

HyNet Hydrogen Production Plant 1 – Technical Note

EPR Response – 18a - Safety Studies

Requirement

18(a) – Accident Risk Assessment (ENVID).

Provide an explanation of why item 1.4 – ‘Release of hydrogen’ has been assessed as a Risk Severity of 1.

Notes: We would expect higher risk ranking for a loss of containment leading to the release of hydrogen, given the potential escalation into a fire.

Response

ENVID Review

The ENVID was documented in the ENVID Report 5194812-000-4EER-4-0004 revision 03. The finding of the ENVID in was that an equipment or pipework failure leading to loss of containment would result in a release of hydrogen. For environmental purposes the release of hydrogen would be a permit breach and environmental damage as hydrogen is an indirect GHG.

Assessment

A risk severity of 1 was assigned – considered as an Incidental level as opposed to Serious assigned to leakage of Natural Gas, Syngas, and Carbon Dioxide. Considerations which applied to the release of the different gases were:

- Natural gas has a high GHG potential and there is a significant mass in the plant. As shown in the assessment table below, the GHG potential multiplied by the mass, results in the highest GHG impact of the potential releases.
- Syngas contains carbon monoxide (CO) which is toxic at low concentrations, and therefore would have an immediate impact on the environment posing an immediate threat to ecology in the vicinity of the plant.
- Carbon dioxide (CO₂) is the main GHG of concern for our planet due to the volumes being released by humanity, although having a lower GHG potential than many other industrial gases.
- Hydrogen (H₂) is not a direct greenhouse gas; it disrupts the distributions of methane and ozone, the second and third most important greenhouse gases after carbon dioxide, because hydrogen reacts with tropospheric hydroxyl radicals, and therefore hydrogen is considered an indirect GHG. The assessment of hydrogen’s GHG potential and mass is an order of magnitude lower than syngas and carbon dioxide which resulted in the lower assessment of severity by the team attending the ENVID workshop.

Table Error! No text of specified style in document.-1Assessment of Environmental Severity of Release

Gas	Notes Against Assessment	GHG Potential	Mass In Plant (Tonnes) ¹	Assessment = GHG pot x mass
Natural Gas (or Refinery Off Gas)	Contribution to global warming and climate change. Serious permit breach, prohibited activity.	25 ²	13.2	330

¹ Hazardous Substances Schedule, 5194812-000-30AL-4-0004, revision 04

² "Report of the Conference of the Parties on its 19th Session" (PDF). UNFCCC. 2014-01-31. Retrieved 2020-07-01.

Gas	Notes Against Assessment	GHG Potential	Mass In Plant (Tonnes) ¹	Assessment = GHG pot x mass
Syngas	Toxic release leading to immediate harm to ecology and environment	3.2 ³	4.5	14.4
Carbon Dioxide	Contribution to global warming and climate change. Serious permit breach, prohibited activity.	1	19.5	19.5
Hydrogen	Permit breach. Hydrogen is an indirect GHG	4.3 ⁴	1.5	6.45

Loss of Containment Leading to Fire

The clarification advises that “We would expect higher risk ranking for a loss of containment leading to the release of hydrogen, given the potential escalation into a fire.”

It is confirmed that this was covered two pages further on to the assessment of release of hydrogen as can be seen in the following extract of the ENVID. Loss of containment leading to fire, including the combustion products from the accident such as heavy metals, smoke, and particulates, has been assess as 4 – Major.

Figure Error! No text of specified style in document. -1 Extract of ENVID

HyNet Low Carbon Hydrogen Plant

PROJECT DOC NO: 5194812-000-4EER-4-0004		REVISION: 03		DATE: 02-02-2021								
MEMBER DOC NO: 805459-00014-4E-REP-0006		REVISION: C1		PAGE: 22 of 32								
DOCUMENT TITLE: ENVID REPORT												
No.	Guideword	Event / Cause	Consequences	Environmental Impact				Safeguards / Controls	Action	By	Number	Comment
				Pathway	Receptor	Routine Operation or Incident	RAM Env Severity					
1.5.13			Catalyst in fixed bed released. (nickel and molybdenum, zinc oxide, copper, alumina). Heavy metal contamination of water and/or land, toxic to aquatic life. Significant and localised contamination.	land/water	freshwater	Incident	3					
1.5.14			Release of water treatment chemicals i.e. sodium hypochlorite, sodium hydroxide and sulphuric acid (25%). Typically stored in 1 m ³ IBCs.	land/water	freshwater	Incident	2	Bunding Drainage system Inventory control				
1.5.15			Combustion products produced from a major fire on site. E.g. heavy metals, smoke, particulates.	air	widespread habitat	Incident	4	Flare system Firefighting and emergency response Equipment design conditions Impact protection Site layout Inventory Control				

The design of the hydrogen plant includes a number of safeguards to protect the environment from such an accident:

- Flare system
- Firefighting and
- emergency response
- Equipment design
- conditions
- Impact protection
- Site layout
- Inventory Control

³ Assumption based on concentration in syngas verses GHG potential of component.

⁴ Derwent, R.G. (2018-10-07). "Hydrogen for Heating: Atmospheric Impacts. A literature review" (PDF). BEIS Research Paper (2018:21).