EPR/AB3101MW

BAT Screening Assessment for N2 Removal

October 2019

BAT Screening Assessment

Management System:	Health, Safety and Environmental (HSE)	**File Name:**	HSE-Permit-INS-PNR -019
Approver:	EPP Manager	**Version No:**	1.0
Reviewer:	Technical Director, Environmental Compliance Advisor, Well Test Manager	**Date of Issue:**	6th October 2019
Author:	EPP Manager	**Proposed date of Review:**	n/a

Version	Section	Revision Information	Date	Reviser
Draft	All	Draft for review	October 19	EPP Manager
Published	All	Reviewed with updated information	October 19	EPP Manager

Documents are reviewed as per proposed review date, or sooner if a significant change to the operation has taken place, to ensure relevance to the systems and process that they define.

Summary

Gas lift using N2 has been demonstrated to be BAT for well clean up for exploration wells at the Preston New Road site.

It has been demonstrated that for methane concentrations of below 30% v/v methane, combustion does not occur, even with the appropriate flares installed. For concentrations between 30% and 50% v/v there is a risk that combustion may not occur.

Therefore, screening has been conducted to evaluate whether a full BAT study should be conducted to assess the options for the removal of the gas lift nitrogen from the combined gas stream, prior to it being sent to the flares for combustion, with the objective of increasing the methane concentration in the gas stream, for a given volumetric flowrate of methane.

The removal of Nitrogen from produced gas streams has been studied and is conducted as part of established production operations throughout the globe – typically at gas production facilities or LNG terminals – where even low levels of inert gases in a hydrocarbon gas stream can have significant commercial impact. However, no examples have been identified whereby temporary well clean-up operations have incorporated nitrogen removal technologies.

Methodology

Criteria of considerations when screening out technology.

Criteria	**Considerations**	**Type of Test**
Economic	Equipment capital/rental cost Infrastructure costs (site and export systems) Benefit/profit costs	Economic viability
Availability	Must be available for use within a 12–18 month horizon Proven in OOG industry at global scale Proven technology/technique in the UK Market/outlet/user for product of waste gas	Yes/ No/ Maybe Yes/No Yes/ No Yes/ No
Environmental/ technical	Environmental performance Land usage Scale of operation	Comparative measure Comparative measure Comparative measure

	Proprietary technology	Comparative measure
	Infrastructure requirements (for example, pipeline)	Comparative measure
	Additional service requirements (for example, steam)	Comparative measure

Source: Waste gas management at onshore oil and gas sites: framework for technique selection, SC170013, April 2019.

Screening Assessment

Option Description	Technology/ process	Description	Pros	Cons	Screen out of further BAT Assessment
Separation of gases (N2 from CH4) Nitrogen removal unit (NRU)	Cryogenic distillation	Pure gases can be separated from gas by first cooling it until it liquefies, then selectively distilling the components at their various boiling temperatures.	Nitrogen separated from natural gas, thus increasing the CH4 concentration in the flare feed stream, thus increasing probability of combustion for a given methane gas flowrate during well cleanup	Require land take and further cost to rent land. No known operation use on gas exploration site. Unproven with variability in methane/ nitrogen feed in compressed time (seconds to minutes). Variability in methane/ nitrogen feed, means NRU design optimisation not possible. High capital cost estimated in the (£) millions and complex OPEX. Typically used to remove low concentration N2 from produced natural gas streams, so not proven technology for high N2 concentrations (i.e. >50%) Energy intensive process to power liquefaction unit requiring further infrastructure. No known market availability for application for an exploration well context.	Yes

Option Description	Technology/ process	Description	Pros	Cons	Screen out of further BAT Assessment
	Non Cryogenic distillation	Pressure swing adsorption via membranes provides separation of gases without liquefaction.	Nitrogen separated from natural gas, thus increasing the CH4 concentration in the flare feed stream, thus increasing probability of combustion for a given methane gas flowrate during well cleanup Lower cost and energy in comparison to Cryogenic distillation.	Market applicability of technique is for long term production rather than short term exploration lifting (hours to days, possibly < 1 month). Unknown membrane performance with variable feedstock of gas from exploration well in a compressed time (seconds to minutes). Variability in methane/ nitrogen feed, means NRU design optimisation not possible. Require specific design assessment and engineering (if at all possible). No known operation or use on a shale gas exploration site.	Yes
	Composite membrane	Composite membrane selectively permeate methane and reject nitrogen	Gas stream of high concentration methane can be produced	At pilot stage only, not commercially available	Yes