FreshWater Watch By earthwatch EUROPE

Investigating freshwater metal pollution in Corby

Corby steelworks circa 1980 © North Northamptonshire Council

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a Earthwatch Europe, Oxford, OX1 1BT
b Artemis Analytical, Schuster Laboratory, Oxford Road, Manchester, M13 9PL

Cover image: Corby steelworks and town, circa 1980 © North Northamptonshire Council

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Thank you to the community of Corby who made this report possible.

Introduction

Prior to its closure in 1980, 10,000 people worked at Corby's steelworks, and the unemployment rates resulting from its closure prompted the local council to launch a regeneration project. The British Steel Corporation demolished the works, and using government and European grants, the council began reclaiming the land. The project involved moving thousands of tonnes of contaminated waste to Deene Quarry, on the outskirts of the town.

Years later, concerns arose when mothers living near the reclamation site gave birth to children with upper limb deformities, at rates three times higher than in the surrounding area.

In a landmark case, a team of experts - including toxicologists and pollution specialists - argued that the council's mismanagement of contaminated waste had spread contaminated dust throughout the town. The heavy metal cadmium was identified on the former steel site, and a medical expert cited research linking it to birth defects in animals. After a three-month civil court hearing, the court ruled in favour of the claimants.

As stated in the British Medical Journal[1], “The judge said there was no doubt that the contaminants present - cadmium, chromium, nickel, polycyclic aromatic hydrocarbons, and dioxins - could cause similar birth defects in animals”

Today, the community are worried that these and other metals are still present in the waterways that run through the town. In August 2025, Corby community leaders approached Earthwatch Europe to investigate metal contamination in Corby’s waterways. In November 2025, 35 citizen scientists assessed 59 freshwater sites across Corby for metal pollution using simple testing kits and collecting samples for laboratory analysis by Artemis Analytical.

Corby steelworks circa 1964 © John Cosford

Corby skyline © Tom Walker

Key findings

- 35 citizen scientists assessed 59 freshwater sites across Corby for 33 elements: 29 metals and metalloids, and 4 reactive non-metals
- At every site across Corby, at least one metal or metalloid was present at concentrations which exceed their predicted no effect concentration (PNEC), the concentration below which no adverse ecological effects are expected.
- Nickel was detected in 30 samples at concentrations higher than its PNEC, and cadmium was detected in 7 samples at elevated concentrations compared to the baseline of the Corby area.
- The sites where cadmium and nickel were found at elevated concentrations were largely found in two general areas: Deene Quarry and a former slag heap in Weldon.

Metals and their environmental toxicity

The water that we drink is taken up from rivers and reservoirs, filtered and disinfected at water treatment works to meet drinking-water standards, then delivered to homes through the mains network. The quality of tap water is regulated by the Drinking Water Inspectorate, with strict limits (see Table 1). Potable (drinking) water is not abstracted from freshwater in Corby.

After we use water, it enters the sewer system, where it is treated at sewage treatment works before being released back into rivers or the sea. Once in the environment, water continues through the natural water cycle (evaporation, condensation, precipitation), re-filling rivers and reservoirs. The Environment Agency is the main body in England responsible for regulating Operators against discharges permits and abstractions licences in the water environment.

Metals are typically hard, shiny elements which conduct heat and electricity. Heavy metals are generally referred to as those metals which possess a specific density of greater than 5 g/cm^3 and can adversely affect the environment and living organisms. The most common heavy metals in wastewater include arsenic, cadmium, chromium, copper, lead, nickel, and zinc, all of which cause risks for the environment[2].

The limits for metal concentrations in the environment – called Environmental Quality Standards - are a little more complicated than the limits for metal concentrations in tap water. These 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.

This study focuses on metal pollution in freshwater environments only, and not in drinking water. For the sake of simplicity, we have indicated the Predicted No Effect Concentration (PNEC) of these metals for freshwater habitats (see Table 1). 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.

What is PNEC?

A Predicted No Effect Concentration, or PNEC, is the level of a substance - such as a metal - below which it is not expected to harm plants, animals, or ecosystems, even if exposure continues over a long time. It relates specifically to environmental health and does not describe effects on human health.

Element (symbol)	Type	DWI limit (ug/l)3	PNEC freshwater (ug/l)4
Aluminium (Al)	Post-transition metal	200	-
Arsenic (As)	Metalloid	10	0.5
Boron (B)	Metalloid	1000	2000
Barium (Ba)	Alkaline earth metal	Not tested	19
Beryllium (Be)	Alkaline earth metal	Not tested	-
Bismuth (Bi)	Post-transition metal	Not tested	-
Cadmium (Cd)	Transition metal	5	0.25
Caesium (Cs)	Alkali metal	Not tested	-
Calcium (Ca)	Alkaline earth metal	Not tested	-
Chromium (Cr)	Transition metal	50	3.4
Cobalt (Co)	Transition metal	Not tested	0.28
Copper (Cu)	Transition metal	2000	1.0
Gallium (Ga)	Post-transition metal	Not tested	-
Indium (In)	Post-transition metal	Not tested	-
Iron (Fe)	Transition metal	200	1000
Lead (Pb)	Post-transition metal	10	1.3
Lithium (Li)	Alkali metal	Not tested	-
Manganese (Mn)	Transition metal	50	123
Magnesium (Mg)	Alkaline earth metal	Not tested	-
Nickel (Ni)	Transition metal	20	2
Phosphorous (P)	Reactive non-metal	Not tested	-
Potassium (K)	Alkali metal	Not tested	-
Rubidium (Rb)	Alkali metal	Not tested	-
Selenium (Se)	Reactive non-metal	10	0.1
Silicon (si)	Metalloid	Not tested	-
Silver (Ag)	Transition metal	No limit	-
Sodium (Na)	Alkali metal	200,000	-
Strontium (Sr)	Alkaline earth metal	Not tested	-
Sulphur (S)	Reactive non-metal	Not tested	-
Tellurium (Te)	Reactive non-metal	Not tested	-
Thallium (Tl)	Post-transition metal	Not tested	0.013
Vanadium (V)	Transition metal	Not tested	4.1
Zinc (Zn)	Transition metal	None specified	7.8

Table 1. Elements analysed, their type as defined in the periodic table, their limit as regulated by the DWI, and their PNEC for freshwater habitats. Not tested indicates the DWI does not test for this metal. None specified indicates the DWI has not specified the limit. The (-) symbol indicates where the PNEC record cannot be found in the NORMAN toxicology database.

Distribution of metals across Corby

Fifty-nine freshwater sites across Corby were tested for the presence of thirty-three elements; twenty-nine metals and metalloids, and four reactive non-metals.

At every site, at least one metal or metalloid was detected at concentrations higher than its PNEC, meaning that it could pose risk to aquatic life.

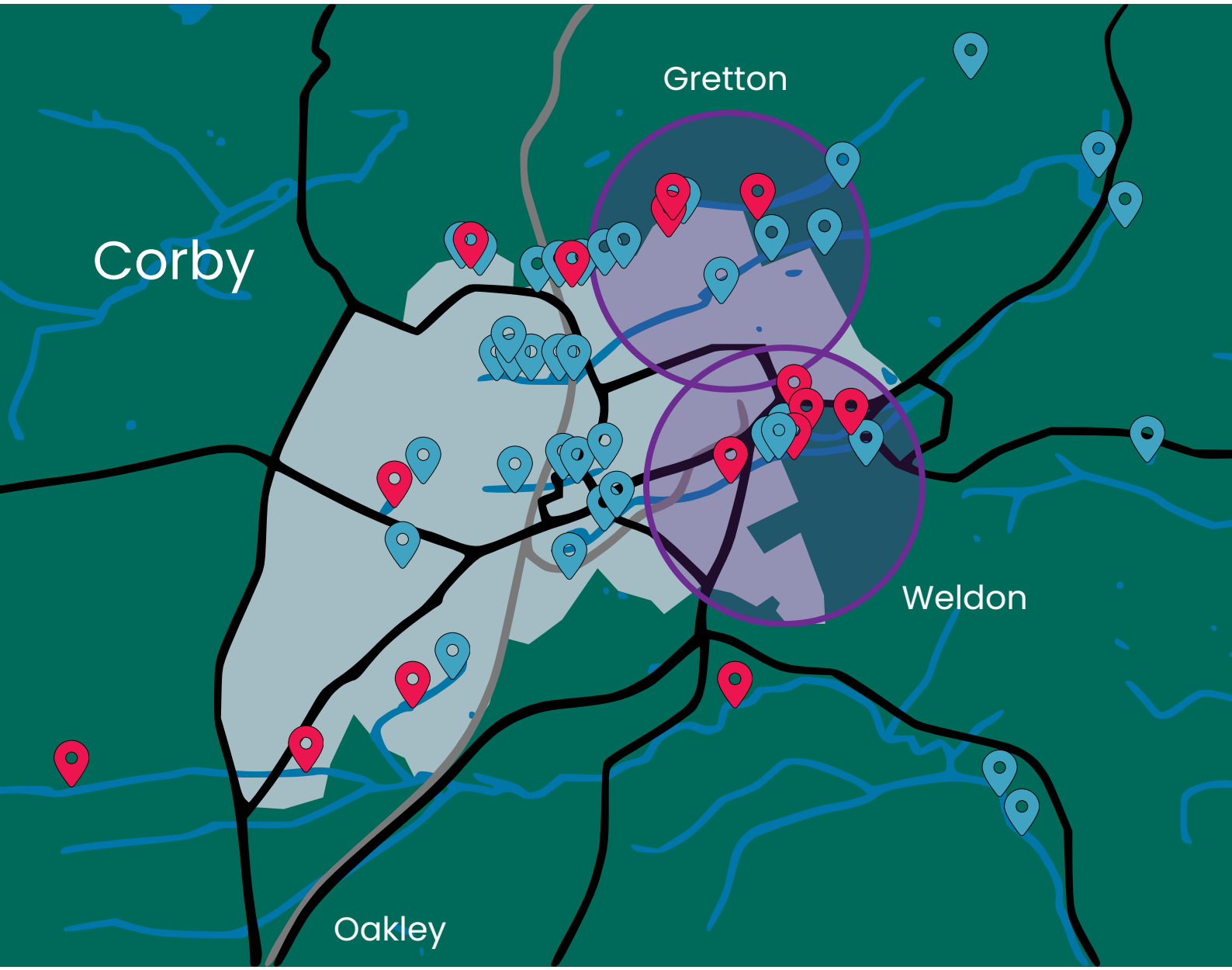
The distribution of metals across Corby was not uniform, with different sites polluted by a variety of different metals. The number of times metals were detected at concentrations higher than their PNEC is listed in Table 2.

The median number of elements higher than their PNEC was five. Fifteen sites had six or more elements present at concentrations higher than their PNEC.

These sites were centred in two pollution hotspots: one in Gretton and one in Weldon (Figure 1).

Element (symbol)	PNEC freshwater (ug/l)[4]	Number of sites detected (above LoQ)	Number of sites higher than PNEC	% of sites higher than PNEC
Arsenic (As)	0.5	59	58	98
Boron (B)	2000	59	0	0
Barium (Ba)	19	59	37	63
Cadmium (Cd)	0.25	30	0	0
Chromium (Cr)	3.4	59	0	0
Cobalt (Co)	0.28	59	33	56
Copper	1.0	59	59	100
Iron (Fe)	1000	59	0	0
Lead (Pb)	1.2	28	1	2
Manganese (Mn)	123	59	1	2
Nickel (Ni)	2	48	30	51
Selenium (Se)	0.1	22	22	37
Thallium (Tl)	0.013	0	0	0
Vanadium (V)	4.1	59	2	3
Zinc (Zn)	7.8	36	28	47

Table 2. Number of sites where metals with known PNECs were detected: at their Limit of Quantitation (LoQ) - the lowest concentration of a substance an analytical method can measure with acceptable accuracy and precision - and at concentrations higher than the PNEC.



Sample with six or more metals or metalloids over PNEC level

Sample with fewer than six metals or metalloids over PNEC level

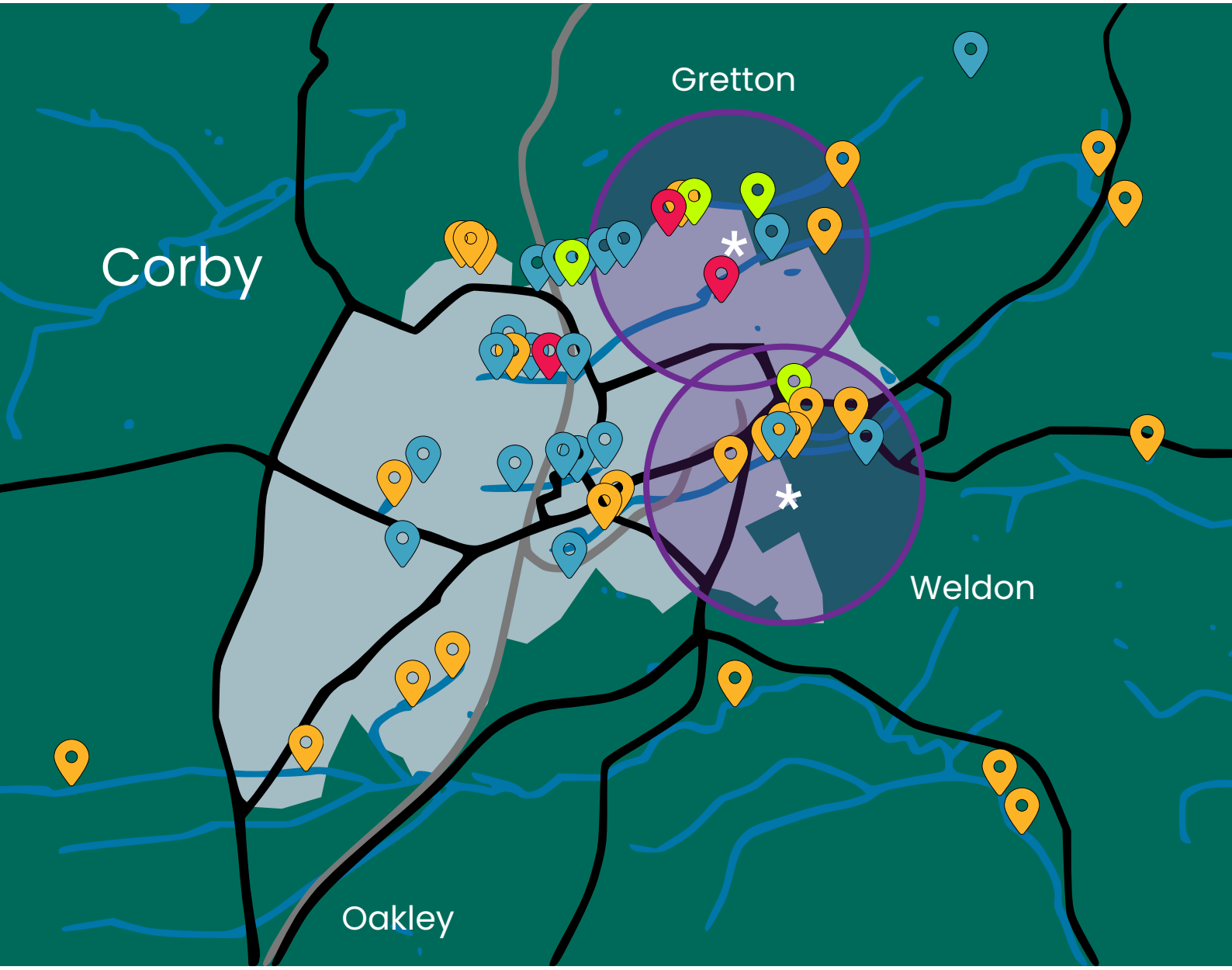
Figure 1. Location of samples with six or more metals or metalloids above their PNEC. Pollution hotspots highlighted in purple.

Our data show that the concentrations of five metals (cadmium, caesium, gallium, rubidium and vanadium) were found at significantly higher concentrations within 1 mile from the pollution hotspots compared to other sites across Corby ($p=<0.01$, Mann-Whitney tests). Although concentrations were significantly elevated, the majority of these metals did not exceed their PNEC.

Due to the historic mismanagement of contaminated waste, the community were particularly concerned about the presence of cadmium, chromium and nickel in Corby's freshwaters.

Chromium was not detected at elevated concentrations, or above its PNEC in any sample; while nickel was detected at 30 sites at concentrations higher than its PNEC. Cadmium was not detected at concentrations higher than its PNEC, however, it was detected at 7 sites at elevated concentrations compared to the baseline of the Corby area, indicating a clear source (Figure 2).

The sites where cadmium was elevated and nickel was at high concentrations were largely found in two general areas: Deene Quarry – a site where thousands of tonnes of contaminated waste were dumped in the 1980s and 90s – and a former slag heap in Weldon, which is not a confirmed landfill site for the contaminated waste.



Cadmium elevated above baseline

Cadmium elevated and nickel over PNEC

Nickel over PNEC

Cadmium not elevated and nickel below PNEC

Figure 2. Sites where cadmium was elevated and nickel was detected at concentrations higher than its PNEC. Pollution hotspots highlighted in purple. Deene Quarry and the former slag heap in Weldon are indicated by the *

How do these results compare?

Comparison of citizen science and lab results

We compared the results obtained using a citizen science testing kit and the laboratory analysis (described in detail in the methods section of this report). Our data suggest that, where the citizen scientists measured high concentrations of metals, high concentrations were also detected using laboratory analysis. However, at lower concentrations of metals, both the detection limit of the method and the presence of multiple interfering compounds in the river (phosphate, carbonate, chloride) did not allow for reliable estimates using the citizen science testing kits, with the kits over-estimating concentrations.

(c) Janet Sturgess

Comparison of citizen-generated data and Environment Agency data

A river basin is the area of land around a river from which all water is drained. A river basin district includes one or more river basins, and each district has a river basin management plan that outlines the objectives, standards, and measures for managing water.

Corby is located in the Anglian River Basin District and in the Willow Brook operational catchment of the River Nene. There are three waterbodies in this operational catchment: Northern Stream, Southern Stream and Willow Brook. The Environment Agency have classified all three waterbodies as having moderate ecological status based on multiple samples per year[5]. Data from 2019 and 2022 indicates that all three waterbodies had high status of copper, iron, manganese and zinc, and are considered "Good" in terms of their cadmium and nickel levels, based on Environmental Quality Standards rather than PNEC.


(c) Paula Boulton


(c) Sara Earl


(c) Janet Sturgess


(c) Sara Earl

Discussion

This study provides valuable insights that complement official monitoring efforts and helps to ensure transparency and accountability from polluters. The data presented in this report are indicative of two things.

Firstly, that metal and metalloid pollution across the UK's freshwaters warrants further investigation. The presence of elevated concentrations of cobalt, copper and nickel in sites not directly impacted by the Quarry in Corby – including those upstream of potential pollution hotspots – suggests that heavy metal pollution could be a widespread issue in the area, affecting more locations than Corby alone.

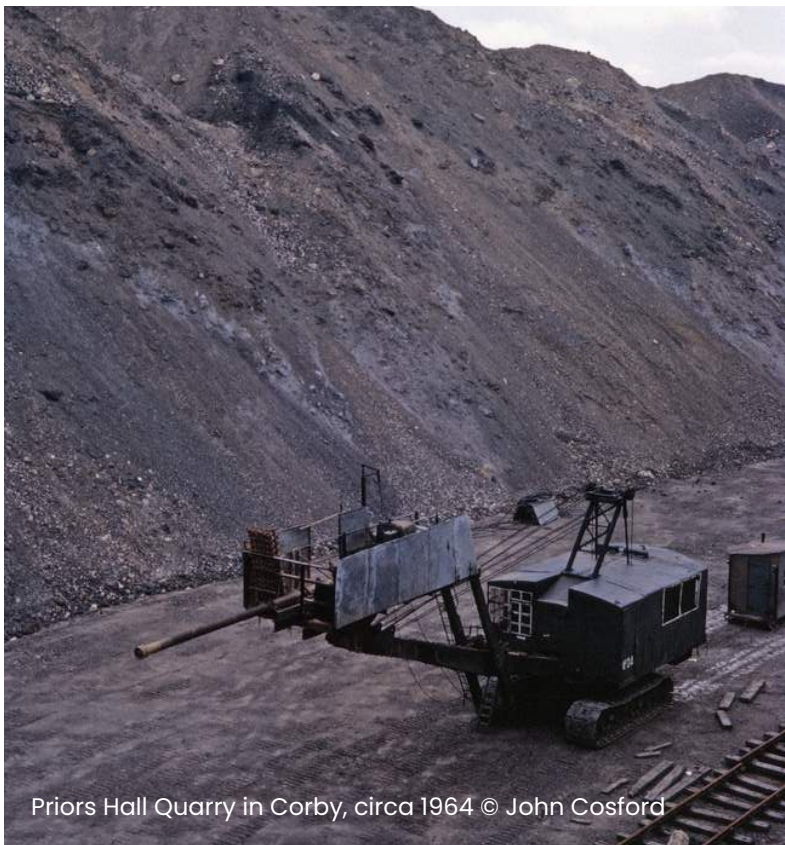
Secondly, that cadmium - a metal implicated in the Corby toxic waste case – is present in freshwater sites surrounding Deene Quarry and a former slag heap in Weldon at elevated concentrations compared to the baseline of the Corby area.

Further testing of the freshwater sites in these pollution hotspots would build a more complete picture of the potential contaminants entering Corby's freshwater environment, and whether they are entering through groundwater or from surface runoff.

This investigation was conducted during a period of heavy rainfall; by repeating it in dry weather we could better understand the potential sources of pollution. A relative decrease in concentration during dry weather would suggest a rain driven surface runoff source, whereas higher concentrations during periods of low river discharge would indicate a more constant source, such as groundwater.

It is important to note that this study does not address human health concerns. The presence of cadmium and other heavy metals in the water around Deene Quarry suggests that contaminants may be leaching from this site and are impacting aquatic life. However, determining whether the site poses risk to human health as well as aquatic life requires further investigation and collaboration with health-focused research organisations.

Earthwatch Europe champions citizen science, the active involvement of non-scientists in the scientific research process. We are proud to have supported the residents of Corby to gather accurate and timely information on their local water quality: we thank them for making this investigation possible, and we will continue to support them to fight for the health of their freshwater environments.



Priors Hall Quarry in Corby, circa 1964 © John Cosford

Methods

On Saturday November 22nd, between 11.30am and 2pm, 35 trained citizen scientists collected samples of water from 59 freshwater sites across Corby. At 51 of these sites, the water was also assessed for metal contamination using citizen science testing kits for cadmium, copper, manganese, nickel and zinc.

Citizen science testing kits

Citizen scientists were recruited through Corby community leaders and trained by Earthwatch prior to testing.

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. Participants submitted data via the ArcGIS Survey123 webpage or via paper copy.

After the testing day, the printed colour charts were compared to the original colour charts provided by the manufacturer and a colour drift was noted, meaning that in-field concentrations were over-estimated. These were corrected based on the results from laboratory testing.

As the detection limit of the citizen science method and the presence of multiple interfering compounds in the river did not allow for reliable estimates, the results in this report are drawn from laboratory data only.

Lab testing

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. Both the LoD and LoQ are indicated in the full dataset, which can be accessed here: https://earthwatch.org.uk/?sdm_process_download=1&download_id=16527

Note, Selenium and Thallium had a higher LoQ than PNEC, meaning they may be present at concentrations which pose risk to aquatic life at more sites than we were able to reliably detect.

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Earthwatch Europe is an environmental charity that champions citizen science to help people understand and protect the natural world. We believe that when communities are equipped with the right tools, they can play a vital role in monitoring the environment and gathering the data needed to drive change.

By training individuals—from local residents to school groups—to collect high-quality scientific data, we create evidence-based insights into the health of our cities, soils, and waterways. Our work focuses on practical, community-led projects like creating urban greenspace through our Nature in Cities programme or monitoring freshwater quality through the FreshWater Watch programme.

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