Pharmaceutical load from primary emission sources to WWTPs and from WWTPs into the environment

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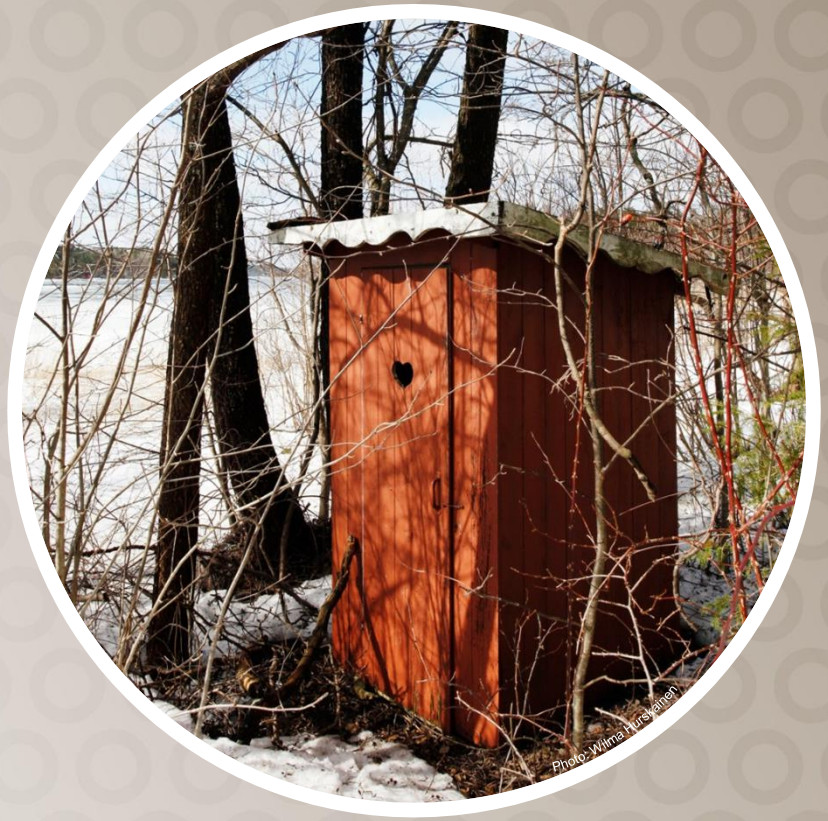
EPIC-project, final seminar, 17.5.2019

Needs



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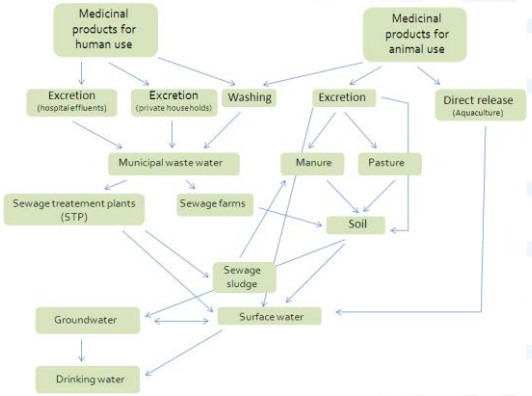
Pharmaceutical emissions into the environment

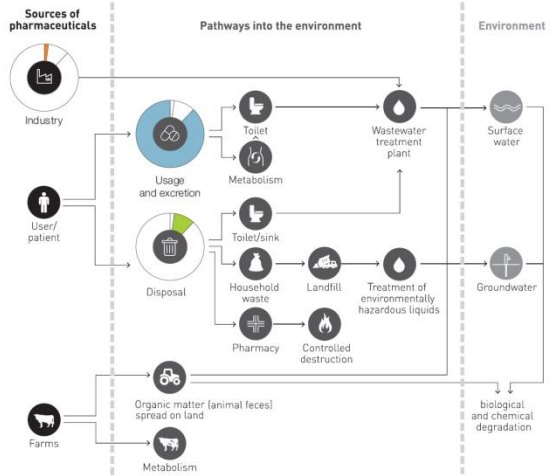
- Roughly 30 – 90 % of orally used pharmaceuticals are excreted as original active substances
  - Also metabolites may be active, or be reverted back into the original active substance (e.g. carbamazepine)

⇒Excreted substaces end up in the sewage network

⇒Treated waste waters are emitted into the environment



BIO Intelligence Service (2013)



AESGP, EFPIA and Medicines for Europe

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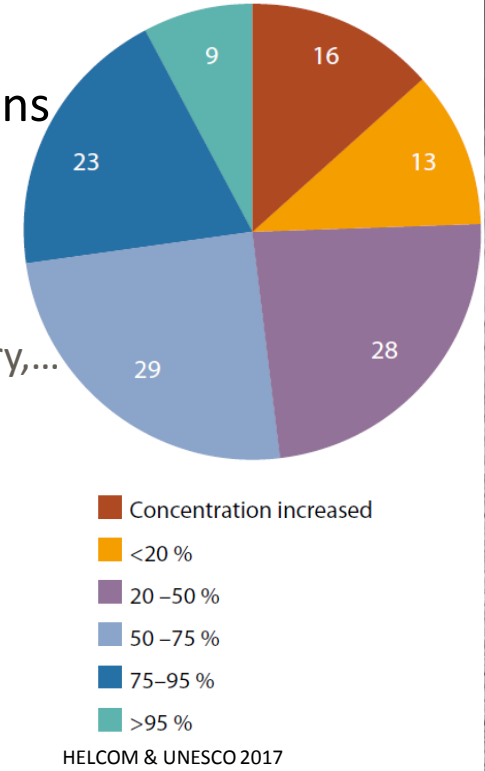
Sewage treatment & APIs

- Where are pharmaceutical emissions generated?
  - Primary emission sources are scattered
    - Households, healthcare sector, industry,…
- Many pharmaceuticals are poorly removed at conventional WWTPs



HELCOM & UNESCO 2017

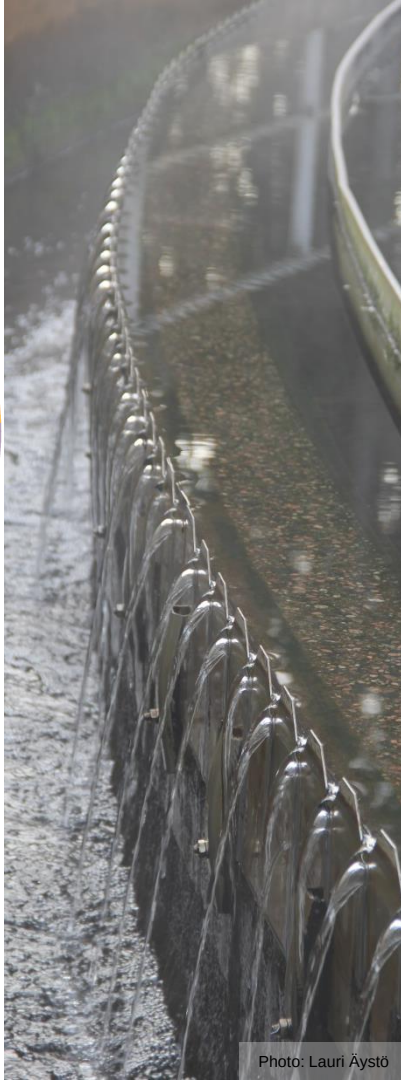


Photo: Lauri Äystö

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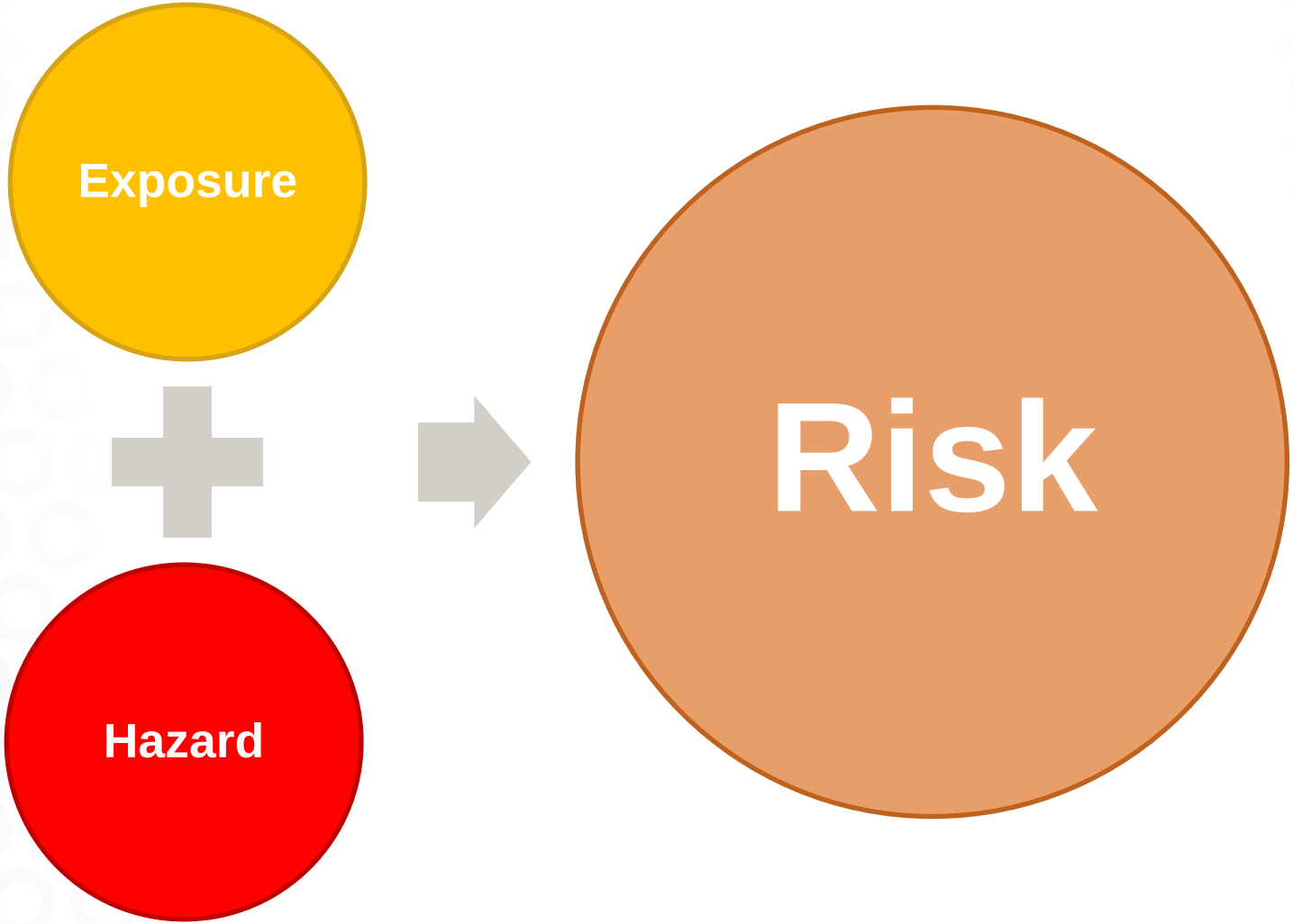

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Approach

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Sampling in different types of locations

- Three hospitals (HI)
- One site providing supported housing (own WWTP)
- Three household sewer lines (HSL)
  - One has its own WWTP
- Four WWTPs

Site	Type	N of samples		
		Inf.	Eff.	Sludge
HUS	HI	3		-
TYKS	HI	4		-
Eksote	HI	3		-
Rinnekoti	HI/WWTP	2	2	1
SYKE	HSL	3	-	-
HSY	HSL	3	-	-
Ylöjärvi	HSL/WWTP	2	2	-
HSY	WWTP	2	2	2
Kymen vesi	WWTP	1	1	1
TSP	WWTP	1	1	1
LRE	WWTP	1	1	1

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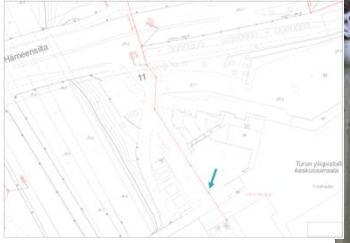
Sampling & analyses



- Composite samples
  - WWTPs & HSLs using automated samplers
  - HIs manually

- Several sites => several obstacles & funky situations…

- 98 – 236 substances were analysed in water samples
  - 60 in sludge samples
  - Pharmaceuticals & pesticides

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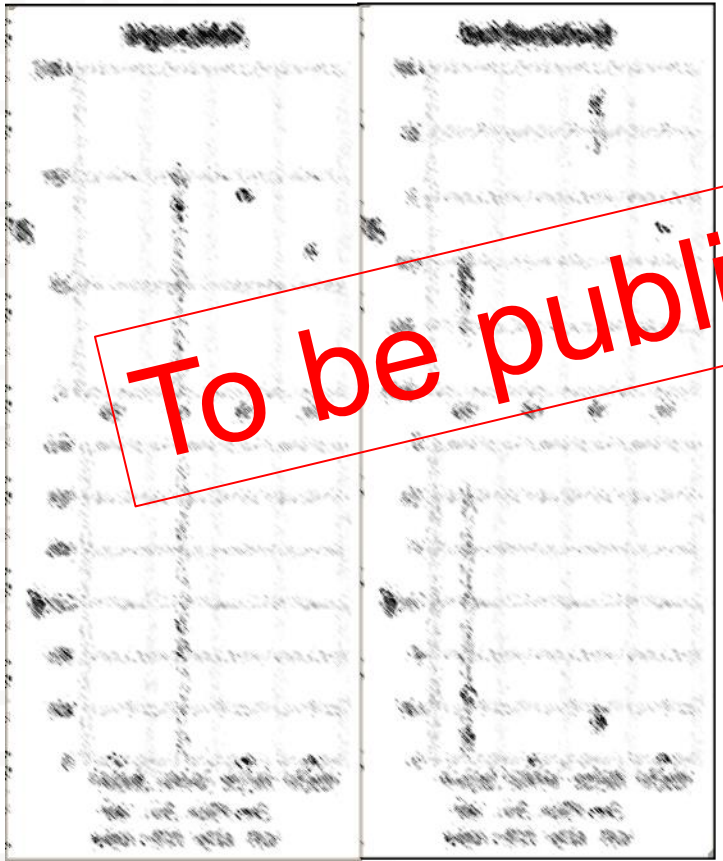
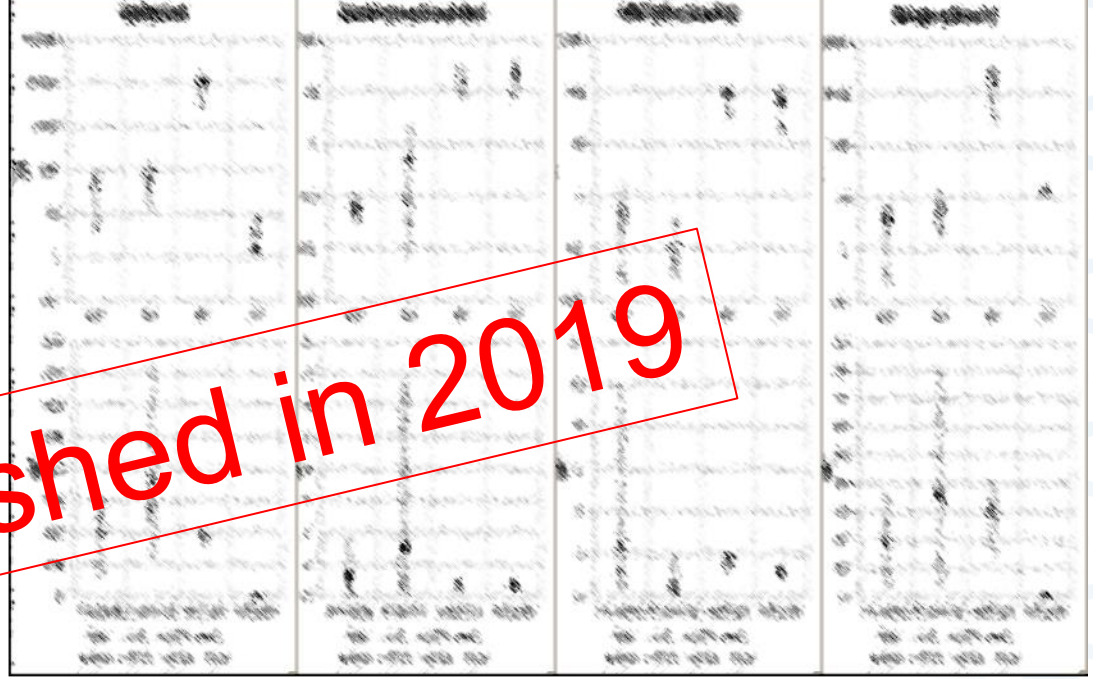
Results - Water





- API-specific average loads to WWTPs ranged from ~1 g/d (testosterone) to 10 kg/d (caffeine) and 5,3 kg/d (paracetamol)
- Loads in effluent waters ranged from ~0,1 g/d (progesterone) to ~140 g/ (hydrochlorothiazide)

Results - Sludge

- 14 substances detected in every sludge sample

- Rough assumptions…
  - Annually 150 000 dry tons of sludge generated in Finland
  - ~40 % eventually used in agricultural applications
  - If concentrations as detected in EPIC, then

⇒E.g. ~165 kg of ciprofloxacin directed to production of soil improvers etc

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Benefits

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Benefits

- Results can help to
  - Identify substances that should be eliminated before reaching WWTP
  - Identify locations where treatment methods should be applied
  - Direct further screening campaigns

Photo: Lauri Äystö

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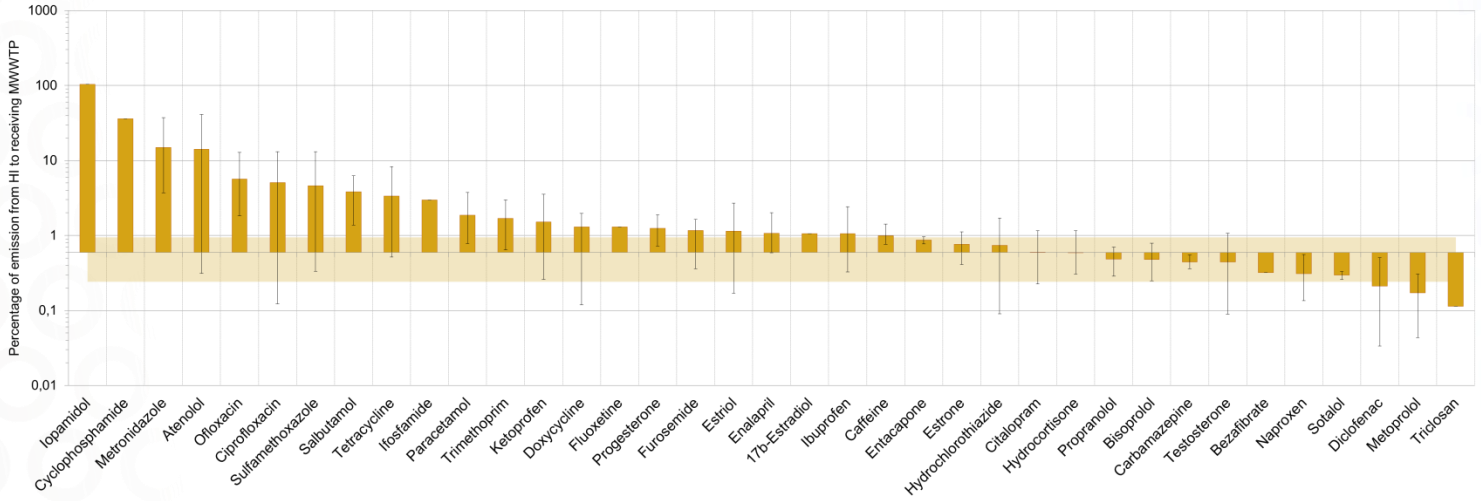
Where should waste water treatment efforts be directed..?

- For certain substances HIs seem to emit a large portion of the load received at WWTPs
  - Targeted treatment/separate collection/?



Äystö et al. 2018

Collaboration

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Collaboration during the project

- Project partners & Laki ja Vesi Oy
  - Help with sampling, etc.
- HIs
  - Important background information concerning the sites
  - Invaluable help in finding sampling locations
- WWTPs & household sewer lines
  - Help in sampling, background information

Photo: SYKEkuva

Thank you!

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Photo: Lauri Äystö

Rinnekoti-Säätiö

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