FreshWater Watch
By earthwatch
EUROPE

Investigating urban runoff in the River Cherwell

Contents

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Introduction

In late 2025, a mountain of fly-tipped waste approximately 150m long and 6m high was discovered on a field between the River Cherwell and the A34 near Kidlington.

Fly-tippers are thought to have started building up the mound of waste in the summer. The Environment Agency said they became aware of it in July. The rubbish itself is made up of what appears to be processed domestic waste, shredded plastics, polystyrene, tyres, and other household items.

In a recent statement the Environment Agency said specialist officers "found no evidence of pollution after extensive tests of both the waste and the river... work continues to ensure the river and surrounding environment are protected"[1].

However, details as to which pollutants were investigated have not been made clear.

Several organisations have collaborated along with citizen scientists to further investigate the pollution. This study was coordinated by environmental charity and independent research organisation, Earthwatch Europe, and supported by two freshwater campaigning organisations - Thames21 and Friends of the River Thames – as well as two laboratories: Emissions Analytics and Artemis Analytical.

Key findings

- Nine metals and metalloids – arsenic, barium, cobalt, copper, lead, nickel, selenium, thallium and zinc - were detected in the River Cherwell at concentrations higher than their Predicted No Effect Concentrations.
- The chemicals 2,4-Di-tert-butylphenol and methylene chloride were both detected at particularly high concentrations upstream of the landfill site.
- Although unsightly, and a possible source of microplastics and microbial matter contamination, our data indicate the landfill site is currently unlikely to be a significant source of metal and chemical pollution in the River Cherwell.

Results

Citizen scientists monitored three sites along the River Cherwell on Wednesday 26 November: one upstream site of the area of waste and two downstream. Volunteers conducted citizen science tests for five metals (cadmium, copper, manganese, nickel and zinc) and collected samples (in duplicate) for metals analysis by Artemis Analytical and analysis of organic pollution by Emissions Analytics.

The limits for metal concentrations in the environment – called Environmental Quality Standards - are based on the bioavailable fraction of the metal. Factors like pH and dissolved organic carbon influence a metal's bioavailability and are used to determine site-specific limits. The Environment Agency classify waterbodies based on multiple samples per year.

For this report we have indicated the Predicted No Effect Concentration (PNEC) of these metals for freshwater habitats as a limit to evaluate the concentrations observed in the River Cherwell[2].

The PNEC is the estimated concentration of a substance below which adverse effects on ecosystems are unlikely to occur. Metals at a concentration higher than their PNEC value could pose risk to aquatic life.

Artemis Analytical tested for the presence of thirty-three elements; twenty-nine metals and metalloids, and four reactive non-metals. The concentration of these elements are indicated in Table 1.

Nine metals and metalloids – arsenic, barium, cobalt, copper, lead, nickel, selenium, thallium and zinc - were detected in the River Cherwell at concentrations higher than their PNEC.

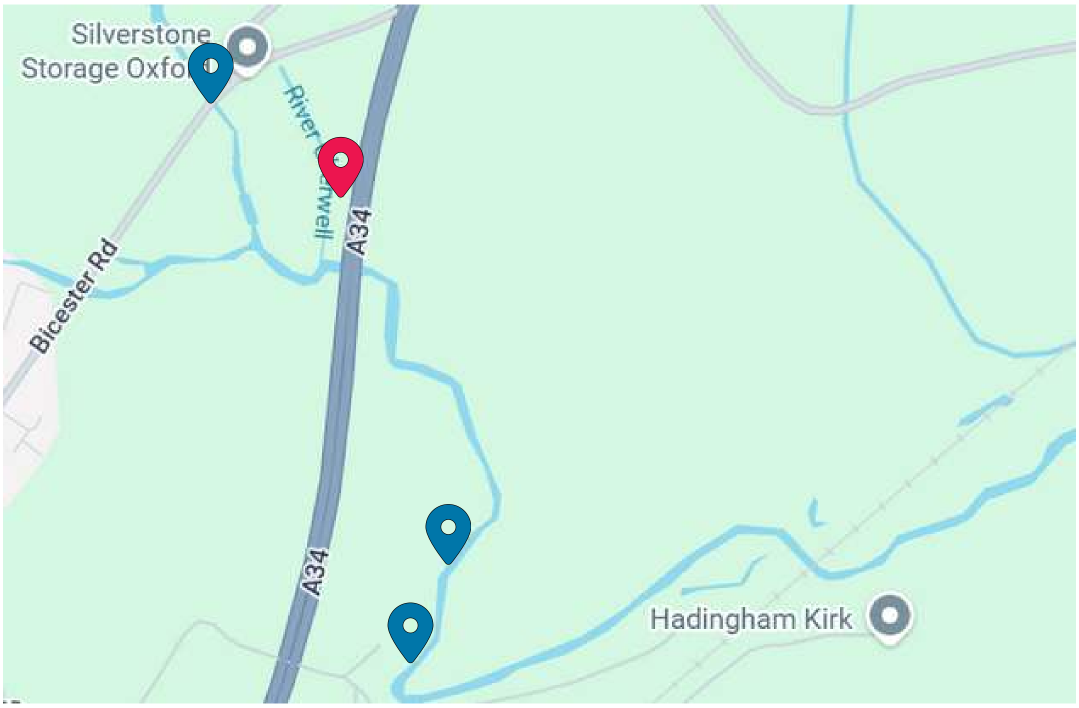

Table 1. Map of sampling sites. The red pin indicates the landfill. Blue pins are sampling sites.

Metal	PNEC	Upstream		Downstream 1		Downstream 2	
		Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
Aluminium	-	66.62	61.99	< LOD	144.19	108.25	104.12
Arsenic	0.50	1.19	1.38	1.16	1.34	1.29	1.23
Barium	19.00	20.26	15.16	10.52	10.74	9.90	9.63
Beryllium	-	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD
Bismuth	-	0.02	0.03	0.05	0.05	0.04	0.04
Boron	2000.00	64.94	64.66	66.61	67.38	72.47	67.94
Caesium	-	0.07	0.06	0.04	0.05	0.05	0.04
Cadmium	0.08	0.01	0.01	0.02	0.01	< LOD	0.01
Calcium	-	61639.63	61829.25	57258.35	57303.58	55668.63	54880.54
Chromium	3.40	0.46	0.43	0.34	0.63	0.48	0.46
Cobalt	0.28	0.24	0.25	0.23	0.32	0.24	0.25
Copper	1.00	3.24	3.52	2.21	2.64	3.04	3.26
Gallium	-	0.01	0.02	< LOD	0.04	0.04	0.03
Indium	-	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD
Iron	1000.00	107.60	117.05	10.49	315.27	166.33	136.34
Lead	1.20	0.70	0.71	0.09	0.42	1.36	0.18
Lithium	-	8.10	7.74	8.04	7.47	7.09	7.12
Magnesium	-	5821.98	5687.90	5607.11	5750.68	5693.08	5591.13
Manganese	123.00	5.89	5.93	0.43	8.74	2.52	1.52
Nickel	2.00	2.34	2.27	2.02	2.44	2.96	2.21
Phosphorous	-	141.61	147.28	120.94	158.61	126.48	128.85
Potassium	-	4717.33	4700.71	4636.99	4682.76	4552.08	4738.10
Rubidium	-	1.86	1.79	1.68	1.89	1.74	1.89
Selenium	0.10	0.40	0.39	< LOD	< LOD	0.07	< LOD
Silicon	-	4360.91	4330.53	4234.01	4553.27	4477.41	4359.84
Silver	-	0.07	0.01	0.01	0.01	0.06	0.01
Sodium	-	24098.82	23473.36	24400.47	25061.68	24246.96	24092.34
Strontium	-	249.61	246.22	238.89	242.10	239.41	232.51
Sulphur	-	27391.70	27080.17	26731.08	26508.82	25735.68	25226.12
Tellurium	-	0.05	0.04	0.10	0.15	0.15	0.07
Thallium	0.01	0.03	0.01	0.02	0.01	< LOD	0.01
Vanadium	4.10	0.89	0.88	0.72	1.12	0.94	0.90
Zinc	7.80	6.31	4.25	8.14	6.21	3.31	9.39

Table 2. Metal concentrations (in ug/l) up and downstream of the landfill site along the River Cherwell. Those in red are higher than their PNEC. The (-) symbol indicates where the PNEC record cannot be found in the NORMAN toxicology database. <LOD indicates where concentrations were lower than the Limit of Detection.

Emissions Analytics analysed the presence of a number of important organic micropollutants using solid-phase microextraction with two-dimensional Gas Chromatography-Mass Spectrometry; average concentrations from duplicate measurements for up and downstream samples are presented in Table 3.

Nine pollutants were detected in the River Cherwell at concentrations higher than their PNEC.

2,4-Di-tert-butylphenol was detected at particularly high concentrations upstream of the landfill site; a compound known to be very toxic to aquatic life with long lasting effects. The presence of methylene chloride at high concentrations is also concerning: the Environmental Protection Agency considers methylene chloride to be a probable human carcinogen.

Chemical	PNEC	Upstream	Downstream 1	Downstream 2
Methylene chloride	0.02	0.0577	0.0275	0.0504
1,3-bis(1,1-dimethylethyl)-Benzene	0.000096	0.0512	0.0475	0.0516
2,2-dimethyl-1-Propanol	0.112	0.0021	< LOD	< LOD
2,6-bis(1,1-dimethylethyl)-2,5-Cyclohexadiene-1,4-dione	0.00086	0.0345	0.0224	0.0306
2,4-Di-tert-butylphenol	0.00032	1.8178	1.4435	1.6927
2,5-bis(1,1-dimethylethyl)-Phenol	0.00032	0.0087	0.0100	0.0056
1,2,3,4,4a,5,8,9,12,12a-decahydro-1,4-Methanobenzocyclodecene	0.000023	0.0017	0.0027	< LOD
2,4-di-t-butyl-6-nitro-Phenol	0.00012	0.0099	< LOD	0.0026
1,3,5-trimethyl-2-octadecyl-Cyclohexane	-	< LOD	0.0051	0.0106
3,5-bis(1,1-dimethylethyl)-Phenol	0.00057	< LOD	< LOD	0.0075

Table 3. Concentrations (in ug/ml) of organic micropollutants measured in the River Cherwell up and downstream of the landfill site. Compounds shown in red exceed their PNEC values. <LOD indicates where concentrations were lower than the Limit of Detection.

Discussion

Why were concentrations of pollutant not significantly higher downstream of the landfill compared to upstream?

Our data suggest the river is polluted by road runoff and upstream pollution sources more so than it is through landfill contaminants.

Sampling of the river upstream of the landfill site took place from a bridge over which the Bicester Road runs. The increased concentrations in the upstream site indicate a source of these pollutions, possibly related to road runoff.

Both downstream sites were downstream of the A34 bridge over the Cherwell. Downstream concentrations of pollutants may be reduced by dilution, as tributaries entering the river decrease downstream contaminant levels, and by attenuation processes associated with riparian and in-river vegetation, which can promote metal retention in biomass and sediments. There may also be reduced flow pathways from the A34 to the river, reducing the chemical and metal pollution entering from this road compared to the Bicester Road.

It is entirely possible that the landfill is leaching other forms of pollution – microplastics, PFAS and microbial matter – into the river; and indeed, that these contaminants as well as metals and organic pollutants are leaching into surrounding soils. It is also possible that chemical and metal contaminants may begin to leach into the river over a prolonged period of time. However, confirmation of this would require further investigation.

The poor state of many waterbodies in the UK is down to a complex and interconnected range of pollution sources: sewage discharge, agriculture and urban runoff. In the River Cherwell, investigating the landfill site has revealed something arguably more concerning: the water quality in the river is already negatively impacted upstream of the landfill.

The Environment Agency has classified the Cherwell as having moderate ecological status, based on multiple samples per year[3]. Data from 2019 and 2022 indicate that the river had high status of copper, iron, manganese and zinc, and is considered "Good" in terms of lead and nickel levels, based on Environmental Quality Standards rather than PNEC.

Earthwatch Europe believes in the power of data for change, in citizen science for transformative action, and in the strength of collaboration to address these complex pollution issues.

We strongly call on authorities to continue working with us to engage communities and integrate citizen science into national freshwater monitoring frameworks. At the same time, we encourage citizen scientists to continue their essential work in monitoring and championing the health of their local rivers, lakes, ponds, and streams.

Methods

On Wednesday 26 November, three trained citizen scientists collected samples of water from three freshwater sites along the River Cherwell.

Citizen science metals testing kits

The measurements of cadmium, copper, manganese, nickel and zinc were made colourimetrically in closed tubes using a standard plastic cuvette for a fixed volume of 1.5mL. The testing kit measured five metals in the dissolved state – copper, nickel, cadmium, zinc, manganese. The sum of the dissolved metals was detected by the kit, which produced a colour change based on a chemical reaction between 1-(2-Pyridylazo)-2-naphthol (PAN) and the dissolved metals in the water. Colours were compared to standard reference colour charts provided to the citizen scientists, assigning colour brightness to one of seven concentration intervals.

Lab testing - metals

Samples were analysed by Artemis Analytical using Tandem Quadrupole Inductively Coupled Plasma Mass Spectrometry (ICP-MS/MS). Briefly, samples were split, with one fraction used to measure pH and total dissolve solids (TDS) and the second fraction used to measure the concentration of elements. This second fraction was diluted x10 in nitric acid (or x20 for 4 higher TDS samples) with a final concentration of 2% nitric, and filtered (0.45 micron) prior to ICP-MS/MS analysis.

Field blanks and external standards were acidified to the same concentration, ensuring all samples were matrix matched. The Limit of Detection (LoD) and Limit of Quantitation (LoQ) were calculated using a 3:1 and 10:1 signal-to-noise ratio respectively for each element.

Lab testing - chemicals

Emissions Analytics analysed the presence of compounds using solid-phase microextraction with two-dimensional Gas Chromatography-Mass Spectrometry.

Samples were extracted using the DVB/PDMS/Carbon WR Smart SPME fibre and desorbed on a GC injection. An Agilent 8890 Gas Chromatographer equipped with a Markes International Bench Time-of-Flight Mass Spectrometer (GCxGC-TOF-MS), using a flow modulator from SepSolve Analytical was used to analyse chemical concentration. The repeatability of measurements is typically reported as ±25% of the concentration values.

References

1. Morris, J. (2025, December 24) “No evidence waste mountain has polluted river” BBC News

2. NORMAN Ecotoxicology Database

3. Environment Agency Catchment Data Explorer Cherwell (Bletchingdon to Ray) https://environment.data.gov.uk/catchment-planning/WaterBody/GB106039037432

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