HyNet North West

VERTEX HYDROGEN

HyNet Hydrogen Production Plant 1 – Technical Note

EPR Response – 9ciii – BAT for Cooling

Summary

Problem Statement

Quantify the potential electrical power input demand reduction from selecting a more energy efficient cooling option (for example use of direct cooling or evaporative cooling towers).

Response

Further Development

A value engineering exercise shall be completed on the cooling circuit as part of the current engineering phase. This exercise shall examine the merit of possible alternative options for the cooling circuit such as replacing it with an evaporative cooling tower system.

Associated areas that would be reviewed shall be the evaporative cooling tower water circulation pump and fan electrical power demand, along with the development of heat integration and actual number of water-cooling heat exchangers to further improve the overall cooling system.

However, in the interim, the following paragraphs provide some guidance as to what could be envisaged as being completed during the value engineering exercise.

Current Design Basis

An air-cooled closed-circuit cooling system was specified in the HyNet Basis of Design [5194812-000-30EA-2-0001 Rev 6]. The BoD notes as the underlying reasons for this selection: "Limited raw water make up or continuous flow for cooling tower circuit or once through cooling system. No brine discharge route for cooling tower blowdown. Demin water from recycled effluent and raw water make up will be used to charge and top up system. Closed circuit allows us to better manage potential leakage of toxic and flammables from higher pressure process to lower pressure cooling medium."

Cooling Circuit Review Areas

Evaporative cooling towers require make up for continuous evaporation loss of water, for a 1900 m^3/hr capacity Cooling Tower (CT) there would be approximately 29m^3/hr of evaporation losses with additional blow-down loss based on cycle of concentration which depends on the solids content in the source water.

Additionally chemical injection & biological algae removal package cost for OPEX and CAPEX for storage and handling as well as disposal of spillage and cleaning as per source water solid content and algae formation.

Operational cost for cooler cleaning and maintenance and material selection based on composition and corrosion study need to be additionally monitored.

Limitations of water resource, water loss and treatment shall be reviewed as discussions are underway with United Utilities who provide the water resource.

There is a potential to reduce the power requirements using an evaporative cooling system. This could be as follows for the electrical equipment;

1. Cooling Medium circulation Pump and Cooling fans load could be reduced (current total 547 kW).
2. Reduction in gas compression duties (Hydrogen, CO_2) if water-cooled interstage coolers can slightly reduce the temperature of inlet gas (increasing the gas density).

However, this would be balance against any changes in the cooling circuit such as moving all air coolers to cooling medium heat exchanger units.

Therefore, the actual evaporative cooling water circulation pump and fan's electrical power demand shall be developed with respect to heat integration and actual number of water-cooling heat exchangers during further improvement and finalization of cooling system.

References Used:

[1] Appendix#2