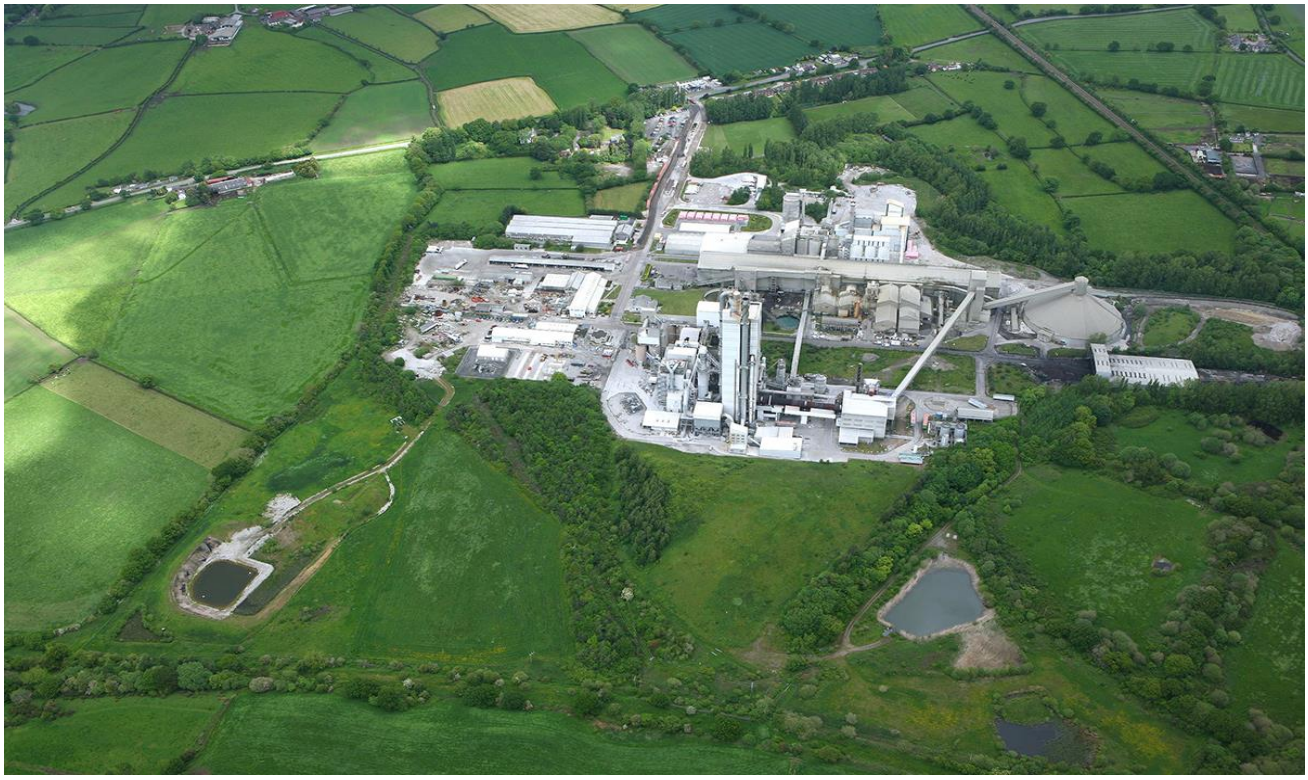
HEIDELBERG MATERIALS

Padeswood Carbon Capture Plant – FEED Phase

Environmental Basis of Design

Document no. Rev 0: 215000-00190-000-EN-BOD-00001



04 March 2024

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PROJECT 215000-00190 - 215000-00190-000-EN-BOD-00001: Padeswood Carbon Capture Plant – FEED Phase - Environmental Basis of Design

Rev	Description	Originator	Reviewer	Worley Approver	Revision Date	Customer Approver	Approval Date
Rev A	Issued for Review	A. Stephen	A. Moghaddam	A. George	19 January 2024		
Rev 0	Issued for Design	DocuSigned by: Alexander Stephen 0D5A26073AFD414... A. Stephen	DocuSigned by: Alireza Moghaddam 243F27B4D340405... A. Moghaddam	DocuSigned by: Adrian George 64E594A2CA484E5... A. George	04 March 2024		

Revision History

Rev	Status	Section	Description of Change
A	IFR	All	Issued for Review and Discipline Check
0	IFD	Various	Issued for Design

Holds

No	Section	Description	Input From	Planned Date

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1. Project Introduction

Heidelberg Materials (HM) has become a partner in the HyNet Northwest consortium, which aims to create the world's first low-carbon industrial cluster in the region of Northwest England. The proposed hydrogen and carbon capture and storage (CCS) industrial cluster will play a critical role in the UK's transition to net zero greenhouse gas emissions and the fight against climate change. As part of 'Making Net Zero Possible', Asset Improvement programme options to decarbonise COMPANY cement plant are being considered. Carbon Capture (CC) is one of the key technologies being developed as a route to decarbonisation. COMPANY cement plant located at Padeswood which currently produces about 110 ton per hour (tph) of clinker, has been selected by DESNZ as a track 1 phase 2 carbon capture project. The PROJECT will enable carbon capture from the existing cement kiln 4 and from a new Combined Heat and Power (CHP) plant designed to provide the heat and electricity required to operate the Carbon Capture and Compression (CCC) plant. Captured CO_2 will be transported by pipeline to the HyNet CO_2 main pipeline at Northop Hall AGI for onward transportation to storage offshore in depleted gas fields operated by Eni UK. The PROJECT will enable the production of net zero cement for use in the UK construction industry.

Ahead of this CONTRACTOR has been engaged by COMPANY to undertake a pre-FEED study for the carbon capture development. The pre-FEED study was completed in March 2023. Based on the pre-FEED study, an amine-based post combustion CO_2 capture technology has been selected as a suitable technology for capturing 95% of the CO_2 emissions from cement plant.

A consortium between Mitsubishi Heavy Industries (MHI) and Worley as the selected FEED contractor for the Heidelberg Material (HM) Padeswood CCS Project shall deliver an overall FEED package utilizing MHI's Carbon capture technology.

The capture plant can be considered a green field development, but some elements of the integration with the cement plant will be considered brown field. Green field elements will be developed by MHI and Worley, while brownfield elements will be developed by both HM and MHI/Worley.

2. Document Purpose

This document comprises the environmental basis of design for the Heidelberg Project and is intended to be used by all project disciplines to ensure the resulting project design is compliant with environmental requirements.

This document touches on general environmental management approaches which will be expanded on by the Environmental Management and Monitoring Plan (Ref 7).

This document scope covers construction and operational phases of the project.

This document compiles the relevant legislation, regulations, standards and design considerations for environmental protection that shall be embedded into project design.

3. Abbreviations, Definitions & References

3.1 Abbreviations

Abbreviation	Description
µg/m³	Microgram per cubic meter
ALARP	As Low As Reasonably Practical
API	American Petroleum Institute
BAT	Best Available Techniques
BEP	Best Engineering Practice
BREF	Best Available Technique Reference
CCP	Carbon Capture Plant
CCS	Carbon Capture and Storage
CFC	Chlorofluorocarbons
CHP	Combined Heat and Power
CO_2	Carbon Dioxide
EA	Environment Agency
ECE	Environmental Critical Equipment
EIA	Environmental Impact Assessment
ETS	Emissions Trading Scheme
EU	European Union
FEED	Front End Engineering and Design
GIIP	Good International Industry Practice
HCFC	Hydrochlorofluorocarbons
HFC	Hydrofluorocarbons
IED	Industrial Emissions Directive
IFC	International Financial Institute
kPa	Kilopascal
LDAR	Leak Detection and Repair
MCPD	Medium Combustion Plant Directive
MEA	Mono-ethanolamine
METS	Manage your Emission Trading scheme reporting System
mg/l	Milligrams per Litre
mg/Nm³	Milligrams per normal cubic meter
NDMA	Nitrosodimethylamine
ng/l	Nanograms per Litre
ng/m³	Nanograms per cubic meter
NRW	National Resources Wales
PCB	Poly-chlorinated biphenyls
PCC	Post-combustion Carbon Capture
SCR	Selective Catalytic Reduction
US-EPA	United States Environmental Protection Agency

Table 3-1: List of Abbreviations

3.2 Definitions

Term	Description
COMPANY	Heidelberg Materials
CONTRACTOR	Consortium of Worley Europe Limited and Mitsubishi Heavy Industries Limited (MHI)
LICENSOR	MHI entering a Licensing Agreement with the CLIENT
PROJECT	Padeswood Carbon Capture Plant
DELIVERY PARTNER	Company other than the prime COMPANY and CONTRACTOR associated with the delivery of the PROJECT.
SUPPLIER/VENDOR	Company / organisation suppling equipment, materials or services.
SUB-SUPPLIER	The organisation selected by the SUPPLIER/VENDOR to supply the part of equipment and services.
WORK	Shall mean all and any of the WORKs and / or services and / or materials required to be provided under the Contract with CLIENT.
shall and must	Indicates mandatory requirements
Should	Indicates that a provision is not mandatory but recommended as good practice.
May	Used to indicate that optional action is available

Table 3-2: List of Definitions

3.3 Order of Precedence

The requirements of the standards and publications referenced in this document shall be applied in the following order of precedence:

1. Government Acts, Regulations, and Statutory Requirements
2. Purchase Order
3. Project Data Sheets
4. Project Drawings
5. Project Specifications
6. Referenced Specifications and Publications
7. Referenced Codes & Standards

Any conflict between the minimum requirements of the above documents shall be brought to the DELIVERY PARTNER attention for resolution.

An alternate specification or design may only be used when it satisfies the government and statutory requirements and offers a benefit to the project. All such alternatives shall require approval from DELIVERY PARTNER.

3.4 References

Ref	Document Number	Document Title
Ref 1	Revision 08, Dated 19-Oct-2023	Padeswood CCS basis of design
Ref 2	215000-00190-000-PR-REP-00006	Process Description

Ref	Document Number	Document Title
Ref 3	Ambient Air Quality Limits	(online) DEFRA Air Quality Objectives
Ref 4	215000-00190-000-EN-REP-00001	Emissions, Discharge and Waste Summary
Ref 5	215000-00190-000-EN-REP-00005	BAT Demonstration Report
Ref 6	215000-00190-000-PR-PHL-00004	Drainage Philosophy
Ref 7	215000-00190-000-SR-PHL-00001	Process Safety Philosophy
Ref 8	215000-00190-000-EN-PLN-00001	Environmental Management and Monitoring Plan
Ref 9	https://www.heidelbergmaterials.co.uk/sites/default/files/2024-01/heidelberg-materials-uk-sustainability-policy-2024.pdf	Heidelberg Materials UK sustainability policy
Ref 10	Large Combustion Plant BREF and BATC	Online Link
Ref 11	Energy Efficiency BREF	Online Link
Ref 12	Emissions from Storage BREF	Online Link
Ref 13	Common Waste gas Management and Treatment in the chemical Sector BATC	Online Link
Ref 14	Common wastewater and Waste gas Treatment/Management systems in the chemical Sector BATC	Online Link
Ref 15	Industrial Cooling Systems BREF	Online Link
Ref 16	Monitoring of Emissions to Air and Water from IED installations	Online Link
Ref 17	BAT Reference for Cement, lime and Magnesium oxide	Online Link
Ref 18	BAT Review for Post Combustion Carbon Capture	Online Link
Ref 19	https://www.gov.uk/government/publications/noise-and-vibration-management-environmental-permits/noise-and-vibration-management-environmental-permits	EA Guidance -Noise and vibration management: environmental permits
Ref 20	Environment Agency - GOV.UK (www.gov.uk)	Using our 2012 methodology to derive new Environmental Assessment Levels for emissions to air Revision of 10 existing EALs and derivation of two new EALs, October 2020
Ref 21	EPA-450/80-023R	Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations)
Ref 22	EPR 4.01	Environmental Agency, Sector Guide notes for the Production of Large Volume Organic Chemicals, Annex1-mission Benchmarks
Ref 23	https://www.gov.uk/guidance/noise-nuisances-how-councils-deal-with-complaints	EA Guidance - Noise nuisances: how councils deal with complaints

Table 3-3: List of References

4. Legal and Regulatory Requirements

The project shall comply with the environmental requirements and applicable regulations in the following order:

- The Environmental Permit Conditions set out by the regional environmental agency (Natural Resource Wales [NRW])
- United Kingdom (UK) National Environmental Acts, Regulations, and Guidance.
- Regional directives and agreements including some European Union (EU) Directives (see Section 4.3.1) particularly if they differentiate and use the more stringent standards
- International Standards and Conventions for which UK is a signatory.
- LICENSOR Standards, where the use of Licensed Technology requires application of such standards. LICENSOR shall advise CLIENT and the CONTRACTOR of any requirements that are different to the above listed environmental requirements.

For the purpose of full compliance with the environmental requirements, the most stringent requirement of the above listed regulations shall be adopted as design criteria.

Note: Where the above regulatory sources are silent about a specific project aspect, the IPPC BREF Guidance Notes shall be considered as the reference (refer to Section4.4).

4.1 UK National Regulations and Standards

As a minimum, the PROJECT shall comply with the UK environmental statutory requirements applicable to onshore facilities:

- The Environmental Permitting (England and Wales) Regulations 2016 as amended by:
- The Environmental Permitting (England and Wales) (Amendment) Regulations 2018
- The Environmental Permitting (England and Wales) (Amendment) (EU Exit) Regulations 2019
- Planning Act 2008
- The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017
- Pollution Prevention and Control Act (1999) and Statutory Instrument 2000 No. 1973, The Pollution Prevention and Control (England and Wales)
- Statutory Instrument 2017 No. 407, The Water Environment (Water Framework Directive) (England and Wales) Regulations, 2017
- Statutory Instrument 2012 No. 3038, Climate Change, The Greenhouse Gas Emissions Trading Scheme Regulations (2012)
- Statutory Instrument 2020 No. 1265-The Greenhouse Gas Emissions Trading Scheme Order 2020 as amended by:
- Statutory Instrument 2020 No. 1557-The Greenhouse Gas Emissions Trading Scheme (Amendment) Order 2020
- Statutory Instrument 2021 No. 1455- The Greenhouse Gas Emissions Trading Scheme (Amendment) Order 2021
- Statutory Instrument 2022 No. 454- The Greenhouse Gas Emissions Trading Scheme (Amendment) Order 2022
- Statutory Instrument 2022 No. 1173-The Greenhouse Gas Emissions Trading Scheme (Amendment) (No. 2) Order 2022

- Statutory Instrument 2017 No. 1012- The Conservation of Habitats and Species Regulations 2017
- Statutory Instrument 2018 No. 1307 - The Conservation of Habitats and Species and Planning (Various Amendments) (England and Wales) Regulations 2018
- Statutory Instrument 2019 No. 579 The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019
- Statutory Instrument 2006 No. 2238 - The Environmental Noise (England) Regulations 2006 as amended by:
- Statutory Instrument 2008 No. 375- The Environmental Noise (England) (Amendment) Regulations 2008
- Statutory Instrument 2009 No. 1610- The Environmental Noise (England) (Amendment) Regulations 2009
- Statutory Instrument 2010 No. 340- The Environmental Noise (England) (Amendment) Regulations 2010
- Statutory Instrument 2018 No. 1089- The Environmental Noise (England) (Amendment) Regulations 2018
- Statutory Instrument 2005 No. 894 – The hazardous Waste (England and Wales) Regulation 2005 as amended by:
- Statutory Instrument 2009 No. 507- The Hazardous Waste (England and Wales) (Amendment) Regulations 2009
- 2016 No. 336- Statutory Instrument the Hazardous Waste (England and Wales) (Amendment) Regulations 2016
- Environmental Protection Act (1990)
- Environment Act 2021
- Marine and Coastal Access Act (2009) as amended by: Marine and Coastal Act 2009 (Amendment) Regulations 2011
- Coast Protection Act (1949)
- The Control of Major Accident Hazards Regulations 2015 (Statutory Instrument 2015 No. 483)
- UK Low Carbon Hydrogen Standard, Guidance on the greenhouse gas emissions and sustainability criteria (2023)

All the local and international LICENSORs and SUPPLIERs/VENDORs shall be aware of the UK regulations and permit conditions particularly when it pertains to a technical confidentiality and concessionary right.

4.2 Local Regulations and Permit Conditions

Heidelberg Materials is responsible for liaison with environmental permitting authority, NRW and local planning authority throughout the Project Lifecycle. The project shall apply for Environmental and Planning Permits.

CONTACTOR shall periodically review NRW website[1] for any emerging guidance relevant to the project.

[1] https://naturalresources.wales/?lang=en

The project shall comply with emissions and discharges limit values as well as any other conditions to be set by NRW regarding the atmospheric emissions, wastewater discharge, solid wastes, odour, and noise. The project shall also conduct all monitoring and metering practices required by NRW regarding ambient air quality, source emissions, wastewater discharges, as well as other waste streams and noise.

4.3 International and Regional Requirements

4.3.1 EU Directives

The UK left the EU in January 2020, and the transition period ended in December 2020. The UK has also left the EU Emissions Trading System (EU ETS) and adopted a new UK Emissions Trading Scheme (UK ETS) launched in May 2021.

Although all these mean that the EU Directives are no longer within the UK regulatory framework, as a minimum the following Directives are applied to the PROJECT:

- Directive 2010/75/EU known as Industrial Emissions Directive (IED)
- Directive (EU) 2015/2193 on Medium Combustion Plants
- Directive 2008/50/EC on ambient air quality
- Directive 2008/98/EC on waste and repealing certain Directives

These directives continue to be implemented in the UK through UK legislation as is explained in the following applications:

- The UK and EU Air Quality Policy Context is based on the Directive 2008/50/EC on ambient air quality and cleaner air for Europe. The Air Quality Directive is implemented in the UK through the "The Air Quality Standards Regulations 2010"
- Application of Best Available Techniques (BAT). Discussed in Section 4.4.

Also, several EU commissions implementing decisions are applied to the PROJECT because of the existing UK regulations that continue to implement these decisions. Applicable commission decisions are as follows:

- Commission Implementing Decision (EU) 2017/1442 of 31 July 2017 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for large combustion plants
- Commission Implementing Decision establishes BAT for wastewater and waste gas treatment/management systems in the chemical sector
- Commission Implementing Decision (EU) 2018/1522 of 11 October 2018 laying down a common format for national air pollution control programmes under Directive (EU) 2016/2284 of the European Parliament and of the Council on the reduction of national emissions of certain atmospheric pollutants

4.3.2 International Codes and Standards

Where the UK national and regional regulatory sources are silent about an environmental aspect of the PROJECT, the internationally accepted guidelines, procedures, and standards may be applied as the environmental design basis for that aspect. The following sources are among the frequently used international standards and guidelines:

- American Petroleum Institute (API)
- US Environmental Protection Agency (US-EPA) Codes of Federal Regulations
- International Financial Institute (IFC)

4.4 Best Available Technique (BAT)

"Best Available Techniques" is defined as the application at facilities of the most effective and advanced production processes, methods/ technologies, or operational practices to prevent and, where that is not practicable, to reduce emissions or discharges and other impacts to the environment as a whole. BAT must, as a minimum, achieve emission or discharge standards stipulated by the UK regulations.

The Best Available Technique Reference (BREF) and Best Available Technique Conclusion (BATC) documents have been drawn up in the framework of the implementation of the Industrial Emissions Directive (IED).

IED and associated BAT Reference documents are implemented through The Environmental Permitting (England and Wales) Regulations 2016 (as amended) and require use of BAT (as minimum) for control of the waste, emissions, and discharges from all industrial projects.

The following BREF documents apply to the PROJECT:

- Large Combustion Plants BREF and BATC (Ref 10)
- Energy Efficiency BREF (Ref 11)
- Emissions from Storage BREF (Ref 12)
- Common Waste Gas Management and Treatment in the Chemical Sector (Ref 13).
- Common Wastewater and Waste Gas Treatment/Management Systems in the Chemical Sector BREF and BATC (Ref 14).
- Industrial Cooling Systems BREF (Ref 15).
- Monitoring of Emissions to Air and Water from IED Installations (ROM) BREF (Ref 16).
- BAT reference document for the production of cement, lime and magnesium oxide (Ref 17).

In addition to the above, there is also the document "BAT Review for New-Build and Retrofit Post-Combustion Carbon Dioxide Capture (PCC) Using Amine-Based Technologies" (Ref 18) which has relevance to this PROJECT.

5. Sustainability and Climate Change

Heidelberg Material is committed to reaching net zero carbon emissions and fulfilling its share of the responsibility to keep the global temperature rise below 1.5° Celsius (Ref 9). The PROJECT will continue to reduce impact on air, land and water by:

- Setting science-based targets to reduce carbon emissions and energy consumption; reducing the use of fossil fuel through efficiency improvements; and using alternative and renewable sources.
- Having stringent targets to reduce emissions to air from all our operations.
- Transitioning our operational fleets from traditional combustion engines to alternative forms of energy and, through collaboration with suppliers, improving the efficiency of our fleets through the adoption of new technology.
- Seeking to apply the principles of environmental stewardship throughout our operations; managing and restoring our sites to ensure land remains of value; implementing biodiversity net gain; and safeguarding geodiversity where appropriate.
- Using water efficiently, recycling where possible and protecting water quality

Appendix A includes a copy of the Heidelberg Materials UK sustainability policy.

5.1 Environmental Protection, Sustainability and Transparency

The PROJECT shall not emit at any time contaminants in such concentration and of such duration as to be injurious to, adversely affect, or cause nuisance to public health or welfare, animal life, vegetation, or property.

Emissions and discharges from the project operations shall not result in a significant increase in environmental impact from the PROJECT.

The PROJECT shall not conceal or appear to minimise the effects of an emission to achieve compliance with the regulations. This includes the introduction of dilution air or incorrect operation of monitoring equipment.

The principle of BAT shall be employed in the design to control emissions, reduce waste and resource use. Relevant BAT to the PROJECT and use of these in design will be covered in the BAT Demonstration Report (Ref 5).

The PROJECT design will incorporate and be aligned with CLIENT's sustainability commitments pillars of Net Zero, Safe and Inclusive, Circular & Resilient and Nature Positive

5.2 Climate Change Resilience

The PROJECT shall incorporate consideration in design for changes to site environmental operating conditions and severe weather as result of climate change.

This includes (but not limited to):

- Sizing of all drainage routes for increased rainfall volumes
- Specifying materials, metallurgy and processes for future temperature extremes
- Construction of elevated infrastructure for increased wind speeds, etc.

6. Atmospheric Emissions

6.1 General

The PROJECT shall not emit at any time air contaminants in such concentration and of such duration as to be injurious to, adversely affect, or cause nuisance to public health or welfare, animal life, vegetation, or property.

The PROJECT shall not conceal or appear to minimise the effects of an emission to achieve compliance with the regulations. This includes the introduction of dilution air or incorrect operation of monitoring equipment.

The principle of BAT shall be employed in the design to control emissions to atmosphere. Also, good engineering practice shall be applied in the choice of methods and equipment to minimise fugitive or secondary emissions.

Atmospheric emissions from the PROJECT operations shall not result in a significant increase in environmental impact from the project.

6.2 Point Sources

Atmospheric emission sources will be detailed in the Emissions, Discharge and Waste Summary Report (Ref 4) which will be prepared as part of FEED.

The primary source of atmospheric emissions will be the new stack which will continuously emit flue gas during operation.

6.3 Point Source Emissions Standards

All emissions to the air from the PROJECT are regulated by the Environmental Permitting (England and Wales) Regulations 2016.

However, the environmental permit, which considers cross-media impacts of air emissions in the project area, may also require compliance with more stringent limits for one or more pollutant emissions. As such the project shall comply with the final emission limits which shall be agreed with the environmental agency (NRW) under the permit conditions.

Until the permit limits are established, design is to refer to the applicable limits in the following European directives:

- Industrial Emissions Directive (IED) (Directive 2010/75/EU); and
- Medium Combustion Plant Directive (MCPD) (Directive EU 2015/2193).

The IED limits are applicable to combustion units with thermal input rating exceeding 50MWth operating >500 hours per year. The MCPD is applicable to sources rated between 2 MWth and <50 MWth operating >500 hours per year.

It is understood the CHP boiler's rating will exceed 50MW_{th} and therefore be classified as a large combustion plant under the IED and be required to meet the associated emission limits as summarised in Table 6-1 below.

Released Substance	Large Combustion Sources (Natural Gas)
	Emission Limit (mg/Nm^3)
Nitrogen Oxides (NOx)	100 (Note 1)
Sulphur Dioxide (SO_2)	-
Carbon Monoxide (CO)	100
Particulate Matter (Dust)	5
Note 1: limit values are defined at a temperature of 273,15 K, a pressure of 101,3 kPa and after correction for the water vapour content of the waste gases and at a standardised O_2 content of 3 %.	

Table 6-1: Source Emission Limits

The above emission limits set out in the table above are not applied to the following:

- Engines for emergency use that operate less than 500 operating hours per year.
- Flares
- Combustion sources with thermal input of less than 5 MW
- Standby power generator
- Diesel firewater pumps

For the emissions other than those listed in the Table 6-1, the UK Environment Agency (EA) benchmark values shall be applied. The EA has produced a sector guideline which sets benchmark values that can be easily achieved by implementing techniques described in the relevant BREF notes. As a minimum these values or more stringent values as may be dictated by the local condition at the project location shall be achieved by the Project.

It should be noted that NWR would expect the project to utilise the best available techniques that can achieve these values unless a cost benefit analysis has been presented to justify alternative values, and then that would be subject to NWR approval.

These values are presented in Table 6-2 below for combustion equipment and Table 6-3 for the cement kilns.

Released Substance	Benchmark Value (mg/Nm^3) Note 1	Remarks
Acrylonitrile	0.5 - 2	0.5 mg/m^3 for incineration and 2 mg/m^3 for scrubbing
Ammonia	10	
Benzene	5	
Butadiene	5	
Carbon monoxide	100	

Released Substance	Benchmark Value (mg/Nm^3) Note 1	Remarks
Ethylene glycol	2	Water scrubbing
Formaldehyde	5 – 10	2mg/m^3 by incineration; 10mg/m^3 by catalytic oxidation
Hydrogen Sulphide	5	
Organic Sulphides and Mercaptans	2	
Oxides of Sulphur (as SO_2)	50 - 100	50 mg/m^3 by wet scrubbing; 100 mg/m^3 by semi-dry
Oxides of Nitrogen (total acid-forming as NO_2)	50 - 200	50 mg/m^3 by SCR, 200 mg/m^3 by wet scrubbing
Particulate matter	5 - 20	5 mg/m^3 by fabric filter, 20 mg/m^3 by ESP
Phenols, cresols, and xylols (as phenol)	10	
VOC	20	"Volatile Organic Compounds" includes all organic compounds release to air in the gas phase.
Source: Environmental Agency, Sector Guide notes for the Production of Large Volume Organic Chemicals (EPR 4.01, Annex1 - mission Benchmarks) (Ref 11) **Note 1:** The reference conditions applicable to these levels are: temperature 273 K, pressure 101.3 kPa (1atmsphere), no correction for water vapour or oxygen		

Table 6-2: Benchmark Values for Point Source Emissions to Atmosphere

Released Substance	Benchmark Value (mg/Nm^3) (a)	Remarks
NOx	< 200 – 450	Pre-heater kilns
	400 - 800	Lepol and long rotary kilns
NH_3	<30 - 50	NH3 slip when SNCR is applied
SOx	< 50 -400	Expressed as SO2
HCl	<10	
PCDD/F	<0.05 – 0.1 ng/Nm3	
HF	<1	
Metals Hg	<0.05	
Metals Cd, T1	<0.05	Combined limit
Metals As, Sb, Pb, Cr, Co, Cu, Mn, Ni, V	<0.5	Combined limit
Dust	<10	Operations other than kiln firing and main milling process.
Source: BAT Reference for Cement, lime and Magnesium oxide (**Ref 17**) **Note** (a) Reference conditions 10% oxygen by volume, 274 K Temperature and 1013 hPA		

Table 6-3: Cement Kiln Atmospheric Emission Benchmark Values

6.4 Amine Emissions

The primary emissions to air from the Heidelberg Material CCP are expected to be the depleted flue gas from the Absorber Column.

The composition of emissions stream shall be determined by the LICENSOR. Nonetheless, with reference to common industry practices, it can be expected that depleted flue gas emission to contain Amine species, nitramines, nitrosamines and ammonia in addition to the criteria emissions such as NOx. Currently flue gas is not treated at the front end of the process to remove NOx prior to amine treatment. Amine solvent emissions can react with NOx in the flue gas and/or atmosphere to form additional nitramine and nitrosamines. RSK shall provide the composition and volumetric emission rate of atmospheric releases for use by the CONTRACTOR in preparation of emission Inventory and FEED phase criteria emissions dispersion modelling. Also, the EIA Contractor shall carry out a dispersion analysis to model amine chemistry and nitrogen deposition.

The Benchmark Limit Values (Table 6-2) do not include any limit value for amines, however the Basis of Design includes project upper limits for the flue gas components with an expectation that Amine emissions will be <1 mg/Nm^3 (Table 6-4 below).

Emission limits for amine and criteria emissions will be set following air quality modelling by The EIA contractor. Licensor and FEED CONTRACTOR shall design to meet these limit values.

In the absence of an emission limit for nitramine and nitrosamines the Best Engineering Practice (BEP) shall be applied.

Trace Components	Project Limit (mg/Nm^3 dry, 10% O_2)
SOx	50
CO	250
NH_3	10
HCl	5
HF	1
NOx (as NO_2)	200
CH_2O (Formaldehyde)	5
C_2H_4O (Acetaldehyde)	5
Amine	<1
TOC (Excluding aldehydes)	10 Mg-C/Nm^3
Particulates	5

Table 6-4: Project Limits (Ref 1)

6.5 Ambient Air Quality Standards

Ambient air is defined as any air on the external side of a pollution source's boundary fence to which the public have access. This includes industrial areas neighboring a pollution source. The standards are concentrations of pollutants that are considered safe for humans and the environment.

Atmospheric emissions from the PROJECT shall not result in ground level concentration of air pollutants exceeding the UK ambient air quality standards (Ref 3) presented in Table 6-5 below.

Pollutant	Averaging Period	UK Air Quality Strategy Objectives	Critical Level for Protection of Vegetation and Ecosystems	Notes
Nitrogen Dioxide (NO_2)	1-hour mean	200 µg/m^3	-	Not to be exceeded more than 18 times a year
	Annual mean	40 µg/m^3	30 µg/m^3	
Sulphur Dioxide (SO_2)	15-minute mean	266 µg/m^3	-	Not to be exceeded more than 35 times a year
	1-hour mean	350 µg/m^3	-	Not to be exceeded more than 24 times a year
	24-hour mean	125 µg/m^3	-	Not to be exceeded more than 3 times a year
	Annual mean & Winter Values	-	20 µg/m^3	Winter values are the average from 1st Oct to 31st March
PM_{10}	24-hours mean	50 µg/m^3	-	Not to be exceeded more than 35 times a year
	Annual mean	40 µg/m^3	-	
$PM_{2.5}$ Exposure Reduction	Annual mean	25 µg/m^3	-	UK (except Scotland) objective for 2020 and maintained thereafter.
Carbon Monoxide (CO)	Maximum daily running 8-hour mean	10 mg/m^3	-	
Benzene	Annual Average	5 µg/m^3	-	Applicable to England and Wales only.
Ozone	8-hours	100 µg/m^3	-	Not to be exceeded more than 10 times a year
PAH	Annual Average	0.25 ng/m^3	-	
1,3-Butadiene	Running Annual mean	2.25 µg/m^3	-	
Lead	Annual mean	0.25 µg/m3		

Table 6-5: Ambient Air Quality Standards

Concentration of amine and amine product in the ambient air shall comply with the Environmental Assessment Level (EAL) defined by the EA (Ref 20). EALs for emissions to air represent a pollutant concentration in ambient air at which no significant risks to human health are expected. The EALs for Mono-ethanolamine (MEA) and Nitrosodimethylamine (NDMA) are shown in Table 6-6.

MEA is a solvent used in post-combustion carbon capture plants and NDMA is a by-product of the use of MEA. EALs for MEA and NDMA can be use as indicative EAL value for amine species and amine by-products respectively.

The EALs have undergone review[2] and it is understood that an extended list of EALs will be published by the EA soon.

Pollutant	Short Term (1hr) EAL	Long Term EAL (Note 1)
Mono-ethanolamine (MEA)	200 µg/m^3	200 µg/m^3
Nitrosodimethylamine (NDMA)	None proposed	0.2 ng/m^3
Note 1: The long-term EAL is usually based on a 24-hour time weighted mean concentration.		

Table 6-6: MEA and NDMA EAL Values

6.6 Minimum Stack Height Requirements

Stack heights of combustion sources and exit velocities shall be designed to provide good lift and dispersion for all emissions, allowing for compliance with the Ambient Air Quality Standards.

6.7 Greenhouse Gas (GHG) Emissions

A UK Emissions Trading Scheme (UK ETS) replaced the UK's participation in the EU ETS on 1 January 2021. The UK ETS Regulators are responsible for enforcing compliance with the UK ETS Regulations, including operational functions such as issuing and ensuring compliance with permits (for installations) and emissions plans (for aviation).

The UK ETS applies regulated activities which result in greenhouse gas emissions, including combustion of fuels on a site where combustion units with a total rated thermal input exceeding 20MW are operated (except in installations where the primary purpose is the incineration of hazardous or municipal waste). As such the UK ETS applies to Heidelberg Material Project. The PROJECT must hold a GHG emissions permit. Permits are issued by the UK ETS Regulators.

The Project shall apply for and receive its GHG emissions permit and submit the GHG Report via the METS system (replacing the Emissions Trading System Workflow Automation Program previously used under the EU ETS).

The PROJECT operation management team should review and understand the GHG Emissions permit, and the conditions within relating to monitoring and reporting obligations, as well as those requiring third-party verification of reportable emissions and activity levels. Failure to comply with the permit and obligations under the Greenhouse Gas Emissions Trading Scheme Order 2020 may lead to significant civil penalties being applied.

Although the project is a GHG abatement facility in nature, an estimate of energy use and GHG emissions from the project sources will be prepared by CONTRACTOR. The estimation will include Scope 1, Scope 2, and, as far as practical, Scope 3 emissions as are defined below:

[2] Review of Environmental Assessment Levels (EALs) for emissions to air: second phase - GOV.UK (www.gov.uk)

- **Scope 1:** Includes GHG emissions directly from operations that are owned or controlled by the PROJECT.
- **Scope 2:** Indirect GHG emissions from the generation of purchased or acquired electricity, steam, heating, or cooling consumed by the PROJECT.
- **Scope 3:** All indirect emissions (not included in scope 2) that occur in the value chain of the PROJECT.

Estimate of emissions will be in compliance with the Greenhouse Gas (GHG) Protocol Standard.

6.8 Fugitive Emissions

Fugitive emission release will be emitted from tanks, flanges, seals and equipment vents. Other potential sources include transfer, storage, and spillage from chemical tanks (e.g., methanol, amine, chemicals), loading and transfer operations from tankers and sludge tanks etc.

Following measures will be implemented in design to avoid or minimise plant wide fugitive emissions as much as practicable. These are:

- Fittings which would result in low fugitive emissions
- Risks from leaks shall be reduced by minimising the number of flanged joints, valves and connections to As Low as Reasonably Practicable (ALARP).
- Appropriate specification and design of tank roofs to minimise emissions depending on the contents
- High integrity compressor and pump seals for high pressure system.
- Consequences from leaks to be minimised to ALARP by providing reliable early leak detection and repair systems (LDAR).
- Closed drains for drainage of hydrocarbons/ amines

In addition, BAT shall be applied to reduce emissions from process vents and for the control of fugitive emissions.

Guidance shall be sought from the BREF for Common Wastewater and Waste Gas Treatment & Management Systems.

6.9 Odours

Odour shall be controlled such that emissions from activities shall be free from odour at levels likely to cause nuisance outside the site boundary. In addition, BAT guidance shall be sought from the BREF for Common Wastewater and Waste Gas Treatment/ Management Systems.

Where, despite all reasonable steps in the design of the plant, extreme weather or other incidents are liable to increase the odour impact at receptors, the PROJECT shall take appropriate and timely action, to prevent further annoyance (the agreed actions shall be defined either in the permit or in the odour section of the Environmental Statement, to be prepared as part of the EIA).

Where odour generating activities take place in the open, or potentially odorous materials are stored outside, a high level of management control and use of best practice shall be considered.

6.10 Minimum Stack Height Requirement

Stack heights of point emission sources and exit velocities shall be designed to provide good lift and dispersion for all emissions.

Stack heights of the emission sources shall be designed using the US EPA Guideline for Determination of Good Engineering Practice (GEP) Stack Height (Ref 21).

According to the GEP, the stack height shall be greater of the:

- 65 m measured from the ground-level elevation of the base of the stack.
- Hg = H + 1.5 L

Where:

- Hg = Stack height measured from the ground-level elevation at the base of the stack
- H = Height of nearby structure(s) measured from the ground-level elevation at the base of the stack
- L = Lesser dimension, height or projected width of nearby structure(s). Nearby means the distance up to five times the lesser of the height or the width dimension of a closest structure but not greater than 0.8 Km.

An air dispersion modelling shall be carried out using the above-estimated stack heights to investigate the state of compliance with ambient air quality standards. The proposed modelling shall consider impact on all sensitive receptors including human and ecological receptors which are of high importance for the site due to location of the PROJECT. Sensitivity analysis shall be carried out to determine appropriate stack height for the combustion sources and/or other mitigation measures adopted if the result of modelling indicates a noncompliance with the ambient air quality standards. Impacts of downwash (wake) effects shall be accounted for in the air dispersion modelling for the stacks located within the influence zone of structures. Figure 6-1 presents an example of the projected building width and structure influence zone.

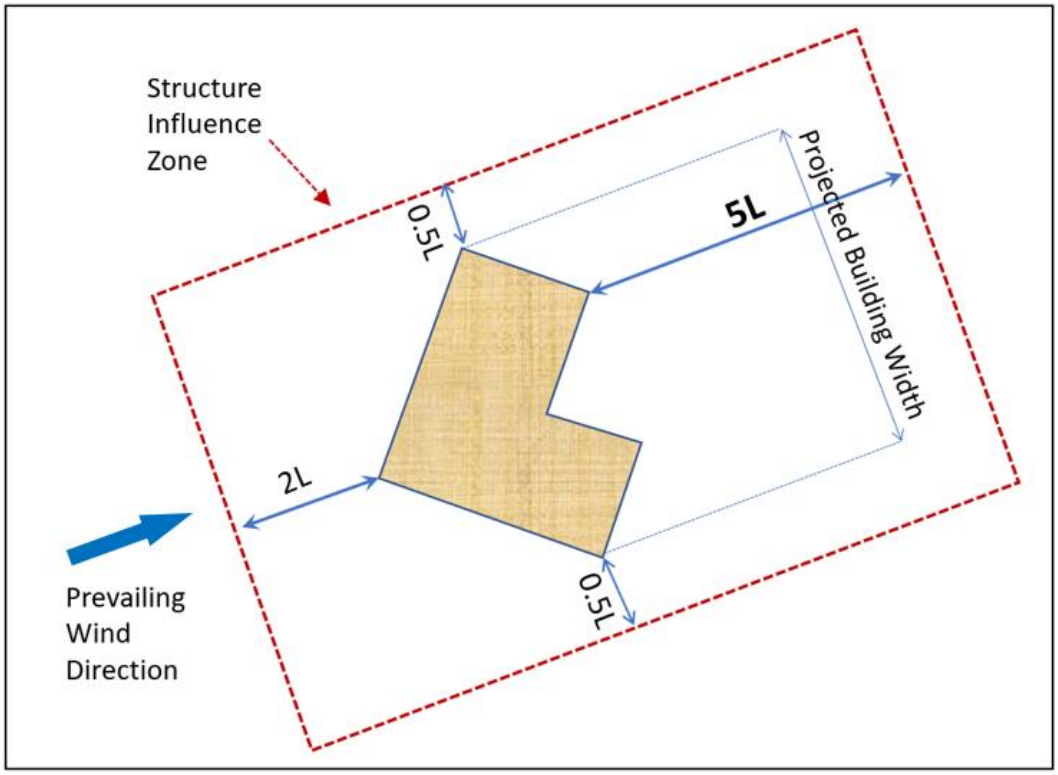

Figure 6-1: An Example of Structure Influence Zone

Where modelling predicts a noncompliance with ambient air quality standard, one or both of the following actions may be adopted to enhance dispersion of pollutants:

- Increase the design stack height of combustion sources
- Raise the temperature at the point of release by flue gas reheating. Flue gas reheating can also reduce the plume visibility.

6.11 Metering and Monitoring

The "Environmental Management and Monitoring Plan" (215000-00190-000-EN-PLN-00001) provides detailed information on emissions metering and monitoring of various sources. Metering and monitoring requirements are specified in the relevant BATC documents as were discussed in the 4.4 of this document. The general metering and monitoring requirements regarding the atmospheric emissions are presented in this section.

6.11.1 Metering

- A "Waste, Emissions and Discharge Inventory" will be established in FEED phase and maintained afterward to inventory the atmospheric emission sources and their associated emissions of NOx, SOx, CO, Particulate Matter (PM), and other key atmospheric pollutants.
- Measurement of SO_2, NO, NO_2, and PM from the combustion sources shall be continuous. Frequency of measurement of other atmospheric pollutants shall be in accordance with the Environmental Permit.
- The design should consider flow measurement of fuel flow or quantity for gas boiler, heaters, and flare pilots. These metering systems are required for forecasting CO_2 emissions and must be incorporated into the design and construction of the facilities.

- Flue gas specifications including volumetric flow, temperatures, and pressure shall be continuously measured on stacks of all combustion sources. Diesel firewater pumps and standby emergency generators are exempt from continuous monitoring due to their temporary usage.

6.11.2 Monitoring

- Emission monitoring ports shall be located on suitable locations on the stacks of all combustion sources. The ports shall be ensured that are safely accessible on combustion equipment. The location of the sampling ports shall be designed according to specific UK standards which are provided by the EA.
- Above requirement applies to the bypass stacks of the combustion sources if such sources include a bypass stack.
- Continuous Emission Monitoring System (CEMS) shall be used in monitoring of emissions from auxiliary boiler and fired heater.
- NOx, SOx, CO, PM, and TOC emissions shall be subject to continuous monitoring. Frequency of monitoring of other emissions shall be per environmental permit conditions.
- An odour monitoring system shall be installed in the boundary of the H2T Plant to cope with public complaints if such monitoring system is required by the EA as part of the Environmental Permit Condition.
- LDAR (Leak Detection and Repair) program for fugitive emission facilities shall be established and operated.
- All atmospheric emissions metering and monitoring equipment shall be listed as Environmental Critical Equipment (ECE) and included in the ECE register. The ECE identification shall be carried out in the EPC phase in accordance with ECE Procedure (215000-00190-000-EN-PRO-00005). The ECE Identification Report and ECE Register shall be prepared following ECE identification. Also, ECE Performance Standards shall be prepared for all metering ECEs.
- The EPC Contractor shall review Environmental Management and Monitoring Plan (215000-00190-000-EN-PLN-00001) and fulfil activities identified under EPC role and responsibilities.

6.12 Further design criteria regarding atmospheric emissions

- Stack heights of combustion sources and exit velocities shall be designed to provide good lift and dispersion for all emissions.
- Stack design shall be based on a minimum exit velocity of 5 m/sec at the fired heaters minimum operating case. This requirement is to prevent downwash of flue gas at turndown conditions.
- NOx emission shall be minimised through designing and installing low NOx technology for the boilers and heaters. Alternative NOx abatement techniques such as Selective Catalytic Reduction (SCR) may also be adopted in order to meet NOx emission limits considering cost implications and safety provisions.

7. Emissions to Water

7.1 Wastewater and Liquid Effluents Streams

BAT requires wastewater streams to be segregated in accordance with stream characteristics and required treatment processes, including separate drainage and collection systems.

Wastewater from the PROJECT has the potential to be contaminated with chemicals and hydrocarbons. Minimization of wastewater through abatement at source of aqueous effluents that have the potential of causing a negative impact on the environment and people must be adopted as a principle. However, there will be no direct discharge of effluents from the PROJECT operations to the environment. Figure 6-1 presents the expected wastewater/effluent streams of the PROJECT.

Effluent	Destination
Sanitary effluent	Local sewage treatment plant
Liquid reclaimer waste	Existing cement facility calciner
Surface run off from plant drains and areas for possible lube oil spills	Oily water interceptor
Condensed water from CO_2 compressor and dehydration beds	Water recovery unit
Water saturated with CO_2 from ISBL	Licensor Capture Plant
Lube oil / coolant	Licensed hazardous treatment facility
Liquid effluents from CO_2 Booster Compression	Liquid effluents drain
Water knock-out in event of upset in pipeline system	Site drain
Quencher water (Effluent from the Direct Contact Cooler (DCC))	WWTP
Amine Contaminated Wastewater	Licensor Capture Plant
Storm Water	Site drain

Table 7-1: Wastewater and effluents streams

Table 7-1 provides high level information regarding the effluent streams which are typical for carbon capture projects. Details of the effluent streams and site drainage strategy will be documented in the PROJECT Drainage Philosophy document (Ref 6).

7.2 Discharges to Sewer

Effluent discharges to sewer will need to meet the discharge standards set in the operational permit and public sewage operator which will be based on the EA and Local Council requirements.

7.3 Discharges to Receiving Water

It is understood that the PROJECT design is for zero-water discharge. Wastewater streams are to be sent OSBL to the existing cement facility for use in production/other processes.

As such, there is no anticipated discharge to receiving water.The standards for discharge to receiving water have been included in **Appendix B** for reference only.

7.4 Site Drainage

The PROJECT site wastewater streams shall be segregated in accordance with stream characteristics and required treatment processes, including separate drainage and collection systems as follows, this excludes any process aqueous effluent which will be routed directly to the Wastewater Treatment Plant (WWTP) by an above ground pipe:

- Clean water drainage including clean storm water run-off from nonpaved areas and run-off from clean areas such as roads, graveled areas, parking areas and water from roof of buildings
- Potentially contaminated drains - water which may be polluted by hydrocarbons from sources such as rain and/or firewater in utility paved areas, wash down of paved areas, water from equipment and structures in utility areas
- Sanitary sewer including sanitary wastewater from toilets, showers, kitchens, floor drains and laboratories (excluding oily and chemical sink wastes)

The design shall provide adequate measures for segregation and local containment of unintended liquid releases in order to prevent migration to soil and ground water. A closed drain system shall be provided for the collection of amine contaminated wastewater and transferring back to the ISBL area where there are facilities to handle the amine contaminated condensate by an above ground pipe.

The PROJECT "Site Drainage Philosophy (Ref 6) provides detailed information about effluent streams and their routing that shall be taken into account in design and construction of the new Heidelberg Material facilities.

Site drainage shall be designed with suitable capacity to accommodate impacts from climate change (i.e., storm waters, increased rainfall levels etc.).

7.5 Water Usage

To minimise the raw water extraction, the PROJECT surface water strategy shall be based on collection, treatment, and reuse of the surface water on site in the cooling system.

Suitable flow metering shall be included across the project process facilities and utilities areas to allow for

- The development of a water balance that accounts for all water uses.
- Meters to track water usage and identify leakage across the PROJECT's major users.

7.6 Monitoring and Metering

Monitoring of discharges and flow-proportional sampling should be provided to ensure that discharges (to environment) are meeting the required standards.

In addition to the monitoring at the point of discharge to the environment, adequate monitoring of wastewater effluent flow and quality from the process units into the wastewater treatment system shall also be provided to ensure that proper treatment of the effluent takes place in the event of fluctuating loads.

The following actions shall be taken for metering and monitoring of the effluents:

Water Usage:

- Specify equipment that enables measuring and monitoring of water use across the Heidelberg Material process facilities and utility units.
- Consider including the following in the measurement and monitoring equipment scope:
  - Meters to track water usage and identify leakage across the Project's major users.
  - The development of a water balance that accounts for all water uses.

Wastewater:

- Equipment that enables measurement and monitoring of wastewater across the Heidelberg Material process facilities and utility units shall be specified.
- The PROJECT shall consider the following items among the measurement and monitoring equipment scope:
  - Facilities for sampling wastewater streams.
  - Wastewater flow meters (or equipment to facilitate the measurement of wastewater flows).

7.7 Design Criteria

1. The PROJECT should minimise fresh water use through:
   - Process selection.
   - Process optimization and water stream reuse.
   - Recycle and cascade (using water more than once in successive processes requiring progressively lower quality water).

2. The PROJECT shall not use any of the following chemical treatments in the cooling water system:
   - Chromium, mercury, and organometallic compounds
   - Mercaptobenzothiazole
   - Shock treatments with biocides other than chlorine, bromine, ozone, and hydrogen peroxide (chlorine biocides include hypochlorite and chlorine dioxide).

3. Wastewater streams shall be segregated in accordance with stream characteristics and required treatment processes, including separate drainage and collection systems . The classification of wastewater streams shall be considered as follows:
   - Process aqueous effluents, including amine contaminated wastewater.
   - Clean water drainage including clean storm water run-off from nonpaved areas and run-off from clean areas such as roads, gravelled areas, parking areas and water from roof of buildings
   - Potentially contaminated drains - water which may be polluted by hydrocarbons from sources such as rain and/or firewater in utility paved areas, wash down of paved areas, water from equipment and structures in utility areas.
   - Sanitary sewer including sanitary wastewater from toilets, showers, kitchens, floor drains and laboratories (excluding oily and chemical sink wastes).

4. Waste oil streams shall be routed to the special offsite facilities for recycling or disposal.

5. Waste solid streams shall be treated/disposed of in accordance with Section 8.
6. The design approach to minimise environmental impact due to aqueous effluent shall include but not be limited to the following:
   - Segregation of drain systems based on the potential contamination and stream classes as defined under item 3) above.
   - Contaminated aqueous effluents shall be disposed of through a treatment facility.
   - Clean water drainage from non-process areas may be discharged to the receiving environment following proposed metering and monitoring.
   - The drainage system shall be designed to cater for the worst-case scenario of either maximum storm water runoff or design case firewater run off to avoid flooding in the CCP areas (including related utility areas).
7. The design shall provide adequate measures for sectioning and local containment of unintended liquid releases and measures to facilitate for counteraction, in order to prevent migration to soil and ground water.

8. Solid Waste

8.1 Waste Management Principles

Specific process should be designed and operated to prevent or minimise the waste generated in accordance with the strategy:

- Replace the hazardous raw material by less hazardous or toxic
- Apply process that give high product yield and minimise waste
- Set up good housekeeping (inventory) and operating practices
- Set up procurement measures to minimise hazardous waste
- Establish recycle and reuse plans, and
- Establishing treatment and disposal plans if the waste materials are still generated.

An Environmental Management and Monitoring Plan (Ref 8) will be prepared as part of FEED to document the framework for waste management in the PROJECT.

8.2 Non-Hazardous Waste Management Strategy

Characterisation of waste should be carried out according to composition, source, types of waste produced, and generation rates. Waste management strategies should include:

- Review of the existing and new waste sources during all phases of the project to identify expected waste generation and possible mitigation
- Process data collection and identification of the waste quantity and use/dispose methods
- Establishment of priorities based on a risk analysis
- Definition of opportunities for source reduction procedures, reuse, recycling, and operational controls for onsite storage; and
- Definition of options / procedures / operational controls for treatment and final disposal.

8.3 Hazardous Waste

The following considerations shall apply to the Project with respect to the hazardous waste management:

- The use of any ozone depleting substance as defined in Montreal Protocol (such as chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), methyl-chloroform, carbon tetrachloride, halons, 1,1,1-trichloroethane, hydrofluorocarbons (HFCs), and methyl-bromide) is prohibited.
- Refrigerants should have an ozone depleting potential of zero and where more than one technically viable alternative is proposed, the substance which poses the lowest HSE, and operability risk should be selected (e.g., lowest global warming potential for environmental risk).
- Where possible, the project shall apply the principle of substitution to eliminate the use of Fluorinated Greenhouse Gases.
- The importation, supply, and use of all forms of asbestos and asbestos-containing materials containing more than 1% asbestos by mass are banned.

- Lead-based paint are prohibited
- Poly-chlorinated biphenyls (PCBs) and PCB-contaminated materials are prohibited.

Design shall ensure that none of these prohibited hazardous substances are specified for use in the project.

Waste Management and Monitoring Plan (215000-00190-000-EN-PLN-00002) provides detail information on management, monitoring, and tracking of the PROJECT waste streams.

9. Occupational Noise

According to the Control of Noise at Work Regulations 2005, the level at which employers must provide hearing protection and hearing protection zones is 85 dB(A) (daily or weekly average exposure). Therefore, the sound pressure level at 1 meter distance from any PROJECT equipment shall not exceed 85 dB(A).

Where it is not reasonably practical to reduce the noise level, the maximum noise limit can be considered 90 dB(A) provided that the workers wear suitable ear defenders. This limit is based on the danger limit value that sets the noise level above which hearing impairment and deafness may result from an eight-hour daily exposure of an unprotected ear.

10. Ambient Environmental Noise

The environmental noise is regulated by the Environmental Noise (England) Regulations 2006 and its amendments.

The EA have published guidance (Ref 12) which outlines the permitting requirements for noise and vibration. The guidance covers the stages of assessment from desktop study to on-site monitoring and the requirement to assess the impact to neighboring receptors.

The regulations also require that installations which need an Environmental Permit must demonstrate that all the appropriate preventive measures are taken to prevent or minimise noise nuisance through the application of BAT. All Contractors, Licensors and Suppliers shall provide noise data for all new equipment.

The project shall consider the following recommendations regarding the noise emissions:

1. In accordance with the DEFRA Guidance on Noise Nuisance (Ref 23), the permitted environmental noise levels at human and ecological receptors are as follows:
   - 34 dB(A) if the underlying level of noise is ≤24 dB(A); and
   - 10 dB(A) above the underlying level of noise if this is more than 24 dB(A)
2. The state of compliance with the above environmental noise limits shall be identified by the noise modelling as part of the Environmental Impact Assessment studies. Noise modelling is to include assessment of tonal, intermittent and impulsive noise, including venting of steam and CO_2 with likely duration and frequency of incidents
3. Where the result of noise modelling indicates an exceedance from the limits set out in the item 1 above, the Project shall consider the following mitigation measures to achieve compliance:
   - Modifying the source to reduce noise output
     - In example of tonal noise, provide blade pass frequency for rotating machinery i.e., fans, blowers, compressors and pumps
   - Influencing equipment selection and insulation
   - Positioning of equipment
   - Enhance maintenance procedures, site practices and behaviour
   - Altering or controlling the transmission of noise (e.g., via acoustic engineering)
   - Communicating with project-affected people and communities so that all parties are better informed about the nature, character, and frequency of the noise disturbance.
4. The basic techniques that should be considered for noise reduction include:
   - Noise reduction at source using engineering techniques incorporated at the design stage of the new plant or modification.
   - Partial or total enclosure of the noise source(s) to physically separate a source of noise from those people who may be harmed or inconvenienced by that noise.
   - Silencing or damping of the source of noise by means of a specially designed acoustic silencer or damping material.
   - Isolation by distance.
   - Regular monitoring, maintenance, and repair of equipment.
   - Provision and use of appropriate hearing protection devices (HPDs) to those personnel required to work in defined Noise Hazard Areas; and

- Administrative controls of work scheduling and employee rotation e.g., by scheduling work for known quieter periods in a process cycle it might be possible to reduce overall employee noise dose.

5. The sirens and broadcast sound level shall be adjusted at 6-10 dB(A) higher than the background noise level of each area.

Appropriate mitigation measures shall be included in the design to prevent increase in background noise levels or minimise the noise level when prevention is not possible.

11. Lighting and Visual Effects

Personnel safety and efficiency of operation are the preliminary factors to be considered while designing the lighting system.

Lighting levels shall, as a minimum, comply with the more stringent of:

- Planning and Permit requirements
- Applicable Health and Safety Regulatory requirements and
- CLIENT Standards.
- Light and lighting. Lighting of workplaces - Outdoor workplaces (BS EN 12464-2)

The lighting system shall be designed to provide the desired quantity of light at the particular location and in the proper visual plane, taking into account all safety requirements for the lighting and considering the following provisions:

1. Lighting near or above the horizontal is usually to be avoided to reduce glare and sky glow (the brightening of the night sky).
2. Good design, correct installation and ongoing maintenance are essential to the optical effectiveness of lighting schemes such as fixed and/or regularly operated functional and decorative lighting elements.
3. In combination with optical good practice aimed at limiting light pollution, efficient lamp and luminaire selection are important considerations to minimise energy use and associated carbon emissions.
4. Tall structures may potentially require aircraft navigation lighting.

12. Further Environmental Design Criteria

12.1 Plant Layout

In order to achieve an optimum layout, without compromising the environmental and safety requirements, the following provisions shall be taken into account in design:

- Providing adequate separation distance between critical sections and equipment in order to minimise loss and damage in the event of an explosion or fire occurring with potential to cause escalation
- Maintaining the operational integrity of the facilities during all possible conditions (e.g. start-up, shutdown, and normal operation)
- Providing sufficient secondary containment for any loss of containment accidental or emergency event

12.2 Environmental Critical Equipment Identification

Environmental Critical Equipment (ECE) are the equipment whose failure could cause or contribute to an environmental accident with severe or catastrophic consequences or whose purpose is to prevent or limit the effect of such an accident.

A workshop-based study shall be carried out in the FEED phase to identify and rank the ECEs in all process facilities and utility units. The purpose of the ECE workshop should be to identify all environmental critical equipment and to ensure that the design is informed of performance standards requirements of such equipment. This will in turn, ensures that people and the environment are protected from the environmental accidents.

The ECE identification methodology will need to be agreed with NRW as part of the permitting workstream.

An ECE register will be developed in the FEED phase. The CONTRACTOR will also prepare Performance Standards and Written Scheme of Examination for any of the identified ECE at the early stage of detailed design.

12.3 Spill Prevention and Response

For the purpose of minimising the environmental consequence of accidental spill, the Project shall maintain a tiered capability for inland response.

The Project shall confirm the following:

1. The provision of resources is sufficient to support the implementation of the inland response capability at the required tier levels within defined timeframes.
2. Availability of necessary specialist and non-specialist resources, including:
    a. Vehicles, plant machinery, equipment, and tools suitable for the environment, terrain and hydrogeological conditions, above and below ground.
    b. Reception and temporary storage facilities for recovered oil and materials.
3. Surveillance methods are available to locate oil, direct the clean-up operations and monitor efficacy.
4. Specialist/non-specialist equipment to monitor surface and groundwater contamination.

5. Means to measure the quantities of recovered oil and other materials.
6. Bund design to consider risk of jetting from the storage tanks.

12.4 Resource Use

The consumption and nature of raw materials, including water, used in the process are of concern and are required specifically to be considered. With respect to raw materials, following considerations shall be given to:

- Reducing the use of chemicals and other bulk materials.
- Substituting less harmful materials, or those which can be more readily abated.
- Understanding the fate of the by-products and contaminants and their environmental impact.

Appendix A. Heidelberg Materials UK sustainability policy

Heidelberg Materials

Issued: November 2023

Heidelberg Materials UK sustainability policy

Policy and scope
Effective management and continual improvement of safety, health, environment, quality, energy, carbon reduction, and responsible sourcing is of key importance to the sustained success of our business. We have a single sustainability policy, which is regularly reviewed and communicated to employees, contractors, visitors, key stakeholders and our supply chain to inform and promote wider adoption of responsible practices.

As a minimum, we comply with all applicable legal and regulatory requirements. Cooperation in the effective implementation of the policy is a condition of employment, partnership and supply.

Business and product innovation
We will ensure continuous business and product innovation by:

- Engaging with our stakeholders to encourage innovative development of our products, services and manufacturing systems to continually improve our sustainability performance.
- Informing our customers about the functional, environmental and safety performance of our products.
- Adopting a systematic and integrated approach. We are committed to achieving the highest standards in complying with ISO 9001, ISO 14001, ISO 45001, ISO 50001, BES 6001 National Highway Sector Scheme 16 and the relevant CE certification marking schemes.

Health, safety and wellbeing
We will ensure Heidelberg Materials UK is a safe and healthy place to work by:

- Eliminating risk in the workplace through monitoring performance and implementation of best practice.
- Developing and implementing action plans to ensure the health, safety and mental wellbeing of our employees. We have enhanced occupational health surveillance for their benefit.
- Committing to the continual improvement of the suitability, adequacy and effectiveness of the occupational health and safety management system.

Environmental responsibility
We are committed to reaching net zero carbon emissions and o fulfilling our share of the responsibility to keep the global temperature rise below 1.5° Celsius. We will continue to reduce our impact on air, land and water by:

- Setting science-based targets to reduce carbon emissions and energy consumption; reducing the use of fossil fuel through efficiency improvements; and using alternative and renewable sources.
- Having stringent targets to reduce emissions to air from all our operations.
- Transitioning our operational fleets from traditional combustion engines to alternative forms of energy and, through collaboration with suppliers, improving the efficiency of our fleets through the adoption of new technology.
- Seeking to apply the principles of environmental stewardship throughout our operations; managing and restoring our sites to ensure land remains of value; implementing biodiversity net gain; and safeguarding geodiversity where appropriate.
- Using water efficiently, recycling where possible and protecting water quality.

Resource use and the circular economy
We will conserve natural resources by:

- Using resources appropriately and sustainably and, where possible, substituting primary resources with alternative materials.
- Adopting the waste hierarchy of waste prevention, reuse of materials, recycling, co-processing and energy recovery to minimise waste disposal and maximise productivity.
- Developing products that improve the quality and sustainability of the built environment and seeking to eliminate all non-conforming products.

Being a good neighbour
We are committed to making a positive contribution to the communities close to our operations and ensuring transparent communication to all our stakeholders by:

- Developing a social value policy outlining our commitment to managing and measuring the social value our organisation is creating.
- Identifying and consulting with local community stakeholders close to our operations.
- Having a programme of employee volunteering days to work on community projects.
- Providing employment, economic activity using local sourcing and local businesses where practical, and building our own business on the basis of responsible practices.

Fairness, awareness, inclusion and respect (FAIR)
We will be a fair, aware, inclusive and respectful company, encouraging a culture that values openness and transparency and recognises individual achievement by:

- Striving for the fair treatment of all our employees and everyone in our supply chain.
- Valuing our workforce and, by recruiting, selecting and developing our employees, contractors and suppliers, to ensure they are appropriately skilled and competent to carry out their roles.
- Committing to the consultation and participation of workers and workers' representatives through formal mechanisms.

Simon Willis

Simon Willis
Chief executive officer, Heidelberg Materials UK, January 2024

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Heidelberg Materials supports the UN Sustainable Development Goals

Appendix B. Discharge to Receiving Water Standards

C.1 Discharges to Receiving Water

Unless are otherwise defined in the EA Permit, specification of treated wastewater for discharge to receiving water shall be in accordance with more stringent conditions set out the following sources:

- UK Environmental permitting technical guidance for the purposed activity including:
  - EPR 4.03: The Inorganic Chemicals Sector, UK, Environment Agency Guidance
- EU directives including:
  - Industrial Emissions Directive, and
  - Urban Wastewater Treatment Directive
- BREF Documents and BAT Associated Emission Levels (AEL), including:
  - BREF for Common Wastewater and Waste Gas Treatment/Management System

Table B-1 presents a design guide to wastewater specification for discharge to the receiving water based on the ranges derived from above mentioned references.

Substance	UK Guidance Range (mg/l)
pH	6-9
Temperature	<3
Total hydrocarbon oil content	1-3
Total Hydrocarbon content	--
Biological oxygen demand	20-30
Chemical oxygen demand	30-125
Total nitrogen (as N)	1-10
Ammoniacal nitrogen (as N)	1-5
Total Suspended solids (TSS) (dried @ 105°C)	20-30
Halogenated Organic Compounds AOX Notes	1
Phenols	--
Sulphides	--
Mercury	0.005
Chlorides	--
Cadmium	0.01
Copper, chromium, Nickel, and lead (each)	0.5
Zinc and tin (each)	2
Dioxins and furans	0.3 ng/l
Arsenic and its compounds, expressed as arsenic	0.05
Total Phosphorus	2

Table B-1: Discharge to Receiving Water (indicative levels)