FICHTNER
Consulting Engineers Limited

Viridor

Runcorn CC Facility

Response to Schedule 5 Notice August 2024

1 Introduction

Viridor is developing the Runcorn carbon capture (CC) facility, which will capture carbon dioxide (CO_2) produced by the Runcorn Energy Recovery Facility (ERF). Viridor has applied for an Environmental Permit (EP) for the CC facility, and the Environment Agency (EA) made a Schedule 5 request for further information on 05/08/2024. This document provides the further information requested.

2 Questions

2.1 Conditioning of carbon dioxide.

1. **Provide further details on the conditioning of captured carbon dioxide (CO_2) including the use of hydrogen to remove oxygen and use of any chemicals used.**

The captured CO_2 will be compressed, deoxygenated and dried to meet the transport and storage Network Code requirements for entry into the pipeline. The gas stream is deoxygenated by injecting hydrogen into the gas stream to react with oxygen and produces water. The reaction is catalysed with a solid palladium catalyst to maximise selectivity and minimise the amount of hydrogen required to deoxygenate the CO_2 gas stream. The wet CO_2 stream is then dried using a pressure/ temperature swing adsorption process using a suitable desiccant (likely to be an alumina silicate powder) to trap the water from the gas stream. The recovered water from this process will be added to the effluent system for treatment and disposal.

2. **Provide an updated raw materials table as found in section 4.1.1 of the supporting information document to include estimated annual consumption.**

Table 1 and Table 2 of the Supporting Information document have been updated below to include hydrogen and sulphuric acid (the latter being required for the water treatment process, i.e. unrelated to the use of hydrogen).

Table 1: Types and amounts of primary raw materials

Schedule 1 Activity	**Material**	**Estimated storage capacity (tonnes)**	**Estimated annual consumption (tpa)**	**Description**
Section 6.10	MEA solution (Holding tank)	900	60	Reagent for the capture of CO_2 within the absorber tower
	MEA solution (Process storage tank)	60		
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	Sodium hydroxide (NaOH)	50	400	Used within the alkali wash and the Reclaimer
	Water treatment chemicals	<10	<50	Corrosion inhibitor, Antiscalant and Biocide
DAA	Sulphuric Acid	56	700	Used to neutralise influent to the water treatment process
Section 6.10	Hydrogen	0.60	8.6	For CO_2 conditioning. Stored at 228barg assuming standard tube trailers are used.

Table 2: Primary raw materials and their effect on the environment

Product	Chemical Composition	Estimated annual consumption (tpa)	Relative impact (%)			Impact Potential	Comments
			Air	Land	Water		
MEA solution	C_2H_7NO	60	100	0	0	Low	Reagent for the capture of CO_2 within the absorber tower. Some MEA solution will be lost from the system vie the flue gases or as a residue and will require replenishment within the CC process.
Sodium hydroxide	NaOH	400	0	0	100	Low	Used in the caustic wash within the DCC for removal of acid gases.
Water treatment chemicals		<10	0	0	100	Low	Dosed into the water treatment process
Sulphuric acid	H_2SO_4	700	0	0	100	Low	Used to neutralise influent to the water treatment process.
Hydrogen	H_2	8.6	0	0	100	Low	The gas stream is deoxygenated by injecting hydrogen into the gas stream to react with oxygen and produce water.

3. Provide details on the storage and handling arrangements for the updated raw materials and confirm these will be included in the Environmental Management System (EMS).

The chemicals will be delivered to site in bulk road tankers using suitably qualified hauliers and drivers. The tanks will be designed, installed and maintained to the appropriate codes in relation to their hazard classification and will be provided with secondary containment that is suitable and sufficient to hazard class and release potential. The storage and handling arrangements for the additional raw materials will be included in the EMS.

4. Provide an updated environmental risk assessment (ERA) that includes an assessment of risk from the handling and storage of hydrogen and any other chemicals identified.

Refer to Appendix A. No updates to the ERA are required for the addition of sulphuric acid as a raw material, as the potential hazards (spillages/leaks of chemicals during delivery/offloading of chemicals and filling of storage tanks) are already accounted for in the ERA submitted with the application.

A Environmental Risk Assessment

What do you do that can harm and what could be harmed?			Managing the risk	Assessing the risk		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Possibility of exposure**	**Consequence**	**What is the overall risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs who is responsible for what?**	**How likely is this contact?**	**What is the harm that can be caused?**	**What is the risk that remains? The balance and probability and consequence**
Fires in hydrogen storage and transfer facilities.	Immediate area – air, site workers.	Direct contact.	Inbuilt fire detection and suppression systems. Installation of fire walls to separate key areas of the plant.	Unlikely.	Visual impact, pollution of air, harm to staff, damage to infrastructure.	Not significant due to control measures in place.
Explosion risk through hydrogen storage failure (or contact with vehicles).	Immediate area – air, site workers.	Direct contact.	Separation/safety distances for hydrogen plant. Compliance of plant with relevant UK and international legislation and standards throughout its design life (including during construction and operation). Installation of barriers around the hydrogen storage facilities to minimise the risk of collision with manoeuvring vehicles.	Unlikely.	Visual impact, pollution of air, harm to staff, damage to infrastructure.	Not significant due to control measures in place.

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Hydrogen storage failure (including leakage).	Local environment – air.	Air.	Construction in accordance with recognised standards and pressure directives. Integrity of storage facilities will be inspected regularly as part of preventative maintenance regimes. Construction quality assurance checks will be undertaken during construction to ensure the integrity of the infrastructure.	Unlikely.	Release of significant quantities of hydrogen to the environment (climate impacts).	Insignificant.
Control failure leading to process control upset.	Local environment – air.	Air.	Good/robust design of control and process monitoring system. Monitoring of process conditions. Regular preventative maintenance of systems.	Unlikely.	Release of substances such as hydrogen, nitrogen, oxygen to atmosphere.	Insignificant.

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Leakage of gases from process plant and equipment.	Local environment – air.	Air.	Regular maintenance, inspections. Redundancy of critical equipment or spares on stock. Good/robust design of control and process monitoring system. Monitoring of process conditions. Quality assurance checks will be undertaken during construction. Plant and equipment certified to relevant standards.		Release of hydrogen to atmosphere. Explosive atmosphere potential.	