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## 1. Introduction

This technical note provides an assessment of the hazardous pollutants which have been analysed within the treated final effluent at Exmouth WwTW as defined in the GOV.UK Guidance entitled 'Surface Water Pollution Risk Assessment for Your Environmental Permit'.

The assessment involves five tests to determine whether modelling is required to define the impact of the hazardous pollutants within the discharge, as outlined in an e-mail from the Environment Agency dated 4th August 2025.

Historically, the permit for Exmouth WwTW contained permit limits for four substances: total copper, total lead, total zinc, and hexachlorocyclohexane. All these limits were removed in a modification of the permit in November 2009.

There is a trade effluent consent for the Exmouth WwTW which allows the discharge of various hazardous pollutants to the sewer. As a consequence, the treated final effluent from the WwTW is analysed for the following metals as totals: cadmium, chromium, copper, iron, lead, nickel, and zinc. These data have been assessed against the five tests as laid out in the Guidance and the e-mail.

## 2. The Treated Final Effluent Data

Since 2020 and up to July 2025, the number of samples which have been analysed for each of the metals is shown in Table 1 below. Also shown in the Table is the number of less than results.

| Metal | Number of Samples | Number of Less Thans (ie. less than the limit of detection) |
|---|---|---|
| **Total Cadmium** | 68 | 68 |
| **Total Chromium** | 68 | 67 |
| **Total Copper** | 68 | 10 |
| **Total Iron** | 67 | 45 |
| **Total Lead** | 67 | 62 |
| **Total Nickel** | 68 | 41 |
| **Total Zinc** | 68 | 35 |

**Table 1. Number of Samples for Each Metal and the Number less than the Limit of Detection**

Unfortunately, for various metals, the limit of detection has changed over the period of the sampling. Also, the limits of detection for the metals have not always been aligned with the EQS values. These factors, coupled with the fact that the analysis of the metals has been for total metals and not dissolved, have made the assessment less definitive than would be hoped. It should therefore be noted that while the assessment has used the existing data, it represents a worst case as the face value of the limit of detection has been used wherever a sample is less than the limit of detection.

The sample data has been analysed in terms of two data sets: one, the total data set, and the other, the last 12 samples. The resulting statistical data have been produced and are shown in Tables 2 and 3.

| Whole Data Set | All in micrograms/l except total iron which is milligrams//l | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Cadmium | Total Chromium | Total Copper | Total Iron | Total Lead | Total Nickel | Total Zinc |
| Average | 3.03 | 11.79 | 10.87 | 0.27 | 9.76 | 10.21 | 31.01 |
| SD | 3.45 | 10.83 | 8.85 | 0.19 | 14.22 | 8.35 | 51.87 |
| Median | 3.00 | 3.00 | 8.25 | 0.20 | 8.87 | 9.90 | 24.50 |
| Geomean | 2.17 | 6.34 | 9.01 | 0.21 | 7.38 | 8.57 | 21.79 |
| Max | 30.00 | 30.00 | 50.00 | 1.00 | 120.00 | 60.00 | 370.00 |
| Min | 0.20 | 1.00 | 2.80 | 0.04 | 4.00 | 2.00 | 7.00 |
| Count | 68 | 68 | 68 | 67 | 67 | 68 | 68 |
| Count of Less thans | 68 | 67 | 10 | 45 | 62 | 41 | 35 |

Table 2. Statistical Data for the Whole Data Set for the Total Metals

| Last 12 Samples | All in micrograms/l except total iron which is milligrams//l | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Cadmium | Total Chromium | Total Copper | Total Iron | Total Lead | Total Nickel | Total Zinc |
| Average | 0.90 | 1.50 | 13.37 | 0.11 | 6.38 | 8.01 | 53.58 |
| SD | 1.27 | 0.90 | 12.45 | 0.07 | 3.39 | 6.85 | 100.75 |
| Median | 0.20 | 1.00 | 8.45 | 0.10 | 4.50 | 6.45 | 22.00 |
| Geomean | 0.39 | 1.32 | 10.52 | 0.09 | 5.75 | 6.08 | 27.02 |
| Max | 3.00 | 3.00 | 49.00 | 0.28 | 12.00 | 25.00 | 370.00 |
| Min | 0.20 | 1.00 | 5.40 | 0.04 | 4.50 | 2.00 | 11.00 |
| Count | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Count of Less thans | 12 | 12 | 0 | 1 | 12 | 1 | 3 |

Table 3. Statistical Data for the Last 12 Samples for the Total Metals

## 3. Test 1

This test compares the average and maximum values in the treated final effluent with the relevant EQS, either as an annual average or Maximum Allowable Concentration (MAC) / 95$^{th}$ percentile.

The relevant EQSs are shown in Table 4 below.

| EQS (all in µg/l) | Annual Average | MAC | 95%ile |
|---|---|---|---|
| **Cadmium Dissolved** | 0.2 | NA | |
| **Chromium VI Dissolved** | 0.6 | | 32 |
| **Copper Dissolved (Note 1)** | 3.76 | NA | |
| **Iron Dissolved** | 1000 | NA | |
| **Lead Dissolved** | 1.3 | 14 | |
| **Nickel Dissolved** | 8.6 | 34 | |
| **Zinc Dissolved (Note 2)** | 7.9 | NA | |

NA = Not Applicable

**Note 1.** The EQS is for a DOC value of < or =1, which is the case for these waters.

**Note 2.** The value includes an ambient background of 1.1 mg/l.

**Table 4. Relevant EQS Values for the Various Metals**

Comparing the average and maximum values for each of the total metals against the EQSs for the dissolved metals gives the following outcomes for the data for the whole data set and the last 12 samples as shown in Tables 5 and 6 below.

| Whole Data Set | All in micrograms/l except total iron which is milligrams//l | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Cadmium | Total Chromium | Total Copper | Total Iron | Total Lead | Total Nickel | Total Zinc |
| Average | 3.03 | 11.79 | 10.87 | 0.27 | 9.76 | 10.21 | 31.01 |
| Max | 30.00 | 30.00 | 50.00 | 1.00 | 120.00 | 60.00 | 370.00 |

**Table 5. Comparison of Average and Maximum Values against EQS for the Whole Data Set**

| Last 12 Samples | All in micrograms/l except total iron which is milligrams//l | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Cadmium | Total Chromium | Total Copper | Total Iron | Total Lead | Total Nickel | Total Zinc |
| Average | 0.90 | 1.50 | 13.37 | 0.11 | 6.38 | 8.01 | 53.58 |
| Max | 3.00 | 3.00 | 49.00 | 0.28 | 12.00 | 25.00 | 370.00 |

**Table 6. Comparison of Average and Maximum Values against EQS for the Last 12 Samples**

The colour coding is green for less than the EQS and light brown for greater than EQS.

The only metal which consistently passes the test is iron.

## 4. Tests 2, 3, and 4

These Tests relate to the location of the discharge of the treated effluent. As the discharge is to a coastal location about 300 m offshore into a water depth at low water spring tides of about 8 m, none of the Tests apply.

## 5. Test 5

This Test looks at the effective volume flux compared with an allowable effective volume flux. The Test in essence is looking at the dilution of the effluent in the coastal waters, taking account of the existing background concentration of a hazardous pollutant in the coastal waters. At the site of the discharge of the final effluent from Exmouth WwTW, the allowable effective volume flux is 3.5 $m^3/s$.

The Test requires flow data for the discharge and background concentration data for the coastal waters at the location of the discharge. The average flow for the treated final effluent at Exmouth WwTW has been

determined from the daily volume flows monitored by South West Water and provided to the Environment Agency as an annual return. The average flow has been calculated from the daily volume data for the period from 2020 to 2024. It is 14,680 $m^3$/day which equates to 0.17 $m^3$/s. The maximum flow for the final treated effluent has been taken to be the flow to full treatment which is 0.273 $m^3$/s.

Background concentrations of the dissolved metals have been assessed from data for a monitoring site at the mouth of the Exe Estuary, River Exe at the Point (Sample point Number SW-70510116). This site has been taken to provide the most representative recent data close to the discharge location. The background data have been assessed from the available data for the period 2020 to 2024. For certain metals, the data are quite limited, while others are all below the limit detection. Where all the data are below the limit of detection, a value of half the limit of detection has been used as the background concentration. The resulting background concentrations are shown in Table 7 below.

| | Average Background Concentration µg/l |
|---|---|
| **Cadmium Dissolved** | 0.015 |
| **Chromium VI Dissolved** | See Text |
| **Copper Dissolved** | 0.220 |
| **Iron Dissolved** | 50.000 |
| **Lead Dissolved** | 0.035 |
| **Nickel Dissolved** | 0.297 |
| **Zinc Dissolved** | 0.345 |

**Table 7 Average Background Concentrations for Dissolved Metals**

It should be noted that the monitoring data for dissolved hexavalent chromium have been discounted as potentially suspect, and a value of 10% of the annual average EQS has been used as a background concentration.

Based on the discharge flow figures, the measured levels of total metals in the treated final effluent, and the estimated background concentrations, the effective volume fluxes have been calculated for both the whole data set and the last 12 samples. The effective volume fluxes have been calculated for all metals, even though iron was considered to be insignificant in the treated final effluent as it is below the EQS.

The effective volume flux (EFV) is calculated as follows:

EFV ($m^3$/s) = (EFR * RC) / (EQS – BC) ;

where: EFR = Effluent Flow Rate

RC = Release Concentration of Substance

EQS = EQS of Substance

BC = Background Concentration in the Coastal Waters near the Discharge Point

For an annual average EQS, the average discharge flow and the average release concentration have been used in the calculation, while for a MAC or 95%ile EQS, the flow to full treatment and the maximum release concentration have been used.

The results are shown in Tables 8 and 9 below. The colour coding is similar to before, where green indicates that the EFV is less than the AEFV, while light brown indicates that it is greater.

| Whole Data Set | Average Data | | | | Max Data | | | |
|---|---|---|---|---|---|---|---|---|
| | EFR * RC | EQS - BC | EFV | | EFC * RC | MAC - BC | EFV | AEVF |
| Cadmium | 0.514 | 0.185 | 2.780 | | NA | | | 3.5 |
| Chromium | 2.003 | 0.540 | 3.710 | | 8.190 | 31.940 | 0.256 | 3.5 |
| Copper | 1.847 | 3.540 | 0.522 | | NA | | | 3.5 |
| Iron | 46.499 | 950.000 | 0.049 | | NA | | | 3.5 |
| Lead | 1.658 | 1.265 | 1.311 | | 32.760 | 13.965 | 2.346 | 3.5 |
| Nickel | 1.734 | 8.303 | 0.209 | | 16.380 | 33.703 | 0.486 | 3.5 |
| Zinc | 5.270 | 7.555 | 0.697 | | NA | | | 3.5 |

Table 8. Comparison of EFVs with the AEVF – Whole Data Set

| Last 12 Samples | Average Data | | | | Max Data | | | |
|---|---|---|---|---|---|---|---|---|
| | EFR * RC | EQS - BC | EFV | | EFC * RC | MAC - BC | EFV | AEVF |
| Cadmium | 0.153 | 0.185 | 0.827 | | NA | | | 3.5 |
| Chromium | 0.255 | 0.540 | 0.472 | | 0.819 | 31.940 | 0.026 | 3.5 |
| Copper | 2.271 | 3.540 | 0.642 | | NA | | | 3.5 |
| Iron | 18.350 | 950.000 | 0.019 | | NA | | | 3.5 |
| Lead | 1.083 | 1.265 | 0.856 | | 3.276 | 13.965 | 0.235 | 3.5 |
| Nickel | 1.361 | 8.303 | 0.164 | | 6.825 | 33.703 | 0.203 | 3.5 |
| Zinc | 9.104 | 7.555 | 1.205 | | NA | | | 3.5 |

Table 9. Comparison of EFVs with the AEVF – Last 12 Samples

The only metal for which the EVF exceeds the AEVF is chromium as an annual average for the whole data set. However, this is considered to be an unrealistic outcome given the limit of detection of 24 µg/l which was used in the early analysis, and has been discounted.

## 6. Conclusions

No metal present in the treated final effluent from Exmouth WwTW requires further assessment in terms of modelling. All the metals assessed, cadmium, chromium, copper, iron, lead, nickel, and zinc, which enter the sewage system via a consented trade effluent, meet the allowable effective volume flux test, and iron was screened out as insignificant, being below the EQS in the discharge.

It is recommended that the metal sampling and analysis undertaken by South West Water on the treated final effluent is revised to give data which is in line with the relevant EQSs, both in terms of the nature of the metal; ie. dissolved as opposed to total, and an appropriate limit of detection. These two recommendations implemented together should allow a more definitive assessment to be made of the metal concentrations in the treated effluent discharge when compared with the relevant EQSs.

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