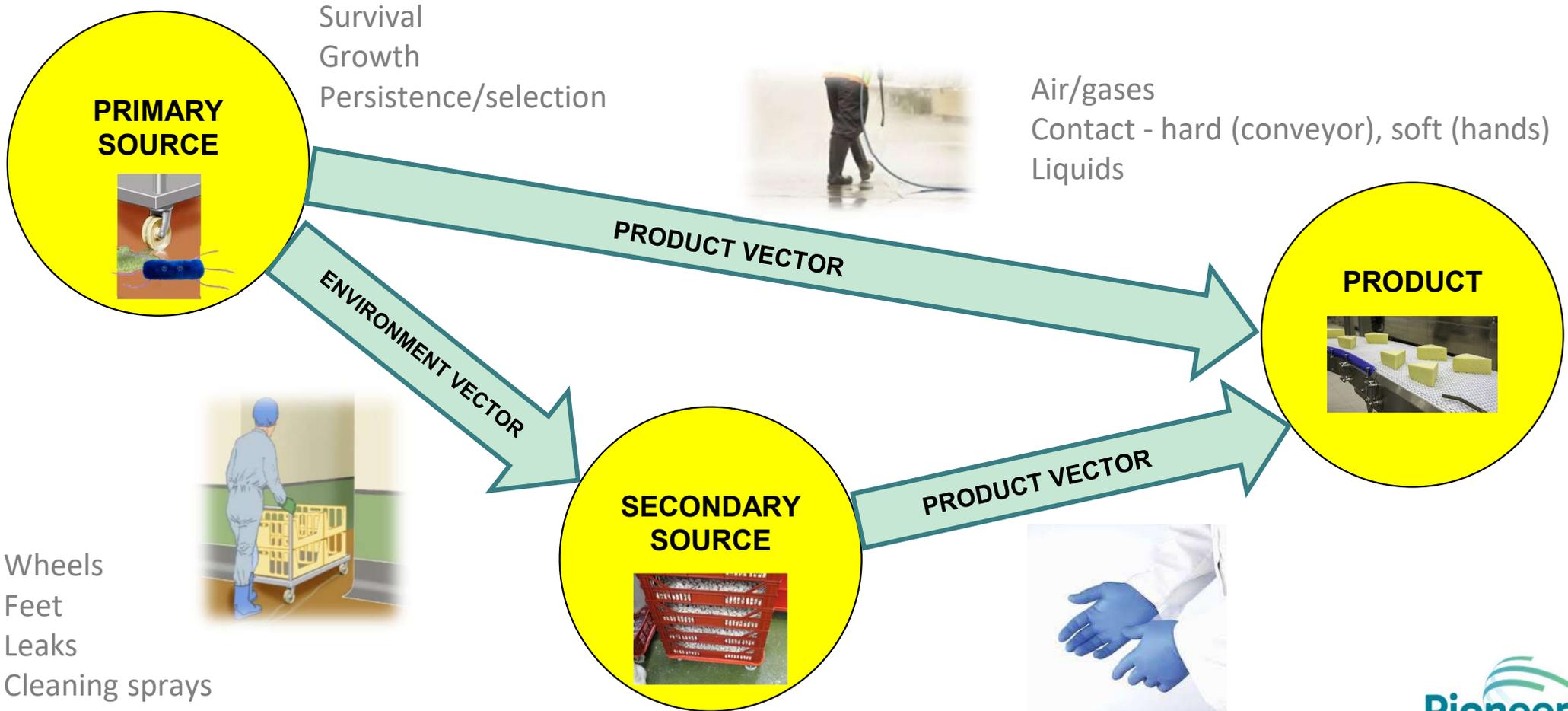
- Separation of low and high hygiene staff – work and rest– stool test?
- Changing room hygienic design and changing sequence
- Restrict movement between low and high hygiene areas to key staff – stool test?
- For visitors - high hygiene areas first
- Segregation of tasks within high hygiene (food contact, ingredient transport handling, cleaning, waste disposal etc.)



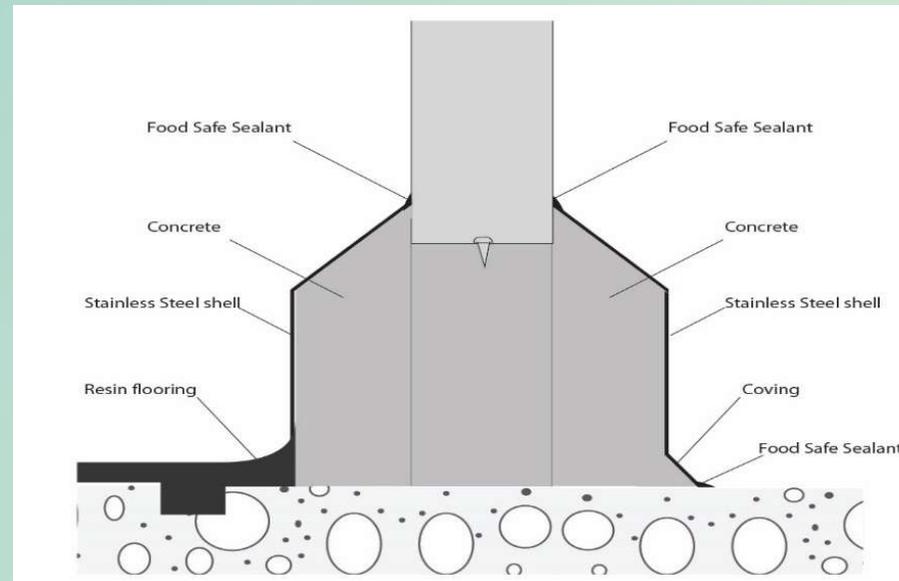
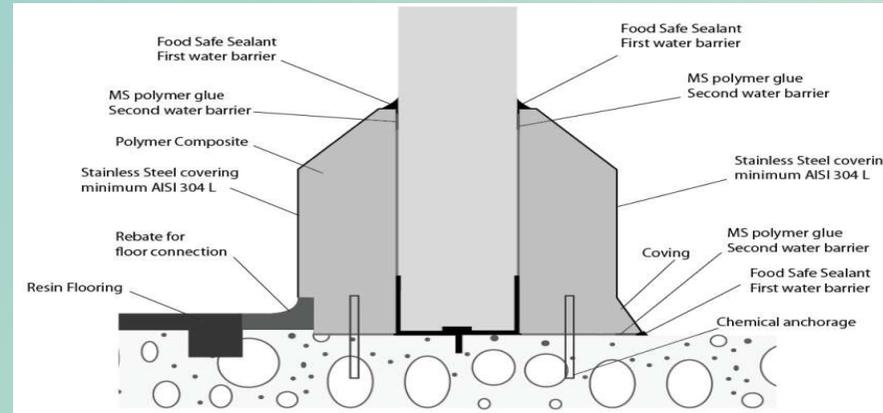
Direct connection to the sewer?



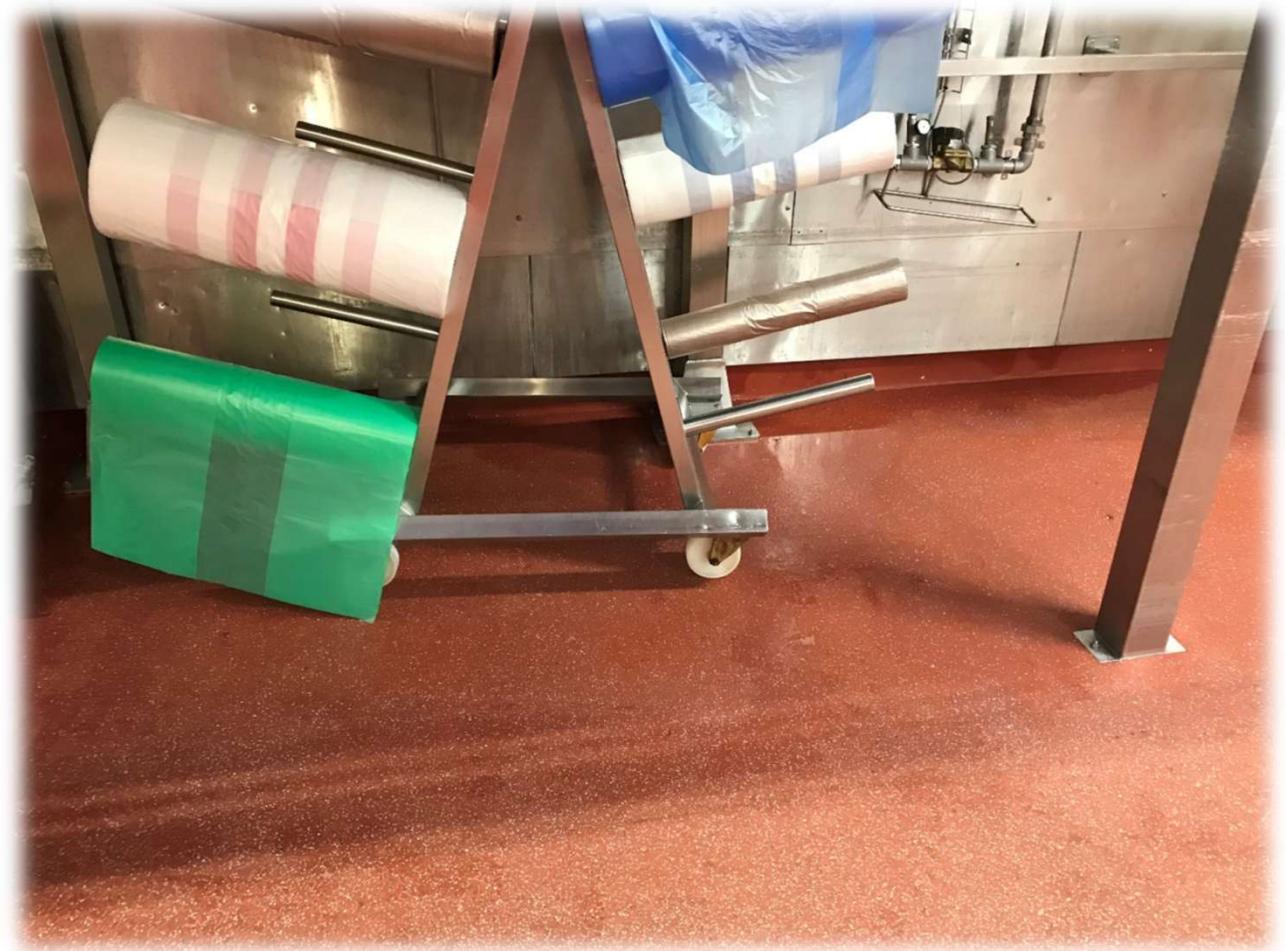
Sources and cross contamination vectors



Wall-to-floor Junctions?



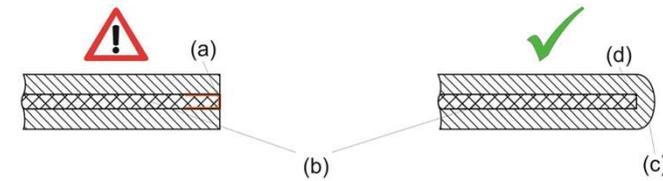
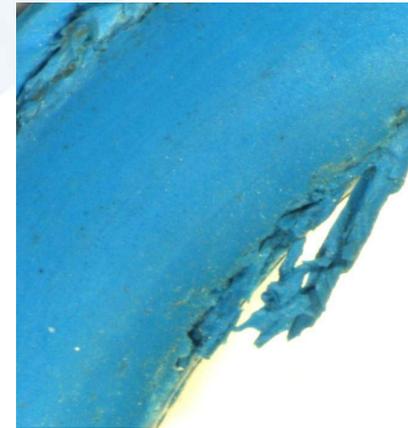
Vectors - isolate!



Disinfect with PAA at a frequency that Lm is not observed in samples

Listeria communities

- Open surface (99%?)
- Inaccessible to cleaning
- Inaccessible due to poor hygienic design
- Inaccessible due to wear
- Inaccessible due to construction failure



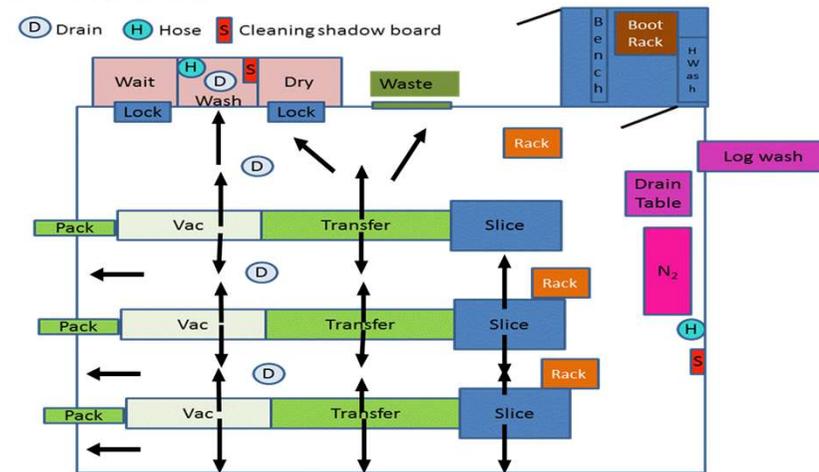
(a) open edge, (b) reinforcement, (c) rounded rim, (d) covered edge

Listeria communities

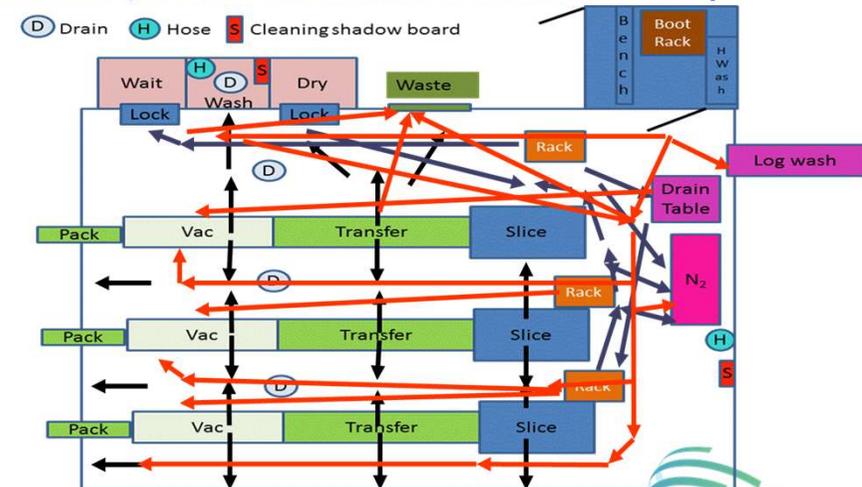
Community	Ability to be cleaned	Biofilm	Persistence	Disinfection resistance	Lm Risk	Control
Open surface	Yes	No	No	No	Low	Routine cleaning and disinfection
Inaccessible: cleaning	(Yes)	Yes	Yes	Disinfection protection	Medium – needs a vector	Education Periodic cleaning Engineering solution
Inaccessible: hygienic design	(Yes)	Yes	Yes	Potential tolerance	High	Periodic cleaning Heat Engineering solution
Inaccessible: wear	No	Yes	Yes	Disinfection tolerance	High	Heat Replace (maintenance solution)
Inaccessible: construction	No	Yes	Yes	Potential tolerance	Medium – needs a vector	Isolation Periodic disinfection Repair

PEP steps	Campden BRI HACCP	CODEX HACCP
Obtain management commitment	1	
Define terms of reference	2	
Select the PEP team	3	
Describe the environment	4	
Product susceptibility	5	
Construct flow diagram	6	
Confirmation of flow diagram	7	
Identify potential hazards and measures for their control	8	1
Determine operational prerequisites	9	2
Establish control or operating limits	10	3
Establish a monitoring system	11	4
Establish a corrective action plan	12	5
Verification of plan	13	6
Establish documentation and record keeping	14	7

Air Movement



Air Movement, Rack Movement & Production Ops



PEP steps

Obtain management commitment

Define terms of reference

Select the PEP team

Describe the environment

Product susceptibility

Construct flow diagram

Confirmation of flow diagram

Identify potential hazards and measures for their control

Determine operational prerequisites

Establish control or operating limits

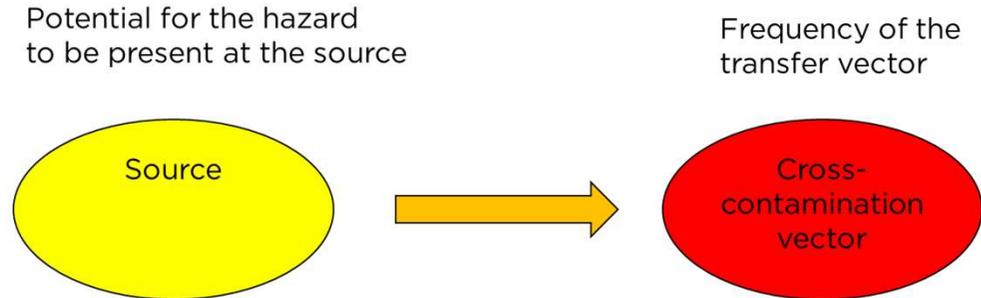
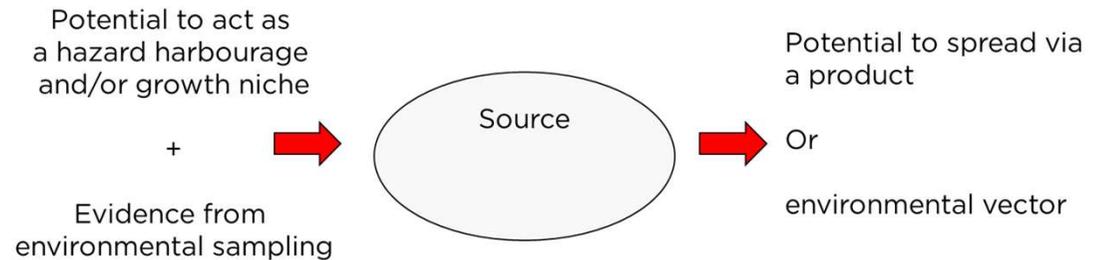
Establish a monitoring system

Establish a corrective action plan

Verification of plan

Establish documentation and record keeping

PEP - Steps



PEP – consider hazard sources



Process step or process activity	Observation	Likely hazard	Sources risk assessment without controls		Risk score	Current or intended source controls	Sources risk assessment with controls		Risk score
			Likelihood of hazard presence LMH	Potential to spread via environmental vectors LMH			Likelihood of hazard presence LMH	Potential to spread via environmental vectors LMH	
Meat slicing	Meat residues were seen on the inside of a switch that operated the machine. If <i>Listeria</i> was present in the switch, it could be transferred to the meat by the operatives finger. Microbiological sampling in the switch was always negative	Listeria	M	L	2	Switches routinely cleaned as part of the end of production sanitation practice	L	L	1
Meat slicing	Fluids were seen oozing out from the joint between the wall and coving. The immediate doorway floor area is a heavy traffic area for personnel and vehicular traffic. Environmental monitoring occasionally identified <i>Listeria</i> spp.	Listeria	H	H	9	Every shift hypochlorous acid is sprayed around the wall/coving joint	M	H	6

PEP - consider hazard sources

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							PR		
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							CAPEX		

PEP - consider hazard vectors



Process step or process activity	Observation	Likely hazard	Contamination event vector(s)	Product vector risk analysis without controls		Risk score	Subsequent control step	Current or intended vector controls	Product vector risk analysis with controls		Risk score
				Potential presence of hazard on vector LMH	Frequency of event LMH				Potential presence of hazard on vector LMH	Frequency of event LMH	
Meat slicing	Joints on the slicer bed harbour debris. They are impossible to access without total slicer dismantling	Listeria	Lm has been identified in joints	H	H	9	None	Partial dismantling and cleaning and disinfection every night. Steaming every 2 weeks	L	H	3

PEP - consider hazard vectors



Process step or process activity	Observation	Likely hazard	Contamination event vector(s)	Product vector risk analysis without controls		Risk score	Subsequent control step	Current or intended vector controls	Product vector risk analysis with controls		Risk score
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OPR

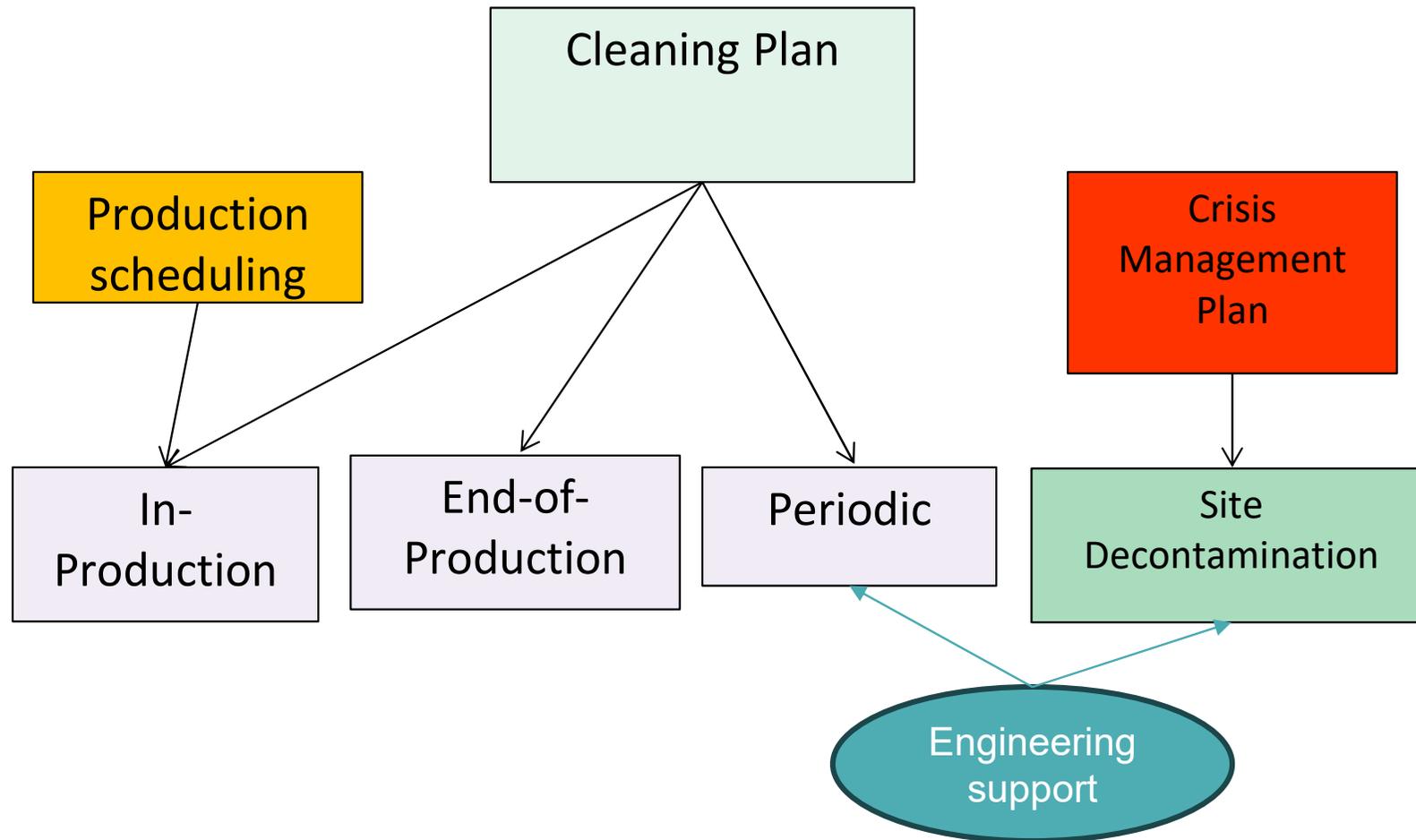
PEP – OPR management document



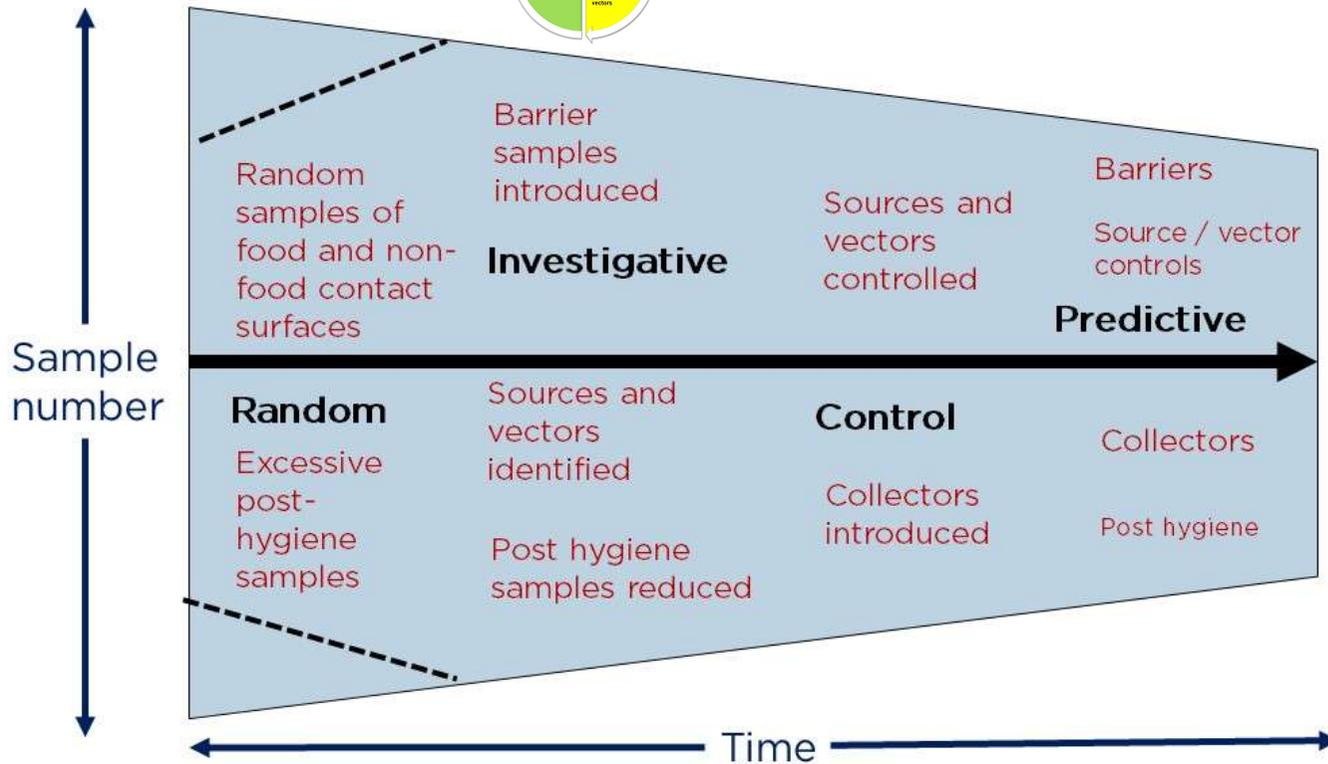
Process step or area	Likely hazards	Source or Contamination event vector(s)	Control measure(s)	Operating limit(s)	Control monitor(s)	Control verification(s)	Corrective action(s)	Records
Meat slicing	Listeria	Transfer of Lm from slicer bed to product during slicing	Cleaning until visual cleanliness ATP testing prior to disinfection Attachment of thermocouples Encasement of slicer and ancillary components in plastic bag Overpressure of sensitive components Steaming until thermocouples read 70°C and then for a further 30 minutes Drying until moisture free	ATP <150 RLU 70°C 30 min	Visual assessment of freedom of debris ATP assessment prior to disinfection Monitoring of time and temperature	Microbiological verification of slicer bed Thermocouple calibration Timer calibration Steam pressure	Staff retraining Recalibration	Visual cleanliness, ATP and microbiological records Temperature and time records Steam pressure records Calibration records

HOLAH, J, et al (2011) HACCP – the rise of the prerequisites. *New Food* 14,11-15

Cleaning & Disinfection - schedule overview



Environmental Sampling: sampling journey



Listeria – I will find you and I will kill you!

Every sample has a defined purpose and an action to undertake if positive

Environmental Sampling

100 environmental samples/month is not unusual

Food processing (best practice)		Chilled Food Association
High risk	High care	Membership data base
0.1%	0.2-0.5%	~0.7%
0.1-0.3% best practice		
1.0 average - improve GMPs		
>1.0% - concern, seek and destroy		

Sample site	Sample position (%)	Sample objectives
Barriers	20-30	Are my barriers in control
Source/vector control	30-40	Are my source and vector controls verified
Collectors	20-30	Are there any early indications of a changing situation
Cleaning verification	10	Is cleaning in control

Conclusions

- Recognition at Corporate level - major hazard for the company (flooding, fire, electricity outage, water shortage etc.) - Business Continuity plan
- Listeria training
- Listeria control plan/5-Point plan/PEP
- Food safety culture
- Objectives/Pay linked to performance for managers

CFA (2026) Assuring safety of ready to eat food in relation to *L. monocytogenes* and Regulation 2073/2005 – Guidance for food business operators (2nd ed) <http://www.chilledfood.org/>

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A 5-Point *Listeria* Control Plan: A European Perspective

HOLAH, J (2022). A 5-Point *Listeria* Control Plan: A European Perspective. *Food Production Trends*, September/October, pp 382-395