

HyNet Hydrogen Production Plant 1 – Technical Note

EPR Response – 5d – Refinery BAT

Summary

Background

The comment relates to Application Table 3-15: HPP Comparison Against Refining of Mineral Oil and Gas BAT Conclusions – Combustion, where it is stated that “CO emissions will be minimised through the use of combustion control measures to ensure efficient combustion.” No detail is currently provided.

Interpretation – unburnt CO to atmosphere from combustion equipment.

Problem Statement

Refinery BAT 37. Provide a description of the proposed operating techniques to comply with BAT 37 of Refining Mineral Oil BAT conclusions (combustion operation control to reduce CO emissions).

Action

The comment applies to Project Datasheets for the Feed Fired Heaters (Document Number. 5194812-000-45ED-4-0003) and the MP Steam Boiler (Document Number, 5194812-000-45ED-4-0013) which both defined emission limits for the package.

The emission limits for the Feed Fired Heaters are shown below, taken from the note in the datasheet:

P2 Estimated Emissions to atmosphere via the fluegas stack. SUPPLIER shall confirm.				
	Units	NG firing (Start up)	Tailgas firing	
Flowrate – normal	kNm ³ /hr	22.6	22.6	
Flowrate – design	kNm ³ /hr	25.2	25.2	
Temperature	°C	140	140	
Composition				
Water	mol %		28.8	
Carbon Dioxide	mol %		2.47	
Oxygen	mol %		1.42	
NO _x (ppmv)	ppmv	80	80	
SO ₂ (ppmv)	ppmv	0.5	0	
Particulates	ppmv	5	5	
CO	ppmv	<5-30 (Indicative), <100	<5-30 (Indicative), <100	
Ammonia	ppmv	<5-15		
HCl	ppmv		<1-5 av samples/yr	
HF	ppmv		<1-2 av samples/yr	
PCDD/F	ppmv		<0.012 - 0.036 ng l-TEQ/Nm ³	
VOC	ppmv		0.6 - 12	

The emission limits for the MP Steam Boiler are shown below, taken from the note in the datasheet:

P2 Estimated Emissions to atmosphere via the fluegas stack. SUPPLIER shall confirm.				
	Units	NG firing	Tailgas firing	
Flowrate – normal	kNm ³ /hr	24.9	24.9	
Flowrate – design	kNm ³ /hr	30.8	30.8	
Temperature	°C	140	140	
Composition				
Water	mol %		30.35	
Carbon Dioxide	mol %		2.3	
Oxygen	mol %		1.39	
NO _x (ppmv)	ppmv	20	20	
SO ₂ (ppmv)	ppmv	0.5	5-35	
Particulates (yearly average)	ppmv	5	5	
CO	ppmv	<5-30 (Indicative), <100	<5-30 (Indicative), <100	
Ammonia	ppmv	<5-15		
HCl	ppmv		<1-5 av samples/yr	
HF	ppmv		<1-2 av samples/yr	
PCDD/F	ppmv		<0.012 - 0.036 ng I-TEQ/Nm ³	
VOC	ppmv		0.6 - 12	

The CO limit for both packages requested is <100ppmv, this is inline with the Best Available Techniques (BAT) Refining of Mineral Oil and Gas. BAT 37 asks for combustion control to reduce CO emissions, the datasheets do not ask how this will be done.

Kent received proposals for the Feed Fired Heaters from two (2) vendors during the FEED stage:

- Verga Engineering
- BIHL

Kent received proposals for the MP Steam Boilers from two (2) vendors during the FEED stage:

- Rentech
- Macchi

All Vendors were asked to provide details of how CO emissions will be minimized through the use of combustion control measures to ensure efficient combustion, response provided below:

Verga Engineering: CO emissions will be below the required level of 100mg/Nm³ but expected values are normally well below this level. This is minimized by the proper excess air regulation to the burner and design of the burner ensuring proper mixing of fuel and air.

With reference to control of the air different strategies can be proposed and considered. The current proposal is based on natural draft burners with manual regulation (very reliable and common) but could be modified by adding an automatic regulation of the air by adding a common plenum to the burners with actuated dampers or installing forced draft burners and relevant forced draft fans.

All the above options are valid and commonly applied. The choice would have to be driven by the frequency of load variation (variation of heater load requires variation of settings in the air registers position on the burners) and “push” to minimize excess air increasing the overall efficiency.

BIHL: Minimising CO is an integral part of the burner design and as long as the heater is operated within excess air specifications we would have no issue guaranteeing CO values between Normal and design heat release. The only time CO becomes a concern is in cold furnaces (below ~675degC) such as at turndown or during startup, at these times CO levels will increase.

Rentech: In the Rentech fully sealed furnace, CO emissions will be very low on natural gas, and especially low on the H2 rich fuel. In addition to the full metering fuel/air ratio controls on this type boiler, an oxygen analyzer is used to monitor the stack O2 level for good combustion conditions.

Macchi: No response as yet.

All the Vendors who replied can meet the requirements and can use combustion control to reduce the CO emissions.

Response

Summary

The project datasheets have been marked up ready for the next issue. The Burner Management System will be Vendor specific and further details of its operation will be requested during Detailed Design.

Updates to Design

Updates are required to the project datasheet (Document No. 5194812-000-45ED-4-0003) as follows:

ADD: Note M7, to ensure the Vendor provides details of the proposed combustion operating techniques to reduce CO emissions and comply with BAT 37 of Refining Mineral Oil BAT conclusions.

Updates are required to the project datasheet ((Document No. 5194812-000-45ED-4-0013) as follows:

ADD: Note M4, to ensure the Vendor provides details of the proposed combustion operating techniques to reduce CO emissions and comply with BAT 37 of Refining Mineral Oil BAT conclusions.

These are shown as red line markups in Attachment 1 and 2.

ATTACHMENT 1: Project Datasheet Red Line Mark-Up

(Datasheet No. 5194812-000-45ED-4-0013)

ATTACHMENT 2: Project Datasheet Red Line Mark-Up

(Datasheet No. 5194812-000-45ED-4-0003)