

German Environment Agency

Umwelt
Bundesamt 

Land Use and Water Quality (LuWQ) 2025, Aarhus

Pesticide metabolites – a regulatory perspective on an emerging group of contaminants for groundwater and drinking water

Helena Banning, Plant Protection Division

Alexander Eckhardt, Toxicology of Drinking Water and Swimming Pool Water

Falk Hilliges, General Water and Soil Aspects



Jahre
Umweltbundesamt
1974–2024

Pesticide metabolites – emerging contaminants in groundwater

Pesticides: an important source of contamination from agriculture

Emission pathways similar to nutrients from fertilizers

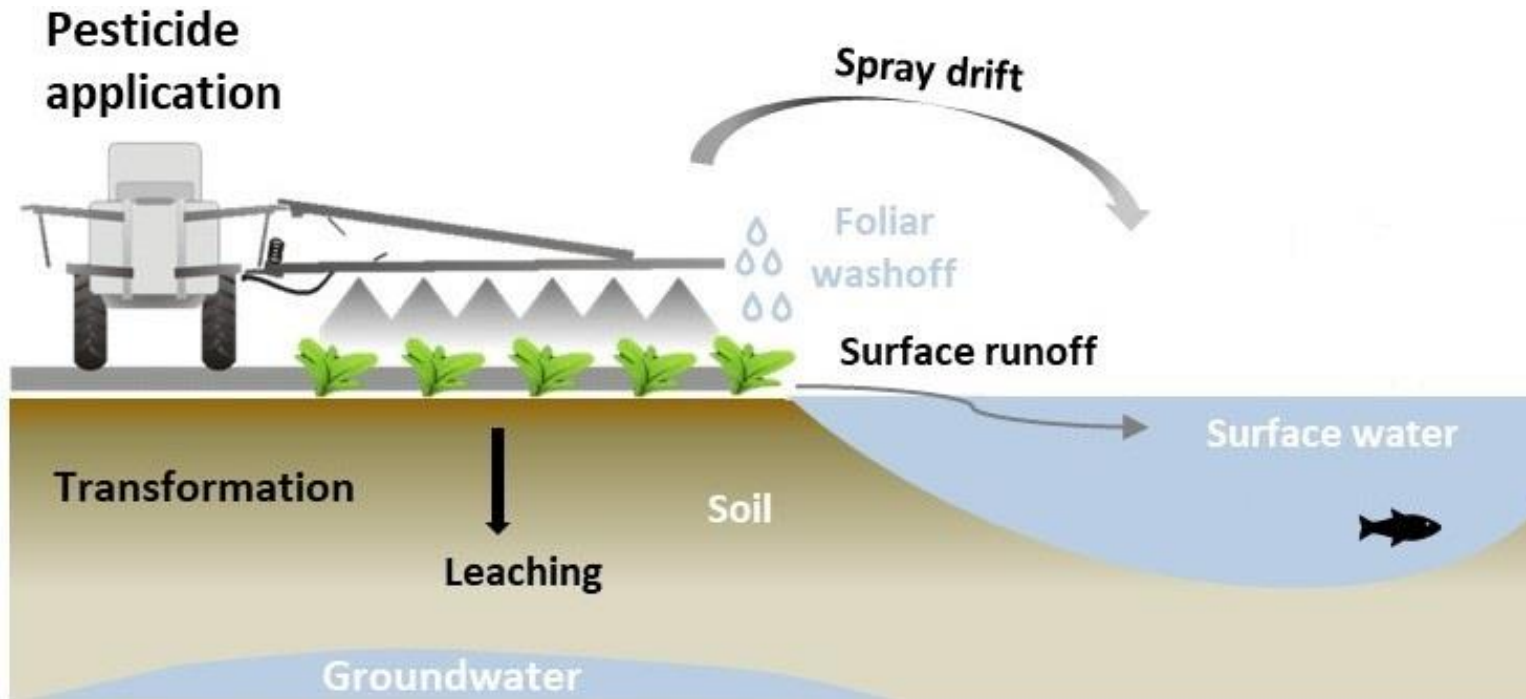


Image based on: Health Canada, 2024

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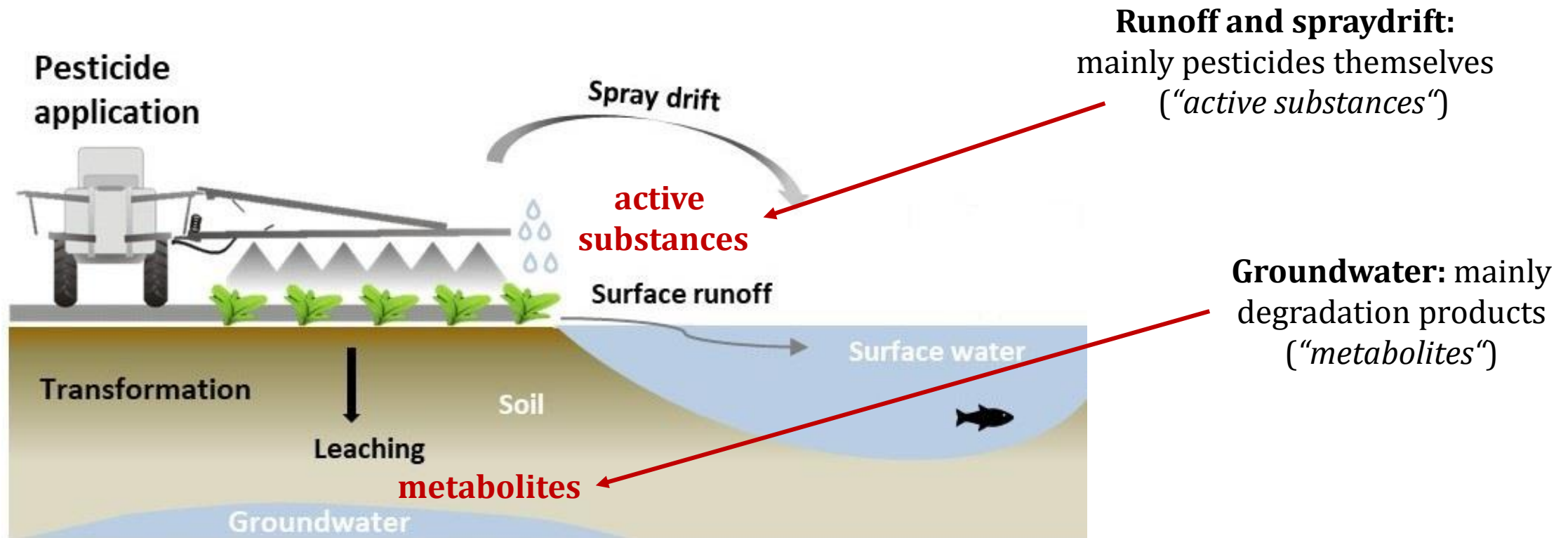
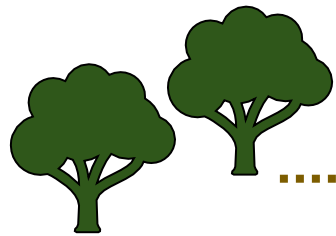


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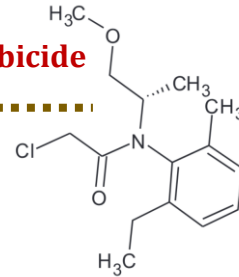
What is a pesticide metabolite?



runoff to surface water



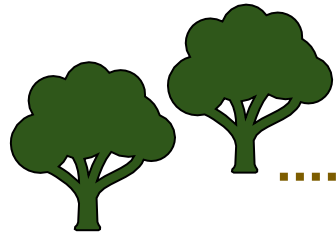
herbicide



spray drift to surface water



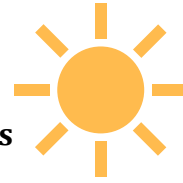
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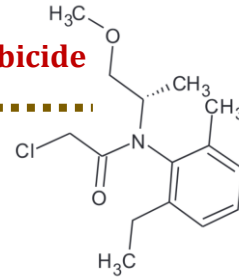
hydrolysis



photolysis



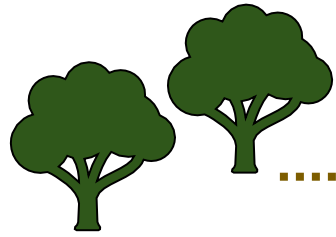
herbicide



biological degradation in soil

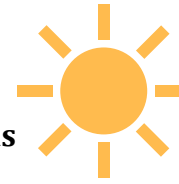


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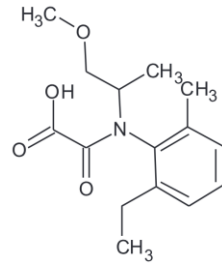
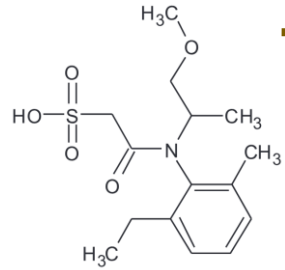
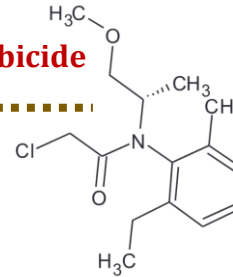


hydrolysis

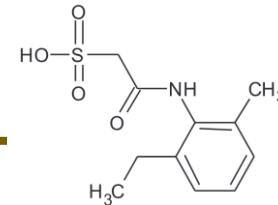
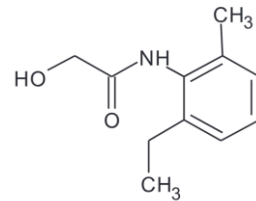
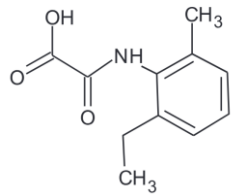
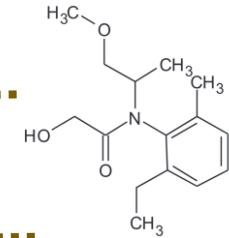
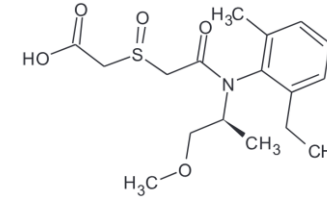
photolysis



herbicide



biological degradation in soil



What is a “relevant” and “non relevant” pesticide metabolite?

EU plant protection regulation EC 1107/2009: “active substances and **their relevant metabolites**”

Details given in **SANCO 221/2000 guidance**: A relevant metabolite...

... is comparable in **pesticidal activity** to the active substance (> 50 %)

... and/or has other **toxicological properties**, e.g. genotoxic, carcinogenic

... and/or is particularly critical to groundwater **ecosystems** (not implemented in all EU states)

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A **non relevant metabolite** does not have these properties, but...

... many are **polar and very mobile**, e.g. hardly removable from water

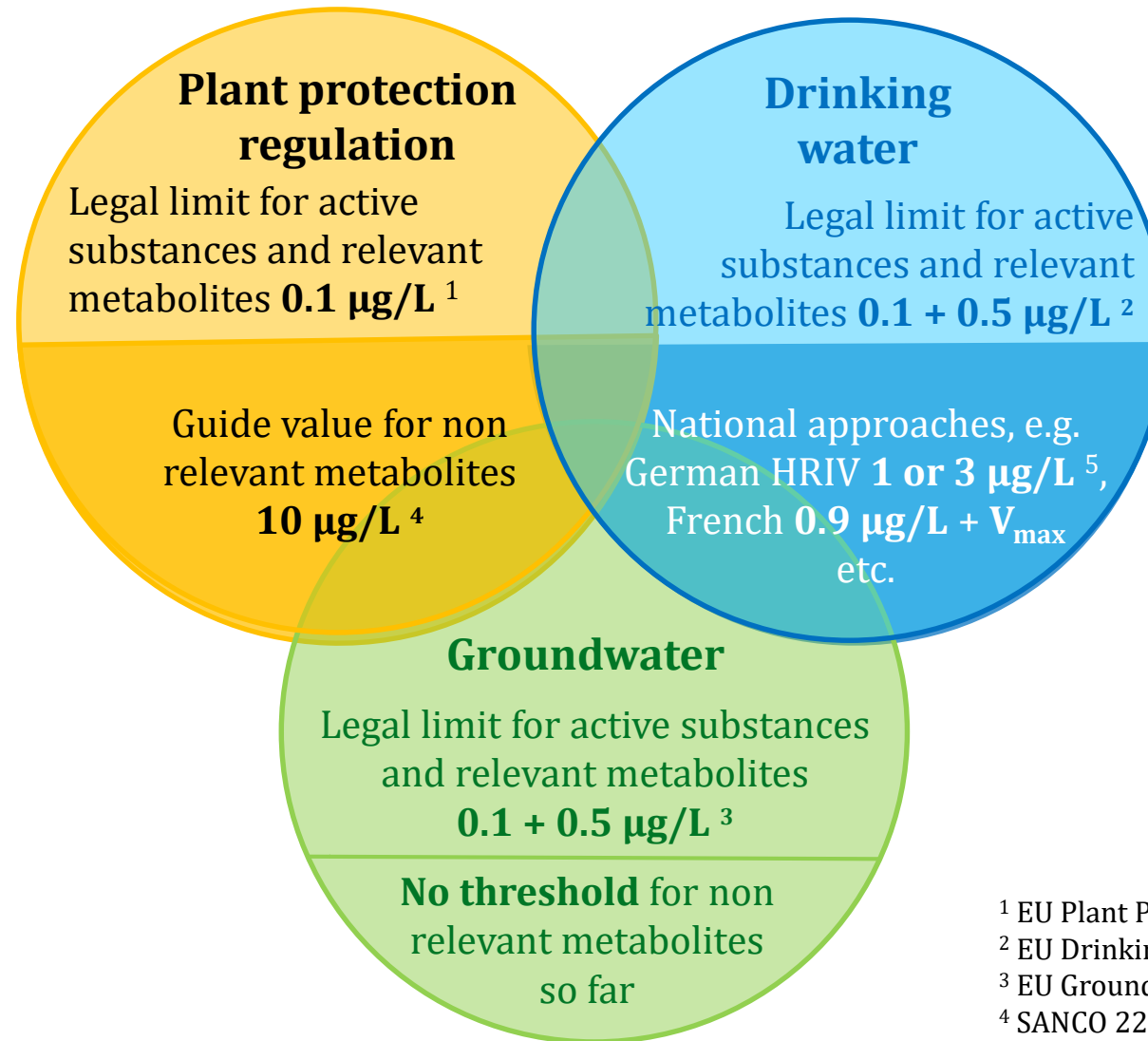
... some are rather **persistent**, e.g. as a terminal degradation product

... **scarce data base** on their effects, if present in high concentrations and in mixtures

A **non relevant metabolite** is less toxic, but is critical in other ways and underregulated

Relevant and non relevant metabolites – differences in regulation

Different thresholds



¹ EU Plant Protection Regulation 1107/2009

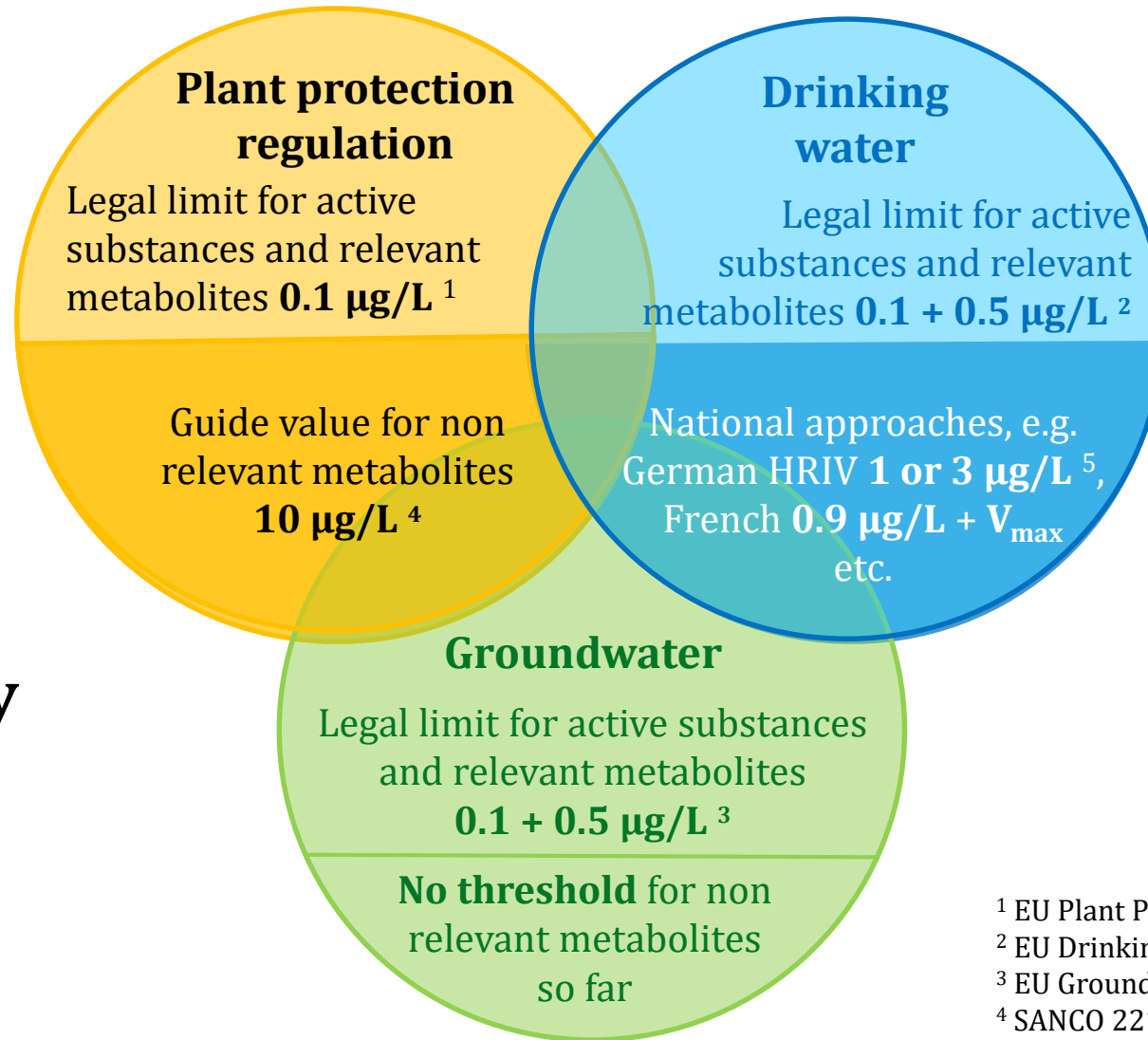
² EU Drinking Water Directive (0.1 µg/L individual, 0.5 µg/L sum)

³ EU Groundwater Directive (0.1 µg/L individual, 0.5 µg/L sum)

⁴ SANCO 221/2000 EU Guidance

⁵ German HRIV/GOW concept

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Differently binding

¹ EU Plant Protection Regulation 1107/2009

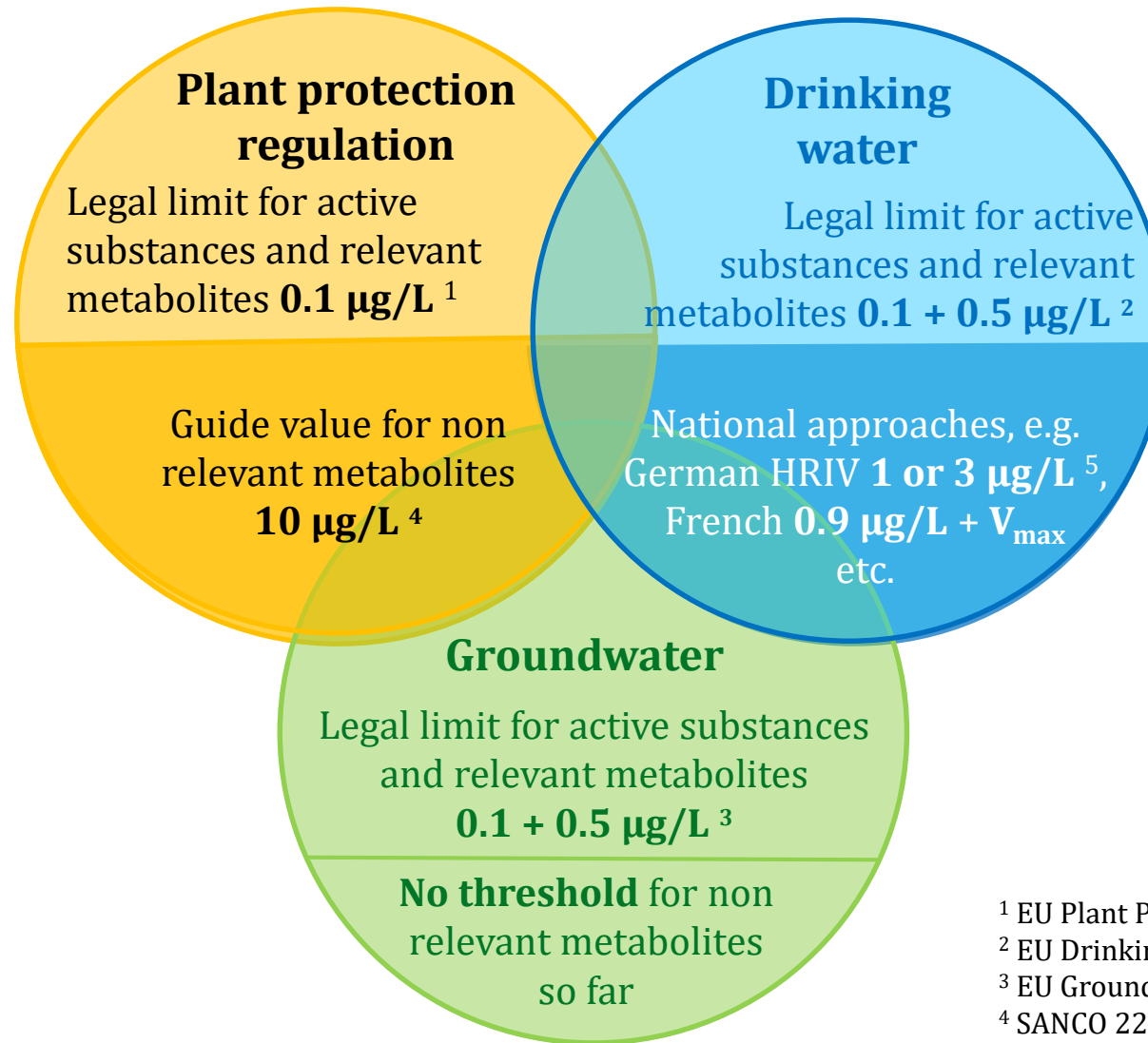
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Relevant and non relevant metabolites – differences in regulation



Different spatial scale

¹ EU Plant Protection Regulation 1107/2009

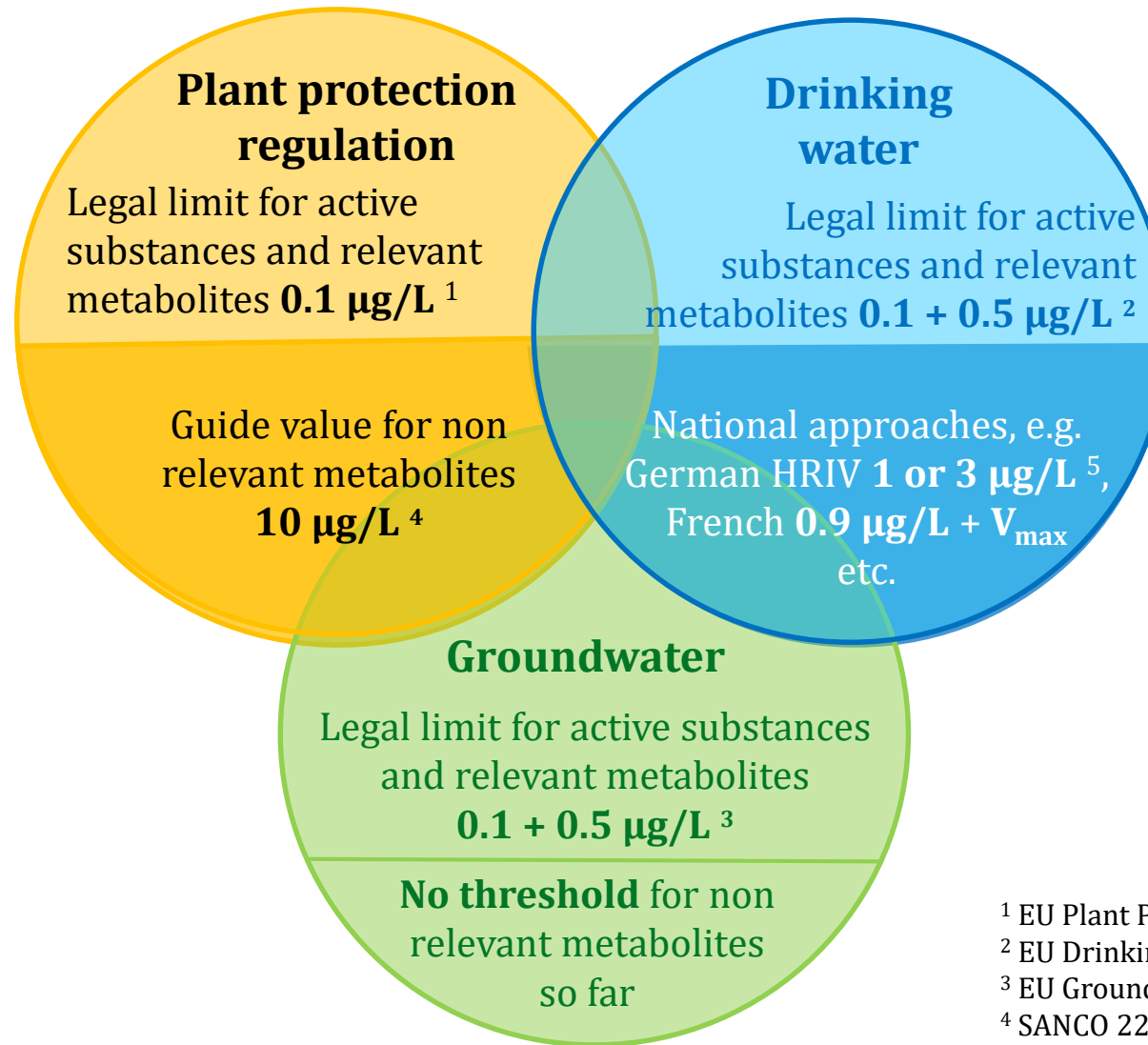
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Inconsistencies in fields of regulation for non relevant metabolites

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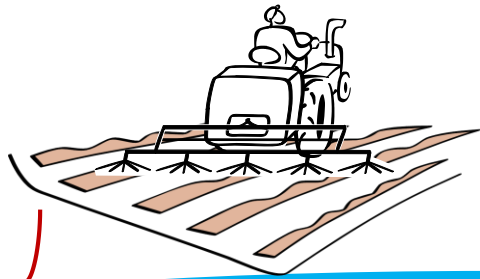
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Relevant and non relevant metabolites – land use conflicts

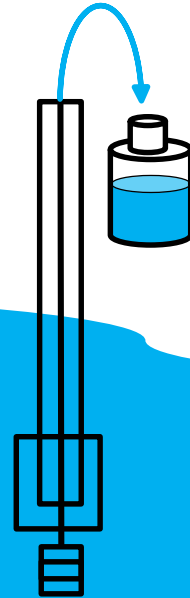
Pesticide application



0.1 µg/L

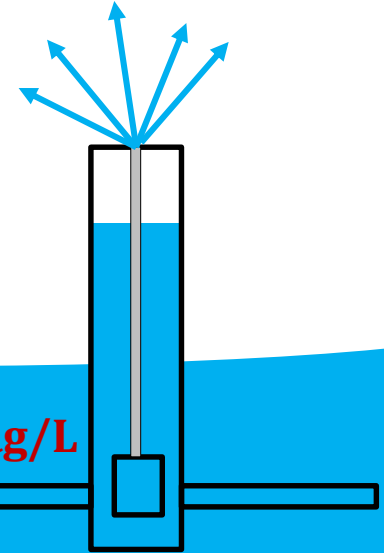
active substance and relevant metabolites

Groundwater quality monitoring



0.1 µg/L

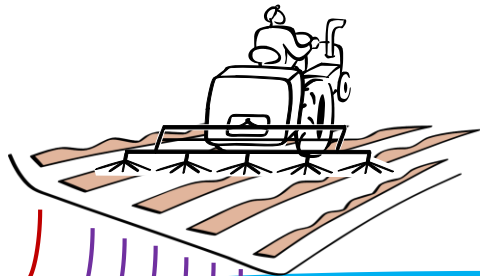
Drinking water abstraction



0.1 µg/L

Relevant and non relevant metabolites – land use conflicts

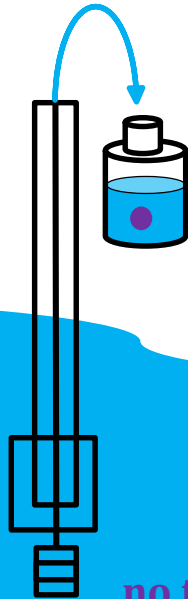
Pesticide application



0.1 $\mu\text{g/L}$ active substance and relevant metabolites

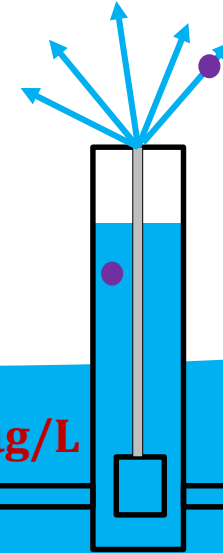
10 $\mu\text{g/L}$ non relevant metabolite

Groundwater quality monitoring



0.1 $\mu\text{g/L}$ no threshold

Drinking water abstraction



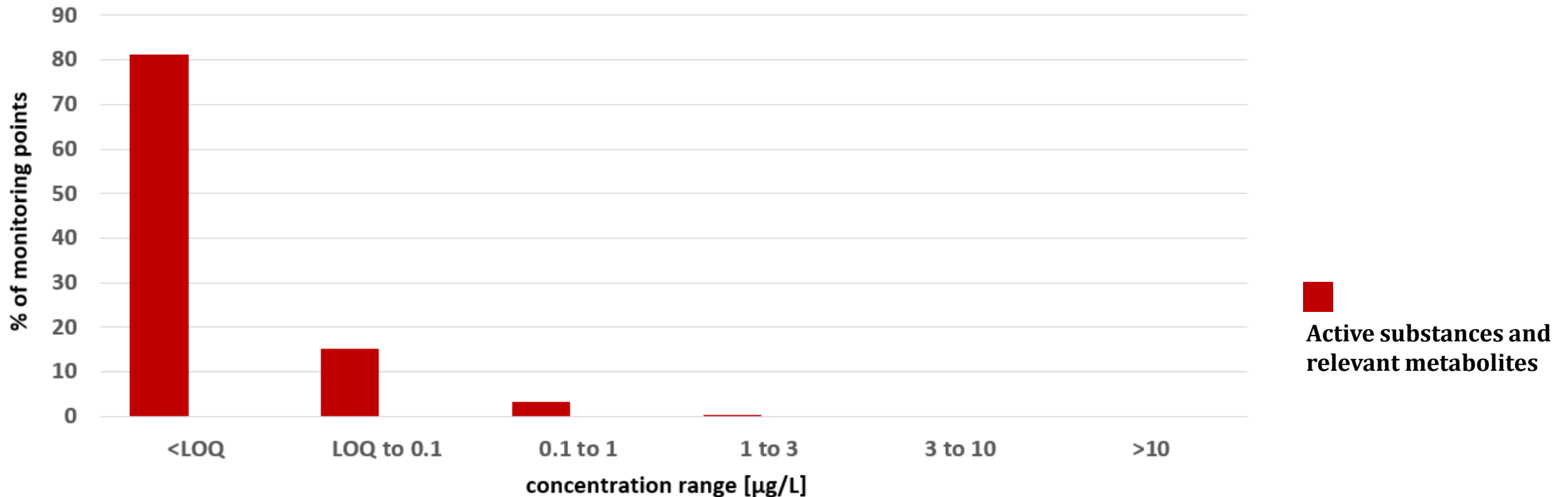
0.1 $\mu\text{g/L}$ national: 0.9* or 1 or 3** or x $\mu\text{g/L}$

* French national value
** German national values

Active substances and relevant metabolites in German groundwater

Monitoring of **active substances and relevant metabolites** by German federal states
16,180 monitoring points in groundwater, between 2017 and 2021

< 19 % detections, < 4 % higher than 0.1 µg/L

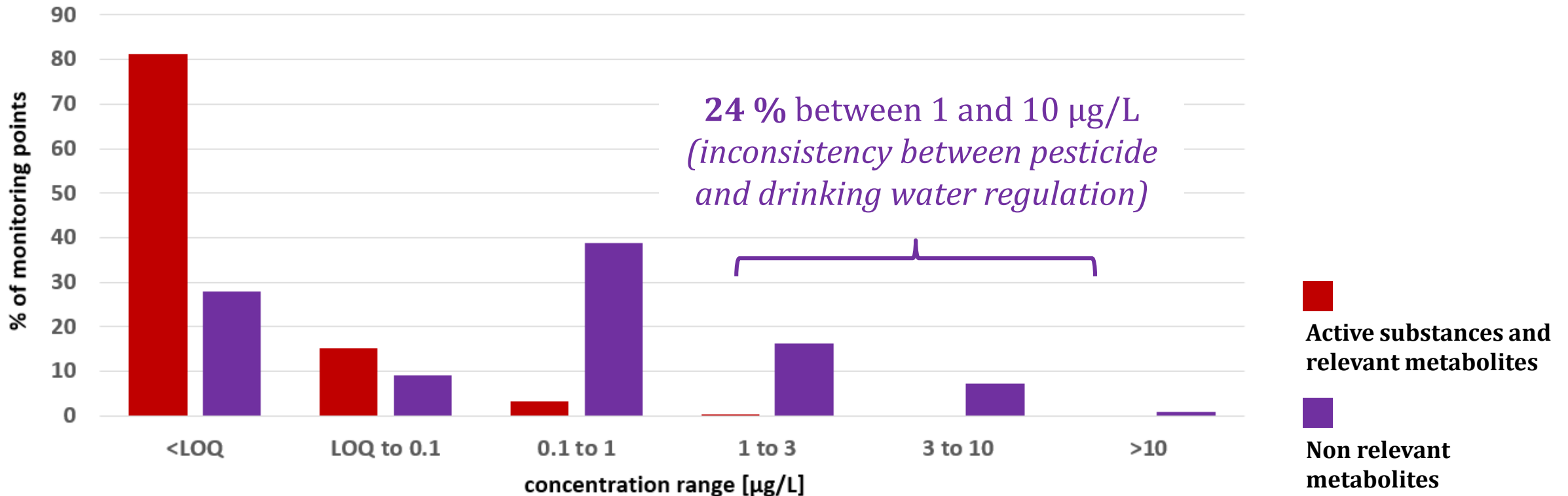


Data from LAWA (2024): https://www.lawa.de/documents/psm-bericht-2023-12-22-barrierearm-final_2_1728974845.pdf

Non relevant metabolites in German groundwater

Monitoring of **non relevant metabolites** by German federal states
12,353 monitoring points in groundwater, between 2017 and 2021

72 % detections, 63 % higher than 0.1 µg/L



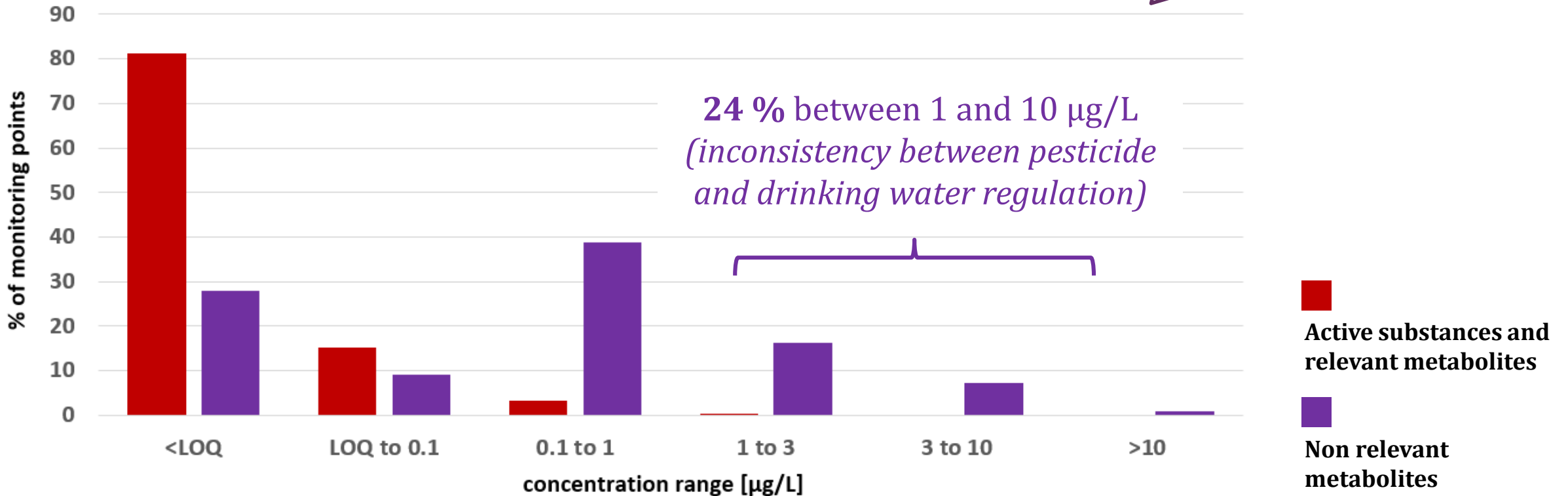
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Monitoring gap:
37 metabolites monitored
about 300 metabolites
with known groundwater
leaching potential



Data from LAWA (2024): https://www.lawa.de/documents/psm-bericht-2023-12-22-barrierearm-final_2_1728974845.pdf

How to manage non relevant metabolites? Progress in EU and national legislations



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- Risk based approach: management in **drinking water abstraction areas**
- Germany: values of **1, 3 or 10 µg/L** – depending on the data basis
- **Supports cooperations**: water supply, health authorities and agriculture

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Ongoing: **EU Groundwater Directive** (trilogue process): EU-wide threshold of **1 µg/L**

- To be used for **groundwater quality** assessment (WFD)
- Monitoring obligation in all member states

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„**All metabolites are relevant**“ (Danish approach)

- Some pesticides cannot be authorised
- How to manage residues from previous pesticide applications (legacies)?

Thank you for your attention

Helena Banning, Alexander Eckhardt, Falk Hilliges

helena.banning@uba.de

New website section on pesticides:

<https://www.umweltbundesamt.de/themen/chemikalien/pflanzenschutzmittel>

Basics on relevant and non relevant pesticide metabolites

https://www.umweltbundesamt.de/sites/default/files/medien/4031/publikationen/umid_01-2022-pflanzenschutzmittel.pdf



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