Technical Note

CLIENT:	**Altilium Metals Ltd**
PROJECT:	**ACT 2: Plymouth Pilot Facility**
SUBJECT:	**H1 Screening Tool – Emissions to Air** **Technical Summary Note**
JOB NO.:	**BM12446/TN002**
DATE:	**June 2025**
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1 CONTEXT

1.1.1 This note has been prepared to provide a summary of the H1 Screening Tool Assessment of emissions to air from Altilium Metal's pilot facility in Plymouth. This assessment has been produced to support their environmental permit application.

1.1.2 The black mass recovery [redacted] In order to assess the impact of the emission to air, each phase's gaseous waste product and concentration has been assessed.

1.1.3 [redacted]. Each phase has a point source emission to air associated with it, except for [redacted]

1) PHASE 1

[redacted]

[redacted]

1.1.7 Acid vapour and hydrogen gas are extracted from each step in the process and will be directed to the scrubber.

2) PHASE 2

[redacted]

1.1.9 The process is a closed flow system and a very small amount of acid vapour and some VOCs are extracted from this stage and released to air through the abatement equipment.

3) PHASE 3

[redacted]

1.1.13 Residual Vapours are produced, these will be directed to the [redacted] Stack.

4) PHASE 4

[redacted]

1.1.15 Any [redacted] processing such as [redacted] be serviced by a scrubber system, targeting ammonia, alkalis and particulates.

1.1.16 All dry powder [redacted] are fully enclosed. Using a solivalve system, this comprises fully automated sealed containment. Further to this, the facility housing this equipment will be enclosed and all processes will take place within customised downflow booths with integrated HEPA filtration.

1.1.17 Air exchange into the contained unit will be subject to further HEPA filtration.

2 STAGE 1 SCREENING ASSESSMENT

2.1.1 In order to assess the potential impacts of the emission to air, the Version 9.2 H1 Screening Tool has been completed to assess the impact of emissions alongside the Environment Agency's guidance on 'Air Emissions Risk Assessment for your Environmental Permit.'

2.1.2 The process contributions of emissions to air have been calculated by using the following methodology:

$$PC_{air} = DF \times RR$$

Where PC is the Process Contribution

Where DF is the Dispersion Factor

Where RR is the Release Rate of the substance

2.2 Substances to be Released

2.2.1 Table 1.1 below provides the substances which may be released as part of each of the phases, along with the long- and short-term worst-case concentrations and the long- and short-term PC calculated by the H1 tool.

2.2.2 Substances will not exceed the BAT AEL indicative emission levels for channelled emissions to air. The substance concentrations have been calculated on a worst-case scenario, in that the BAT AEL maximum have been inputted for both long term and short-term concentrations.

2.2.3 BAT AELs have been derived from the BREF Document for Common Waste Gas Management and Treatment Systems in the Chemical Sector[1], apart from the AEL for Sulphuric Acid which is derived from the BREF for Large Volume Inorganic Chemicals – Ammonia, Acids and Fertilizers[2].

[redacted] Where substances are not available on the H1 Tool, other comparable substances have been used. [redacted]

2.2.5 Sodium Hydroxide has been used as a proxy for lithium as both substance have hazard statement code H314 which is skin corrosive. These two substances have comparable chemical reactivity.

2.2.6 Chromium III has been used as a proxy for Cobalt, it is noted that this assessment does not pertain to Chromium VI as this has hazard statement codes that are no applicable to Cobalt. Cobalt is carcinogenic, mutagenic, a skin and respiratory irritant. Chromium and cobalt are both transition metals and have similar hazard properties including H350: carcinogenic and H317: Aquatic chronic. Chromium also causes skin sensitivity and is toxic to aquatic life like cobalt but has further hazardous properties with regards to it's effects on water environments which exceed the potential effects of cobalt.

2.2.7 Therefore, Chromium III is considered a worst case proxy due to the increased hazard potential compared to cobalt.

Table 1.1: Substances, Concentrations and Long and Short-Term PC

Process Phase	Substance	BAT AEL	Long- and Short-term Concentrations (mg/m³)	Long term PC (ug/m3)	Short term PC (ug/m3)
[redacted]	Sulphuric acid	10 – 35 mg/Nm³	35	6.2	204.98
	Hydrogen Fluoride	≤ 1 mg/Nm³	1	0.32	0.61
	Benzene	<0.5-1 mg/Nm³	1	0.03	0.61
	Toluene	<0.5-1 mg/Nm³	1	1.82	5.86
	Tetrachloroethylene	No BAT AEL Used Benzene <0.5-1 mg/Nm³	1	0.24	5.86

[1] https://eippcb.jrc.ec.europa.eu/reference/common-waste-gas-treatment-chemical-sector
[2] https://eippcb.jrc.ec.europa.eu/reference/large-volume-inorganic-chemicals-ammonia-acids-and-fertilisers

Table 1.1: Substances, Concentrations and Long and Short-Term PC					
Process Phase	**Substance**	**BAT AEL**	**Long- and Short-term Concentrations (mg/m³)**	**Long term PC (ug/m3)**	**Short term PC (ug/m3)**
	n-Hexane	No BAT AEL Used Benzene <0.5-1 mg/Nm³	1	0.18	5.86
[redacted]	Sulphuric acid	10 – 35 mg/Nm³	35	6.2	205.00
	n-Hexane[1]	No BAT AEL Used Benzene <0.5-1 mg/Nm³	1	0.18	5.86
	Ammonia	2-10 mg/Nm³	10	1.77	58.57
	Toluene	<0.5-1 mg/Nm³	1	1.82	5.86
	Tetrachloroethylene	No BAT AEL Used Benzene <0.5-1 mg/Nm³	1	0.24	5.86
[redacted]	Sulphuric acid	10 – 35 mg/Nm³	35	6.2	204.98
[redacted]	Ammonia	2-10 mg/Nm³	10	1.77	58.57
[redacted]	Nickel	< 0.02-0.1 mg/Nm³	0.1	0.004	0.12
	Particulates (PM10)	5 mg/Nm³	5	0.19	3.67
	Particulates (PM2.5)	5 mg/Nm³	5	0.19	6.22
[redacted]	Carbon monoxide	No BAT AEL – as an indication, the emission levels for carbon monoxide are 4-50 mg/Nm³, as a daily average or average over the sampling period.	50	0.32	7.61
	Nickel	< 0.02-0.1 mg/Nm³	0.1	0.004	0.12
	Manganese and compounds[2]	No BAT AEL – same AEL as Nickel applied < 0.02-0.1 mg/Nm³	0.1	0.0007	0.022

Table 1.1: Substances, Concentrations and Long and Short-Term PC					
Process Phase	**Substance**	**BAT AEL**	**Long- and Short-term Concentrations (mg/m³)**	**Long term PC (ug/m3)**	**Short term PC (ug/m3)**
	Cobalt[2]	No BAT AEL – same AEL as Nickel applied < 0.02-0.1 mg/Nm³	0.1	0.0009	0.021
	Lithium[3]	No BAT AEL – same AEL as Nickel applied < 0.02-0.1 mg/Nm³	0.1	0.013	0.43
	Particulates (PM10)	5 mg/Nm³	5	0.19	3.67
	Particulates (PM2.5)	5 mg/Nm³	5	0.19	6.22
	Sulphur Dioxide	<3-150mg/Nm³	35	0.23	4.49

Notes
[1] For VOC emissions, kerosene is part of the emissions inventory for Phase 2, however for the purposes of the screening tool, n-hexane has been used due to Kerosene not being an option.
[2] For the purposes of the tool Chromium III has been used as a proxy for Colbalt
[3] For the purposes of the tool sodium hydroxide has been used as a proxy for Lithium
Sulphuric acid is part of the emissions inventory for phases 1, 2 and 3. In total combination the sulphuric acid releases will not exceed the maximum AEL of 35 mg/Nm³, however, to provide the most conservative screening, these have been assessed as the maximum AEL for each of the three points.

2.3 Effective Height of Release

2.3.1 There will be three stacks from the facility, which are 3.15m in height. The existing building is 6.3m high. As the height of the releases is more than 3m above the ground or building, but is less than 2.5 times the building height, the effective height of release has been estimated by taking the actual height of release (9.45m), subtracting the height of the tallest building within a distance 5 times 'L' (in this instance, the building itself, so within 31.5m (L is 6.3)). The difference is 3.15m which is then multiplied by 1.66; resulting in an estimated effective height of release of **5.2m** for the purposes of the H1 assessment.

2.3.2 This effective stack height gives a long term dispersion factor of 87.6, and short term dispersion factor of 2,173.6.

2.4 Release Rate

2.4.1 The flow is expected to be:

- Phase 1: 1700m^3/hr
- Phase 2: 8000m^3/hr
- Phase 4: 360m^3/hour

2.4.2 The efflux velocity has been calculated using the diameter of the stacks and exact exit flow rate. The efflux velocity used for the assessment is 15m/s.

2.4.3 The release rate for each substance is shown in Table 1.1.

2.5 Operating Mode

2.5.1 An operating mode of 75% has been inputted into the tool.

2.6 Stage One Screening Results

2.6.1 The H1 Screening Tool Stage 1 screens out all of the substance releases as insignificant, with the exception of long and short term process contributions of sulphuric acid, hydrogen fluoride and nickel

2.6.2 Stage 2 screening assessment is required for these three substances.

3 STAGE 2 SCREENING ASSESSMENT

3.1 Air quality background concentrations

3.1.1 Stage 2 of the assessment requires screening of sulphuric acid, hydrogen fluoride and nickel against background concentrations using available data.

3.1.2 Annual mean background concentration mapping from DEFRA's Air Pollution in the UK 2022 report[3] for shows nickel concentration to be 1ng/m^3 and below for the Plymouth area. This has been converted to 0.001µg/m^3 for the calculation. The DEFRA Air Pollution map is a widely accepted source for these type of screening assessments. It is noted that this source is directly linked and recommended for use on the Environment Agency guidance: *Air emissions risk assessment for your environmental permit* as shown below:

[3] https://uk-air.defra.gov.uk/assets/documents/annualreport/air_pollution_uk_2022_issue_1.pdf

You can find out about background concentrations from:

- your local council
- background concentration maps from the government

3.1.3 Background data for Sulphuric Acid has been set at 0µg/m^3 as sulphuric acid monitoring is not undertaken during air routine quality testing in the UK.

3.1.4 Hydrogen Floride background concentrations are set at 0.003 µg/m^3 as taken from the Guidelines for Halogens and Hydrogen Halides in Ambient Air for Protecting Human Health against Acute Irritancy Effects.[4]

3.2 Outcome of Assessment

3.2.1 The outcome of the Test 2 screening shows that the long term PEC passes for all substances however the short term PEC fails for Sulphuric Acid.

3.2.2 Due to the location of the site in close proximity to a SSSI and other designated sites and the short term PEC failing on the Sulphuric Acid, detailed Air Dispersion Modelling will be undertaken for Sulphuric acid and Hydrogen fluoride as there are specific standards for protected conservation areas for these two substances.

3.2.3 The detailed Air Dispersion Model will also assess the impacts of deposition on the hydrogen fluoride and sulphuric acid that were not screened out as insignificant in Test 1.

[4] Guidelines for Halogens and Hydrogen Halides in Ambient Air for Protecting Human Health against Acute Irritancy Effects