Quantification of sources of metals to sewage treatment works

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EMPLOYEE OWNERSHIP

QMS ISO 9001 REGISTERED

QMS ISO 14001 REGISTERED

Aims of project

- Defining proportions of metal inputs into wastewaters which are attributable to different sources (Ag, Al, As, Cd, Cu, Mo, Ni, **Zn**);
- Assessing the importance of natural background levels of metals relative to anthropogenic sources
- Scale – European country level (EU + others)
- Achieved via:
  - » Collect and collate existing data (no new data)
  - » Predict and determine their amounts and significance as sources to STPs (and removal during treatment) using a spreadsheet tool
  - » Constrained budget ~ 10 days input per metal
- Outcomes
  - » Loads by source per country
  - » Identify areas of uncertainty

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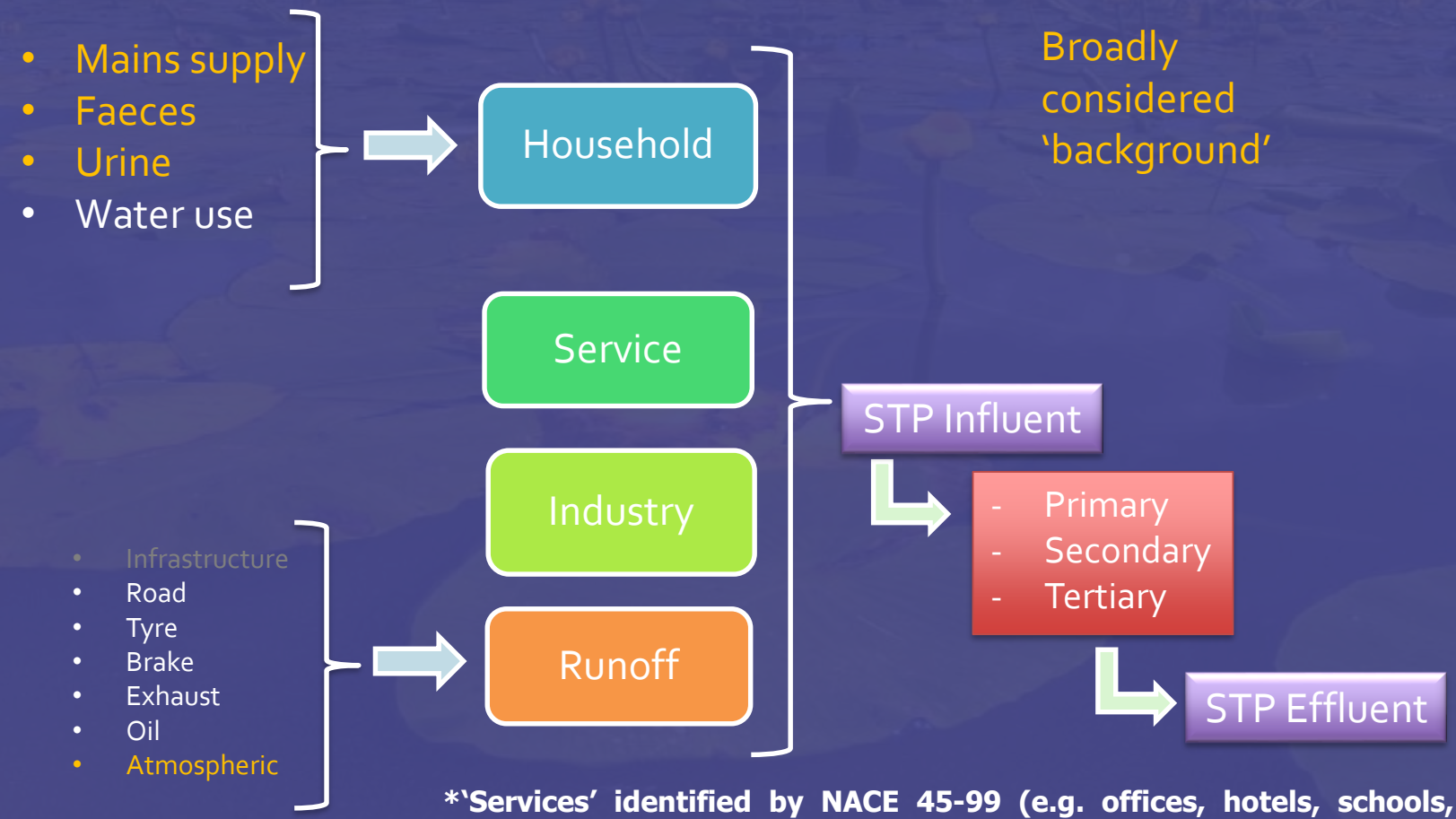
Structure for screening source apportionment exercise



*'Services' identified by NACE 45-99 (e.g. offices, hotels, schools, universities and services), and involve situations where water is mainly used for similar purposes as it is used in households (e.g. sanitary purposes, washing, cleaning and cooking).

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Data searching

- Open literature/reports via
  - » Science Direct
  - » Web of Science
  - » Google
- Supplied industry sector data
- Risk Assessment Reports
- European datasets (Eurostat/ePRTR)
- Consultancy reports (e.g. Deltares)
- MS contacts via wca, WRA and DERAC
- <10 year old data used

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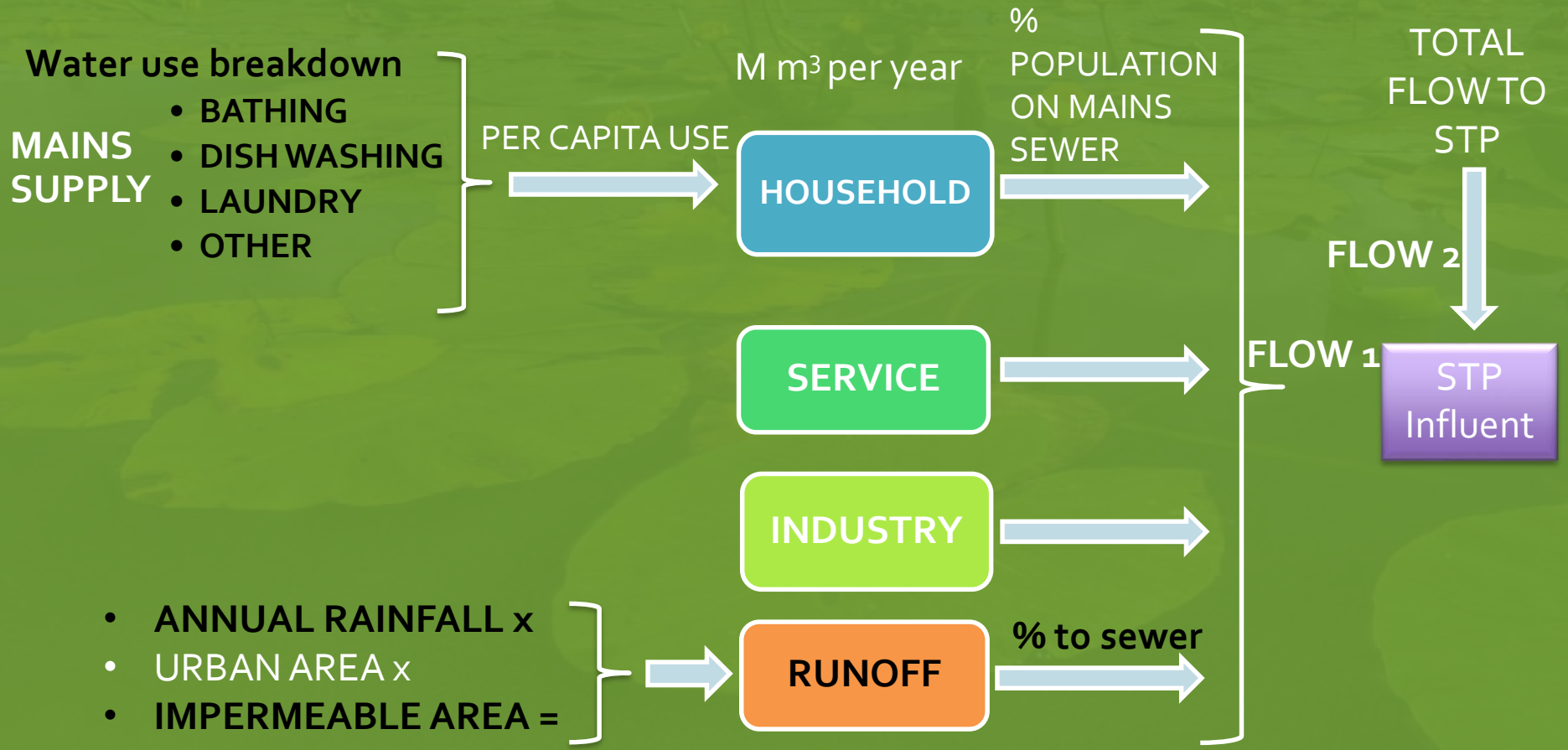
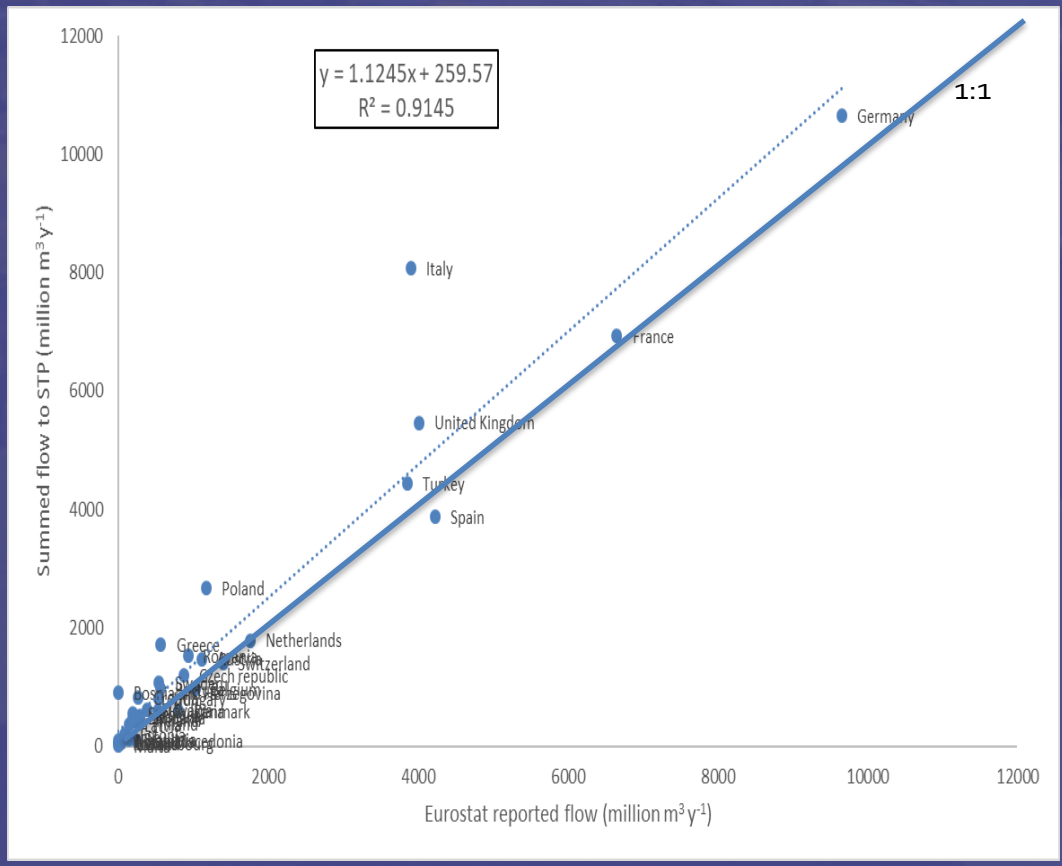
Flow balance per European country

OTHER DATA	EUROSTAT DATA



Volumes of urban runoff to STP

- Volume of runoff to STP = Mean Rainfall x Urban Area x % Impermeable Urban Area x % Runoff to Sewer
- Summed volume = runoff + service + Domestic + industry



Correlation between total UWWTD flow to sewage works and summed domestic, service, industry and calculated runoff

Base data - metals

- Country specific model of wastewater flows
- Covering issues such as concentration data for:
  - Domestic concentrations inputs. UK/worldwide data
  - Event mean runoff from road and roof
  - Industry load to sewer (ePRTR)
  - Service industry (based on reported data for UK only)
  - Mains supply concentrations serve as general basis for backgrounds
- STP Removal rates combined with Eurostat data
- Parameterised for 37 countries – mostly Europe based data with some data from Japan, Australia, USA

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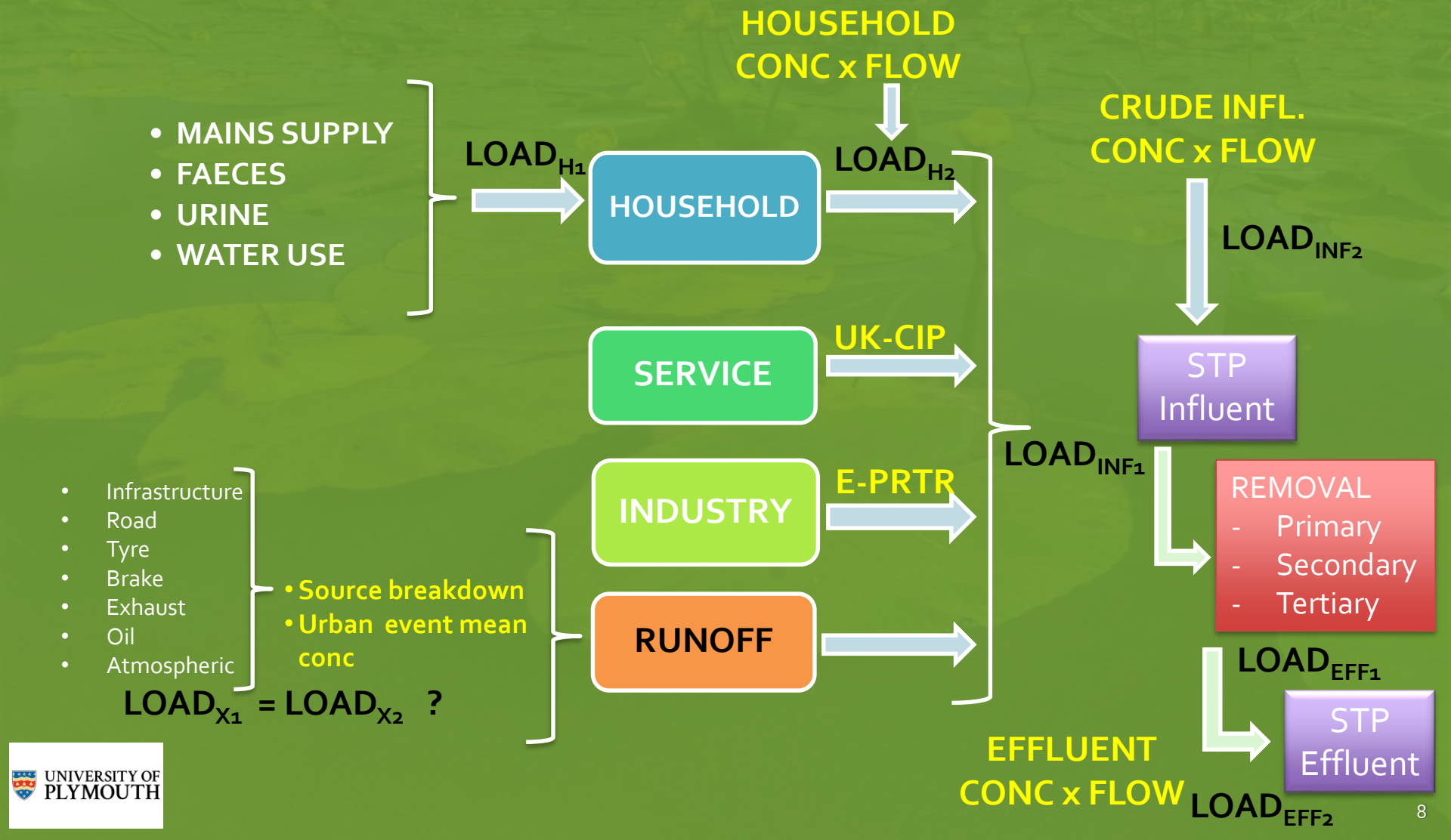
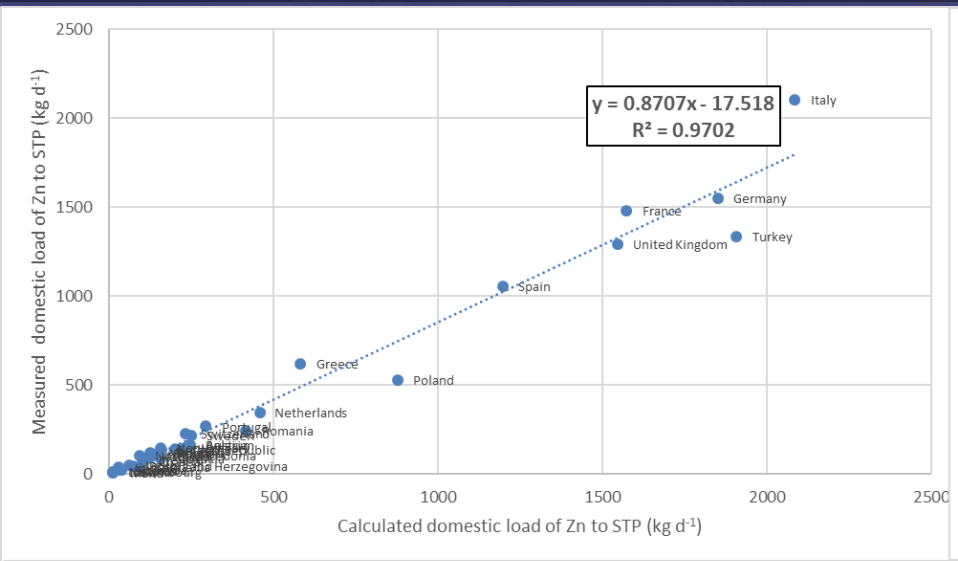
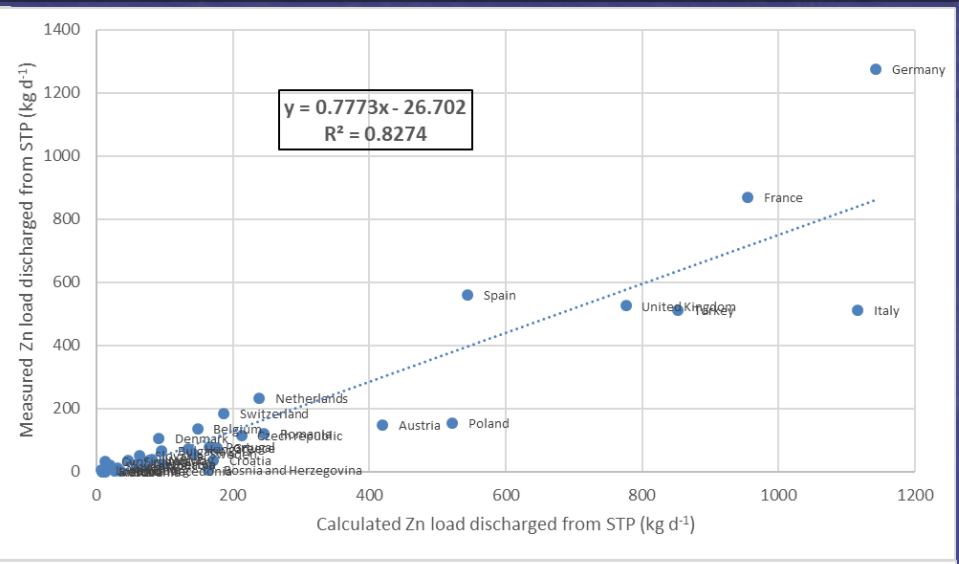
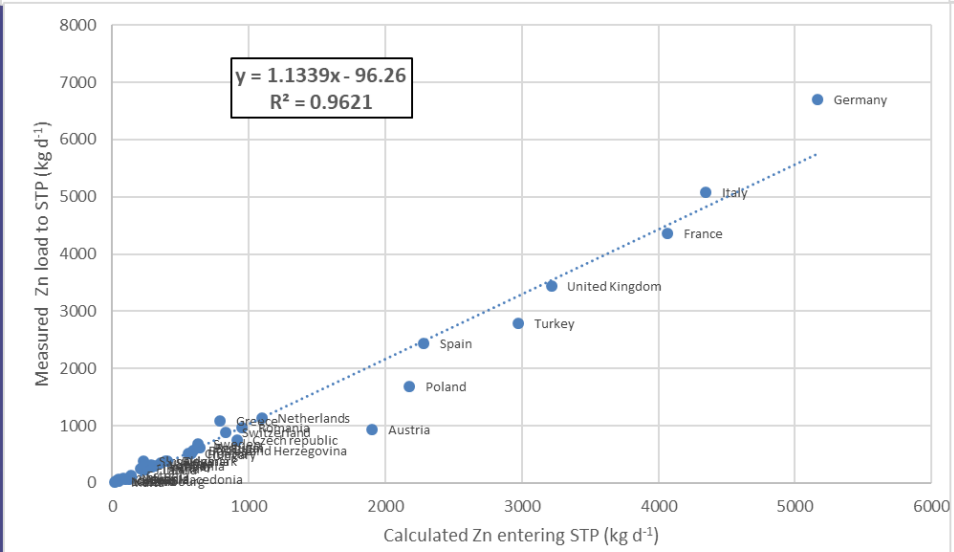
Mass balance per European country
concentration x flow = load

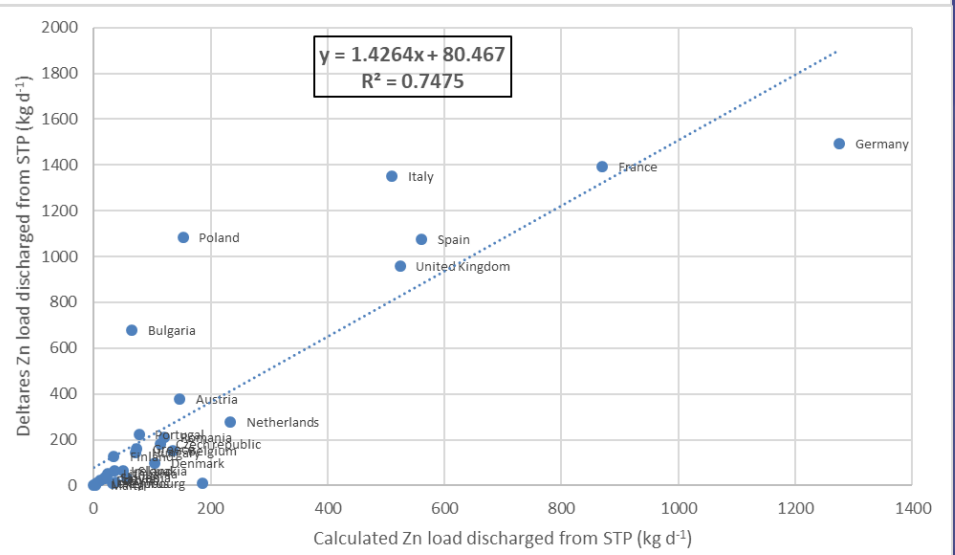


Load comparisons based on different estimation methods

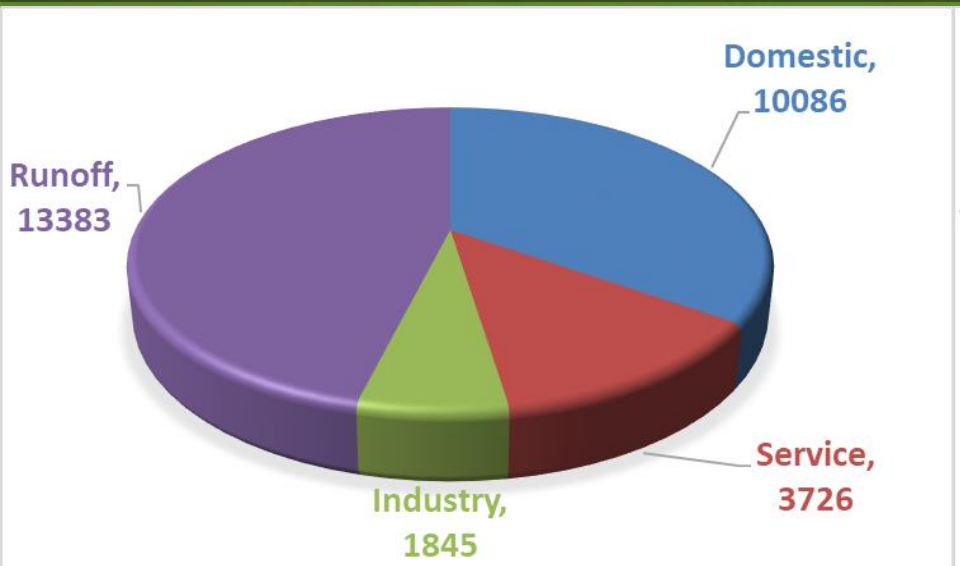


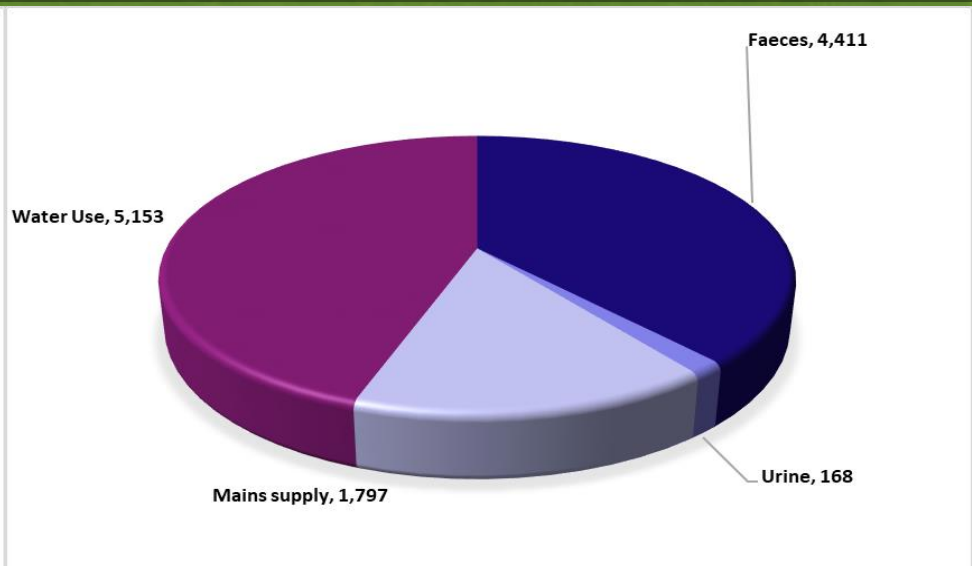


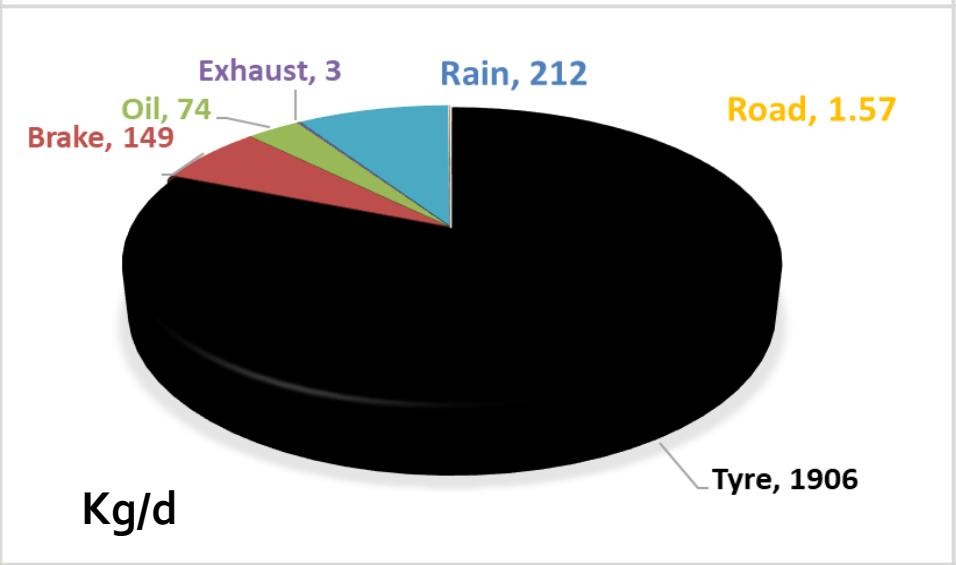


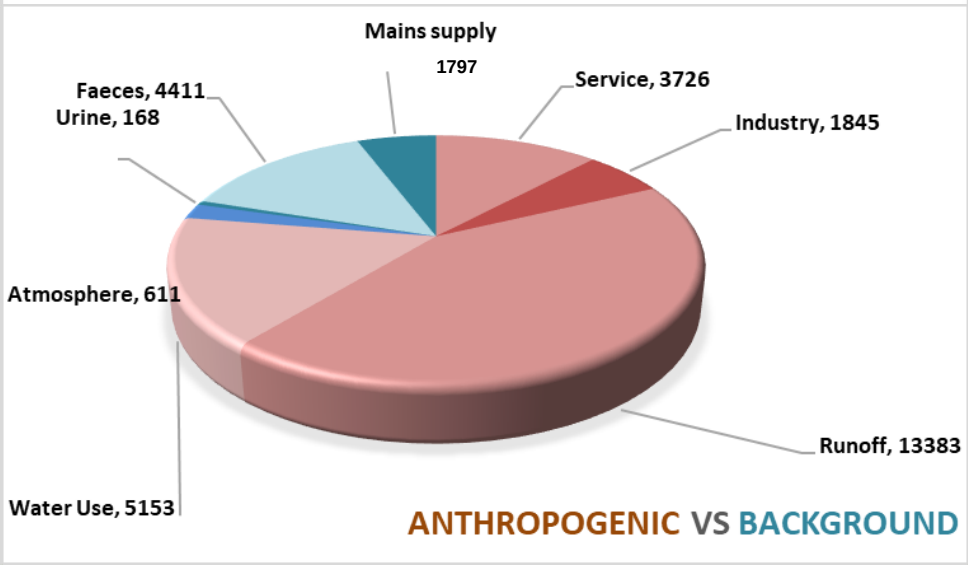


Example: France (kg - Zn/day)



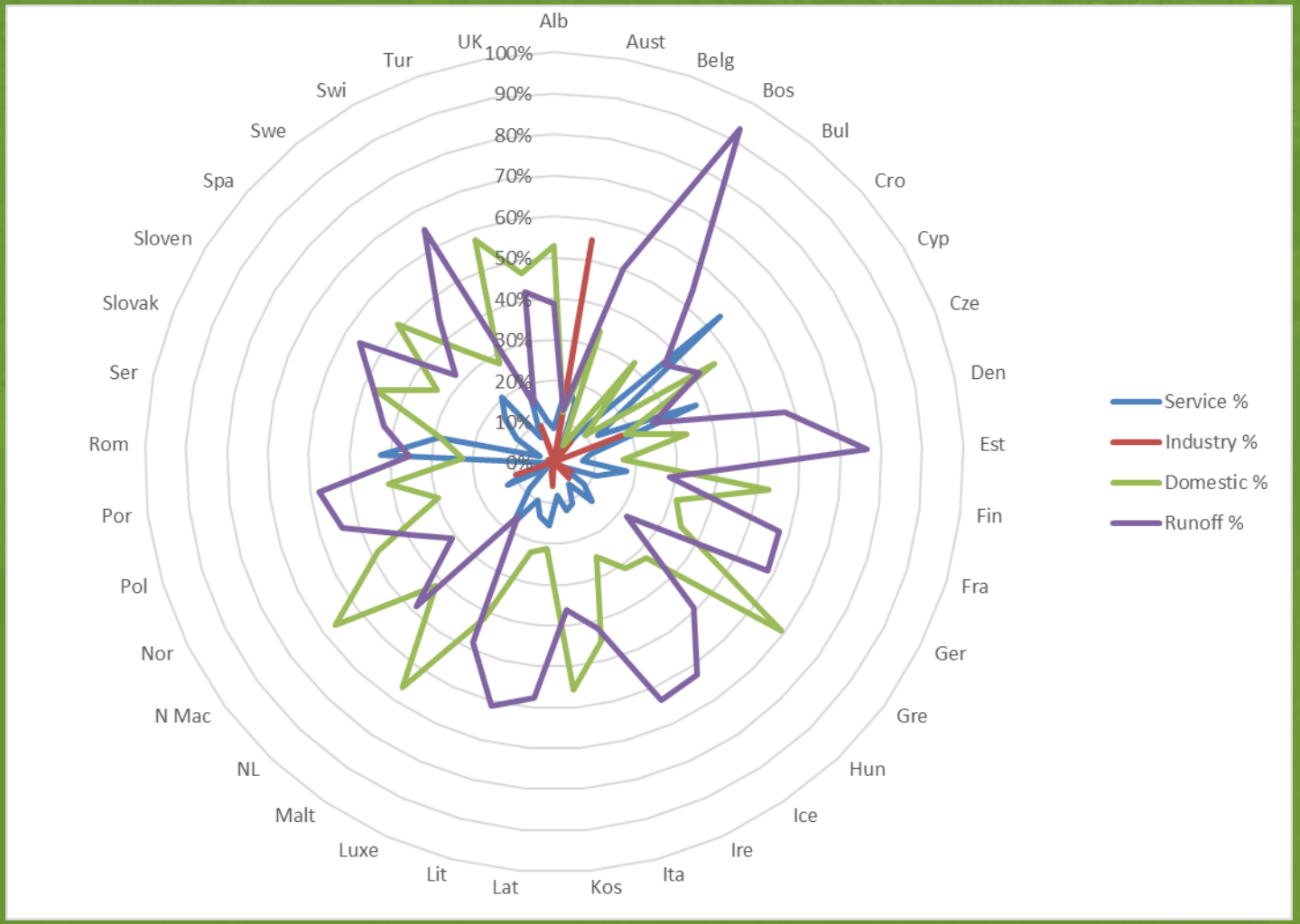






Source apportionment – just driven by population then? ….. No……

e.g. Zinc



Gaps?

- Runoff – probably biggest uncertainty
  - » Infrastructure/architecture contributions?
  - » Transfer of metals from source to STP in runoff – subject to a number of variables
    - *% rain that runs off? (assumed 100%)*
    - *% of runoff load to sewer (assumed 100%)*
    - *SuDs? (assumed limited in urban areas – 90% transmission)*
    - *For vehicle based load calculations (brakes, tyres, road, oil) – need to split rural and urban travel, then separate vs combined sewers*
    - *Leads to variations in estimates compared with EMC x flow*
- Domestic
  - » Faeces/Urine, Mains supply – pretty confident
  - » Plumbing?

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Gaps?

- Industry
  - » Sub ePRTR reporting threshold loads? Likely to be significant, tho accounted for to a degree by 'Service' loads
  - » ePRTR itself – not perfect
- Service
  - » Highly variable in flow and concentration (see UK data)
  - » Limited dataset (UK – but it is very good)
- STP data
  - » Reasonable influent, effluent, removal data (tho again v. variable)
  - » Greater treatment will mean less metals (and other chemicals over time)

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