WRA Bulletin 61

July 2021

EUROPEAN WORK

Metal source apportionment to European sewage treatment plants

Increasing use of publicly available emissions databases (e.g. European-Pollutant Release and Transfer Register [E-PRTR]) by stakeholders and policymakers have brought focus upon Sewage Treatment Plants (STP) as potentially significant sources of metal emissions to aquatic environments. Some of the data used in these databases are relatively high level and not always targeted or specific. Therefore, this project is aimed at delivering an understanding of the proportions of inputs of aluminium, arsenic, cadmium, copper, nickel, molybdenum, silver, and zinc into wastewaters which are attributable to different urban sources. WRA Associate Sean Comber, together with colleagues from wca environment Ltd and from DERAC of Oxford University, developed a spreadsheet model to quantify the key sources of the identified elements to STP in each European country.

Furthermore the importance of ambient background levels of these metals/metalloids relative to anthropogenic sources in wastewaters has been assessed as well as the fate of metals during the wastewater treatment process. It is of particular importance is to identify gaps in information and areas of uncertainty. The aim of the project was not to target the generation of new data, but to identify, collect, collate, and synthesise existing datasets.

Sources were split into four types: (i) domestic (mains tap water, faeces, urine and other sources including plumbing and activity related discharges); (ii) urban runoff (brake, tyre and road abrasion, exhaust emissions, oil loss and atmospheric deposition); (iii) service industry discharges; (iv) industrial emissions (Figure 1).

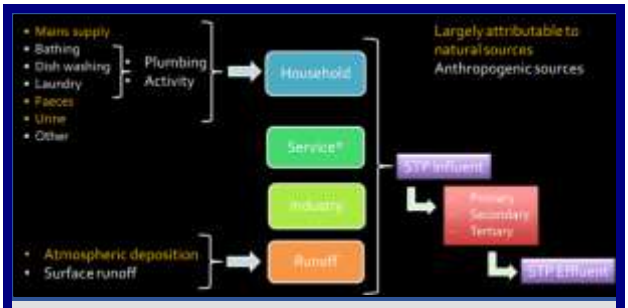

Figure 1 Schematic of the sources quantified for each metal

Key specific sources included copper from brake lining abrasion, and zinc from vehicle tyre abrasion. Significant variations were observed between countries depending on, for example, patterns of use of copper in plumbing and architecture, and metals from industrial discharges tending to be more significant in eastern Europe. For many of the other elements the distribution of emissions between the sources was more evenly distributed reflecting their ubiquitous presence within the urban environment. Runoff sources were typically influenced by traffic density and degree of urbanisation, and service sources from town centre and commercial industries were generally low, reflecting their limited water use compared with domestic and industrial categories (Figure 2).

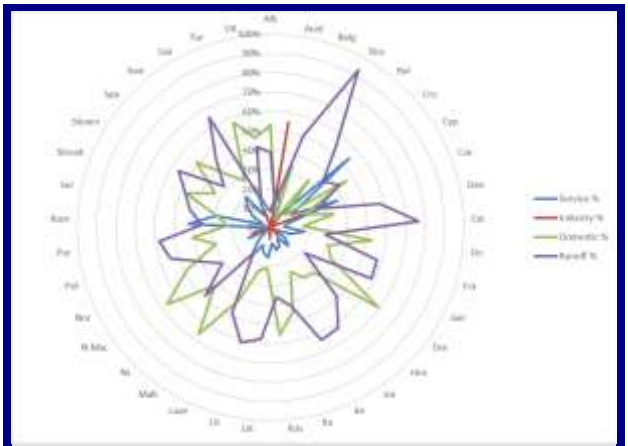

Figure 2 Radar diagram of the split between the main sources of zinc across Europe

Background inputs (defined in this case as mains water supply, urine, faeces and atmospheric deposition) were in most cases less than 25% of the overall contribution for all elements, reflecting the current and historical use of these elements in urban environments. The removal of the elements with the sewage treatment process is generally efficient, for example copper, zinc, aluminium and silver exhibit more than 70% removal to sludge for secondary treatment, while cadmium, nickel and molybdenum exhibit over 50%, with only arsenic exhibiting poor removal (<10%) which may reflect a lack of data or the fact that it is an anion.

Key areas of uncertainty were emissions from certain categories of road transport, the magnitude of emissions from industry discharging metals below the E-PRTR reporting threshold and the lack of data often associated with aluminium, molybdenum, silver, and arsenic for a number of the sources and sub-categories.

UK WORK

Green infrastructure to mitigate pollution in the Salmons and Pymmes Brooks, Enfield, north-east London

As part of the British Geological Survey's CAMELLIA project, the INCA water quality models were applied to two urban catchments located in north east London (Figure 3). This project was undertaken by Partner Paul Whitehead and Associate Gianbattista Bussi of WRA, in collaboration with a number of colleagues from Oxford University, British Geological Survey, Imperial College, UK Centre for Ecology and Hydrology, and Thames 21, a local NGO.

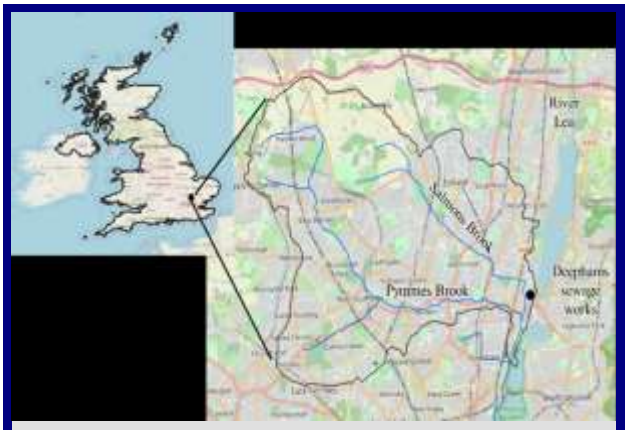

Figure 3 Map showing location of the Salmons and Pymmes Brooks in north-east London, with the Deephams sewage treatment plant close to their outfall into the River Lee.

Poor water quality is a widespread issue in urban rivers and streams in London. Localised pollution can have impacts on local communities, from health issues, environmental degradation and restricted recreational use of water. The Salmons and Pymmes Brooks, located in the London Borough of Enfield, flow into the River Lee just upstream of the former Olympic Park at Stratford. The Salmons Brook is the recipient of effluent wastewater from one of the largest sewage treatment plants in London, the Deephams Sewage Treatment Works, which services a population of about one million people. These two catchments show heavy signs of pollution, mainly due to road runoff, air pollution and pipe misconnections with raw effluent outfalls.

The overall aim of the project was to provide local communities and community action groups, such as Thames 21, with a tool they can use to assess the water quality issues. The first step towards finding a sustainable and effective solution is to identify sources and paths of pollutants and to understand their cycle through catchments and rivers. A set of mitigation strategies have been evaluated to assess pollution control, including wetland construction across the catchments (Figure 4), and the rewilding of the upstream agricultural areas.

Figure 4 Wetland scenario showing all the locations of existing and potential future wetlands in the Salmons and Pymmes Brooks catchments. The thick green lines represent the stretches of river interested by a potential wetland, although the wetland does not necessarily cover the entire reach.

The results of this project show that a substantial reduction in nitrate, ammonium and phosphorus concentrations can be achieved if a proper catchment-scale wetland implementation strategy is put in place (Figure 5). Furthermore, the project shows how the nutrient reduction efficiency of the wetlands should not be affected by future climate change, by using the latest UKCP-18 data sets from the UK Meteorological Office.

Figure 5 Wetland constructed to reduce pollution levels

Next WRA Board Meeting

Tuesday 12th October 2021, at 09.30 hrs at Blewbury.

The WRA Bulletin is a quarterly publication, and relies on contributions submitted by Partners, Associates and Consultants. The document is circulated by email, and published on the WRA web-site, aiming to keep the WRA network up-to-date with respect to current activities. Please email contributions for future issues to Nick Mandeville: nick@watres.com

Water Resource Associates LLP, PO Box 838, Wallingford, Oxon OX10 9XA. Tel: +44[0] 1491 838 190, www.watres.com