HyNet North West

VERTEXHYDROGEN

HyNet Hydrogen Production Plant 1 – Technical Note

EPR Response – 2b – Flare Gas Recovery

Summary

Background

The potential use of a flare gas recovery system and high integrity relief valves is listed in the "Considerations & Guidance" section of Table 3-22: HPP Comparison Against Hydrogen Production BAT Guidance – Flaring. The guidance is reproduced from "Guidance for Establishing Best Available Techniques for Hydrogen Production from Methane and Refinery Fuel Gas with Carbon Capture", 7415737-0001 Rev R5. 20.4.2021"

The table describes what aspects have been included in the flare's design but does not address why others, such as flare gas recovery, have not.

Problem Statement

Confirm whether the blowdown system will include high integrity relief valves and a flare gas recovery system according to the requirements of Mineral Oil Refining BAT conclusion 56 or provide a detailed technical justification as to why such a system would not be suitable for the proposed plant.

Notes: BAT conclusion 56 includes flare gas recovery systems among the techniques to be considered as part of correct design of flares. Such a system might minimise air quality impacts, maximise raw materials efficiency and carbon capture performance of the plant. However, we haven't found any reference to such a system in the application.

Response

References:

Basis of Design (5194812-000-30EA-2-0001, Rev. 06)

Flare, Vent and Blowdown Philosophy (5194812-000-49EC-4-0003, Rev. 03)

P&IDs: 5194812-400-49DG10-4-0001/3 (Rev. 4)

Flare will be used only during start-up, shutdown, emergency and maintenance. During day-to-day plant operation, with no flow, air can enter the flare headers. Air thus getting inside flare header can produce an explosive mixture.

Least possible quantity of fuel gas will thus be continuously fed to the flare headers. This will produce smokeless flames ignited at the flare tips. Nitrogen will the back-up to fuel gas. When fuel gas supply pressure to flare header goes down, nitrogen will automatically flow into it.

The selection is a single raised flare stack on the Alcohols site serving all Phases 1 and 2. A common flare header will serve the plant with a LP and HP flare riser up the common stack. JM will include flare headers within the LCH and therefore only one branch per Phase joining the flare header.

Following points, of Table 3-22: HPP Comparison Against Hydrogen Production BAT Guidance – Flaring, are addressed:

1. Minimising emissions under start-up, shutdown, and abnormal operations – Means of achieving this include:
    1.1. use of flare gas recovery system with adequate capacity
    1.2. routing gas that would be flared to alternative users
    1.3. the use of high integrity relief valves
    1.4. other measures to limit flaring to other than normal operations
2. Monitoring and reporting of gas sent to flaring and associated parameters of combustion.

1. Minimising emissions under start-up, shutdown, and abnormal operations – use of flare gas recovery system with adequate capacity

    Flare gas recovery takes gases from very low pressures and supplies them at pressure to where they can be used. The typical duty of flare gas recovery requires positive displace type compressors such as rotary lobe or

screw machines. The reliability of these machines decreases with lack of use because of the contact between rotor tips and casing.

The HPP flares are not normally flowing as the plant is designed not to have leakage that would be supplied to flare. The flare is therefore likely to be only in operation during commissioning, start up, and shut down when the product gases are not of a suitable specification to be supplied to customers; or when there is an emergency and the gases from the plant require to be removed from the plant as quickly as possible.

Flare gas recovery is not appropriate for the application to emergency flaring as any disruption to gas flows could endanger plant and life; and any escalation of an incident could potentially pose an increased environmental consequence.

Flare gas recovery therefore would be appropriate for planned commissioning, start up, and shut down activities. These operations are intended to be intermittent; and therefore, there is a risk that the machinery required for flare gas recovery would not be available on demand.

Continuous flare gas recovery would be a different operating case with machinery in use; or cycled operation where there are duty and stand-by machines.

2. Minimising emissions under start-up, shutdown, and abnormal operations – routing gas that would be flared to alternative users

The fuel main within the Stanlow Manufacturing Complex already accepts waste gases from different units and accepted syngas from the Alcohols plant which occupied the site now being taken over by HPP; therefore the fuel gas main can accept refinery off gases, natural gas, syngas, and hydrogen produced by the HPP.

A work stream has been identified to maximise the use of start-up / shutdown / abnormal operation waste gas from HPP1 within the Stanlow Manufacturing Complex.

Where possible, hydrogen product gas which is out of specification for 3rd Party customers will still be used within Stanlow Manufacturing Complex, either through specific H2 converted burners, or by recovery into the Fuel Gas Main.

This will not happen when the refinery energy requirements are in balance (with minimum Natural Gas import), or the quantity of inerts in the waste gas reaches a critical level unsuitable for site fuel gas.

3. Minimising emissions under start-up, shutdown, and abnormal operations – the use of high integrity relief valves

The safety relief valves to be used for this project will have applicable Safety Integrity Level (SIL) rating. That would ensure the high integrity of relief valves installed.

4. Minimising emissions under start-up, shutdown, and abnormal operations – other measures to limit flaring to other than normal operations

As per answer 2.

5. Monitoring and reporting of gas sent to flaring and associated parameters of combustion

Flow measurement and reporting instruments will be installed on the flare headers. These will be upstream of flare stack. This will enable measurement and monitoring of the quantity of flared gases.