



ENVIRONMENTAL RISK ASSESSMENT – EMISSIONS TO SEWER



**PLOT 1C,
WILTON INDUSTRIAL ESTATE,
REDCAR,
TS10 4RF**

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ACRONYMS/TERMS USED IN THE TEXT

AA	Annual Average
EA	Environment Agency
ECL	Environmental Compliance Limited
EQS	Environmental Quality Standard
MAC	Maximum Allowable Concentration
PC	Process Contribution
PEC	Predicted Environmental Concentration
RC	Release Concentration
The Site	Teesside Green Hydrogen Plant, Plot C, Wilton Industrial Estate, Redcar, TS10 4RF

1. H1 RISK ASSESSMENT OF EMISSIONS TO SEWER

1.1. Overview

- 1.1.1. Environmental Compliance Limited (“ECL”) were commissioned by MorGen Energy UK Limited (“MorGen”) to undertake a H1 Assessment for emissions to water associated with to proposed Hydrogen (“H₂”) Plant, hereafter referred to as “the Installation”, located at Plot 1 C, the Wilton Industrial Estate, Redcar, TS10 4RF (“the Site”).
- 1.1.2. The H1 Assessment has been undertaken in accordance with the relevant Environment Agency (“EA”) Guidance^{1 2}. At the time of undertaking the H1 Assessment, the H1 Risk Assessment Tool (Version 9.2)³ is currently under maintenance and therefore assessment of water impacts is unavailable. Consequently, the calculations have been undertaken manually and provided in Appendix I.
- 1.1.3. The site location and drainage details are provided on the Drawings submitted with this Permit Application.
- 1.1.4. The H1 Assessment has been undertaken making use of the substances that will be present in the effluent stream following the treatment of the demineralised water, to produce ultra pure water.
- 1.1.5. The emissions from the water treatment and gas treatment will be discharged into the Sembcorp combined drain direct to the River Tees. The composition of this discharge will be as provided in Table 1.

Table 1: Emissions to Combined Sewer

Substance	Concentration (µ/l)	Annual Mass Release (kg/year)
Total Inorganic Carbon	4750	45.53
Total Organic Carbon	5250	50.33
Chloride	88	0.84
Sulphate	431	4.13
Phosphate	39	0.38
Fluoride	20	0.19
Aluminium	49	0.47
Calcium	49	0.47
Chromium	196	1.88
Copper	49	0.47
Iron	49	0.47
Magnesium	49	0.47
Molybdenum	294	2.82
Nickel	294	2.82
Potassium	99	0.95
Sodium	99	0.95
Titanium	196	1.88
Zinc	1764	16.91

¹ Available online via: <https://www.gov.uk/guidance/risk-assessments-for-your-environmental-permit> (accessed February 2025)

² Available online via: <https://www.gov.uk/guidance/surface-water-pollution-risk-assessment-for-your-environmental-permit> (accessed February 2025)

³ Available online via: <https://admlc.com/h1-tool/> (accessed February 2025)

- 1.1.6. The release concentrations (“RCs”) for the maximum allowable concentration (“MAC”) and annual average (“AA”) RC values for all substances are based on the analysis of the demineralised water, multiplied by an assumed ion rejection factor, in most cases of 95 – 99% to ensure a worst case assessment (i.e. the highest possible concentration for the ions in the reject water (effluent)).
- 1.1.7. The Site’s discharge is via the Sembcorp combined sewer directly to the River Tees and Tess Estuary. Consequently, the H1 Assessment has been undertaken in the first instance using the screening steps for estuaries and coastal waters.

1.2. Substances without EQS

1.2.1. Of the substances to be released from the Installation, the following have no EQS available:

- chloride;
- sulphate;
- sodium;
- potassium;
- calcium;
- magnesium;
- aluminium;
- chromium;
- molybdenum;
- titanium; and
- total inorganic carbon.

1.2.2. Several of the substances listed in paragraph 1.2.1, including chloride, sulphate, sodium, potassium, calcium, magnesium and total inorganic carbon, are naturally occurring major ions or common constituents of the aquatic environment and are therefore not considered to be inherently ecotoxic at the release concentrations proposed.

1.2.3. Their potential environmental effect is generally associated with changes to salinity, hardness, alkalinity or ionic balance rather than substance-specific toxicity. Given the relatively low annual mass releases, discharge to a combined sewer with subsequent release to the River Tees and Tees Estuary, and the absence of substance-specific EQSs for these parameters, these substances are considered to present a low ecotoxic potential in this context. On this basis, the derivation or application of a predicted no-effect concentration (“PNEC”) is not considered necessary for these substances as part of the H1 assessment.

1.2.4. The following PNECs will be used for the remaining substances. These PNECs come from UKTAG/EA EQS derivation reports and REACH-based assessments:

- aluminium PNEC freshwater = 0.05 µg/L (UKTAG/Environment Agency EQS derivation report);
- chromium(III) PNEC freshwater = 4.7 µg/L dissolved Cr(III) (UKTAG/Environment Agency EQS derivation report);
- molybdenum PNEC freshwater = 12.7 mg/L (12,700 µg/L) derived under REACH using

SSD methodology and an assessment factor of 3.

1.2.5. For total titanium, there is no commonly adopted UK EQS or UKTAG PNEC for "total titanium" equivalent to those available for aluminium or chromium. The environmental behaviour and toxicity are highly dependent on the titanium species present (e.g. dissolved titanium, titanium dioxide, nano-TiO₂, titanates).

1.2.6. Consequently, the REACH-derived value for titanium dioxide has been used as 127µg/l.

1.2.7. Based on the information provided in the H1 assessment in Appendix I, when undertaking Screening Test 2, the following results were obtained.

Substance	RC (µg/l)	EFR (m ³ /s) x RC (µg/l)	EFR (m ³ /s) + RFR (m ³ /s)	PCwater (µg/l)	PNEC (µg/l)	PEC/PNEC	Risk Significant?
Aluminium, Total	49	0.018	3.13	0.006	0.05	0.1131	No
Chromium (as CrIII)	196	0.071	3.13	0.023	4.7	0.0048	No
Molybdenum	294	0.106	3.13	0.034	12700	0.0000027	No
Titanium	196	0.071	3.13	0.023	127.000	0.0002	No

Notes to Table

RC = Release Concentration

PC = Process Contribution

Effluent flow rate ("EFR") = 0.000361m³/s

River flow rate = 3.13m³/s

Sewage treatment reduction factor = 1

1.3. Results

1.3.1. It can be seen from the results of the H1 Assessment (see Appendix I) that, following Test 1 screening for estuaries and coastal waters, where MACs and / or AA environmental quality standards ("EQSs") were identified, the RCs can be considered not significant (i.e., they are less than 100% of the assumed MAC and / or the AA EQS) for all substances except total organic carbon, copper, nickel and zinc.

1.3.2. Following further screening (i.e., Test 2 using the freshwater steps) for the substances with potentially significant RCs, the predicted process contributions ("PCs") (i.e., the RCs after accounting for any relevant sewage treatment reduction factors and the dilution available in the receiving water) are less than 4% of the applicable EQS(s) for all substances and therefore require no further assessment.

1.3.3. Were substances had no EQSs, PNECs were used to demonstrate that there is no risk to the environment.

1.4. Conclusions

1.4.1. It has been demonstrated, through the findings of the H1 Assessment, that the environmental risks to the receiving waters can be screened out or have been considered not significant.

APPENDIX I

H1 CALCULATION SHEETS

Teeside Green Hydrogen Plant - H1 Assessment (Water) - Emissions to Sewer



Acronyms / Abbreviations	
AA = Annual Average	PC = Process Contribution
EFR = Effluent Flow Rate	RCact = Release Concentration (without considering sewage treatment reduction)
EQS = Environmental Quality Standard	RCcorr = Release Concentration (taking into consideration sewage treatment reduction)
LT = Long-term, ST = Short-term	RFR = River Flow Rate
MAC = Maximum Allowable Concentration	STRF = Sewage Treatment Reduction Factor

Release Concentrations of Substances Present in Discharges To Sewer:

Discharge Point W1 - Screening Test 1								
Substance	ST EQS	LT EQS	ST		LT		ST	LT
	MAC ^(a)	AA ^(a)	RCact Max ^(b)	RCact Average ^(b)	RCact Max as a %	RCact Average as a %	RCact Max Significant? ^(c)	RCact Average Significant? ^(c)
	(µg/l)	(µg/l)	(µg/l)	(µg/l)	of EQS (MAC)	of EQS (AA)	(MAC >10%)	(AA >10%)
pH	N/A	N/A	8.55(pH)	6.1 (pH)	N/A	N/A	N/A	N/A
Total Inorganic Carbon	N/A	N/A	4750	4750	N/A	N/A	N/A	N/A
Total Organic Carbon	N/A	10000	5250	5250	N/A	52.50%	N/A	Yes
Chloride	N/A	N/A	88	88	N/A	N/A	N/A	N/A
Sulphate	N/A	N/A	431	431	N/A	N/A	N/A	N/A
Phosphate (assessed with Total Phosphorus)	N/A	3000.0	39	39	N/A	1.31%	N/A	No
Fluoride	15000	5000	20	20	0.13%	0.40%	No	No
Aluminium, Total	N/A	N/A	49	49	N/A	N/A	N/A	N/A
Calcium	N/A	N/A	49	49	N/A	N/A	N/A	N/A
Chromium (as CrIII)	N/A	N/A	196	196	N/A	N/A	N/A	N/A
Copper ⁽ⁱ⁾	N/A	5.1	49	49	N/A	961.15%	N/A	Yes
Iron	N/A	1000	49	49	N/A	4.90%	N/a	No
Magnesium	N/A	N/A	49	49	N/A	N/A	N/A	N/A
Molybdenum	N/A	N/A	294	294	N/A	N/A	N/A	N/A
Nickel	34	8.6	294	294	864.78%	3418.90%	Yes	Yes
Potassium	N/A	N/A	99	99	N/A	N/A	N/A	N/A
Sodium	N/A	N/A	99	99	N/A	N/A	N/A	N/A
Titanium	N/A	N/A	196	196	N/A	N/A	N/A	N/A
Zinc	N/A	6.8	1764	1764	N/A	25943.43%	N/A	Yes

Discharge Point W1 - Screening Test 2											
Substance & Averaging Period	EFR ^(d)	RFR ^(e)	STRF ^(f)	RCcorr	EFR (m ³ /s) x RCcorr	EFR (m ³ /s) + RFR (m ³ /s)	PC _{water} ^(g)	ST PC _{water} as % EQS	ST PC _{water}	LT PC _{water} as % EQS	LT PC _{water}
	m ³ /s	(m ³ /s)		(µg/l)	(µg/l)		(µg/l)	MAC	Significant? ^(h)	AA	Significant? ^(h)
Total Organic Carbon	0.000361	3.13	1	5250	1.90	3.13	0.606	N/A	N/A	0.01%	No
Copper	0.000361	3.13	1	49	0.0177	3.13	0.00565	N/A	N/A	0.11%	No
Nickel	0.000361	3.13	1	294	0.106	3.13	0.0339	0.10%	No	0.39%	No
Zinc	0.000361	3.13	1	1764	0.637	3.13	0.204	N/A	N/A	2.99%	No

Notes to H1 Assessment:

Guidance used: Surface water pollution risk assessment for your environmental permit, available online via: <https://www.gov.uk/guidance/surface-water-pollution-risk-assessment-for-your-environmental-permit>

(a)	EQS MAC / AA (where applicable) obtained from either the Environment Agency's: 'Estuaries and Coastal Waters specific pollutants and operational environmental quality standards (EQS)' or from the Environment Agency's: 'Estuaries and Coastal Waters priority hazardous substances, priority substances and other pollutants' spreadsheet. N/A has been specified where appropriate standards could not be found. Values for Total Phosphorus, and TOC are taken from the BAT Reference Document for Common Waste Water and Waste Gas Treatment / Management Systems in the Chemical Sector.
(b)	Based on reject water concentrations.
(c)	In accordance with the EA guidance, concentrations of the tested discharge water that are less than 10% of the EQS do not require further assessments as they are not considered to pose a risk to the environment. For concentrations greater than 10% of the EQS, Test 2 screening is required.
(d)	For the MAC RCs, the EFR is based on the maximum discharge rate, as detailed in the EPTR
(e)	RFR obtained for the River Tees (at Low Moor) from the National River Flow Archive, period of record 1969 - 2024. The flow rate value utilised was equalled or exceeded for 95% of the flow record. Available via: https://nrfa.ceh.ac.uk/data/station/meanflow/25009
(f)	Sewage treatment reduction factors taken from the Excel spreadsheet provided in the EA guidance. As no reduction factor is available for copper, a value of 1 was specified.
(g)	PC _{water} = (EFR x RC) / (EFR + RFR).
(h)	In accordance with the EA guidance, stage two screening involves calculating the PC (which is the RC after it has been diluted by the receiving water). If the PC is 4% or less than the EQS, no further assessments are required.
(i)	DOC in the River Tees can range from 2-20mg/l, therefore to ensure a conservative assessment a value of 2mg/l was used to calculate the EQS for copper. Ref: (https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2019wr025592)