

# Syngas plant features relevant to process safety environmental sciences essay



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## **Safety of the Process From Natural Gas to Syngas Plant**

### **INTRODUCTION**

The growing acceptance of the aftereffect of carbon dioxide emissions on all-around abating has sparked development of an amount of technologies for decreasing the energy's production impact. One of the technologies arising is that natural gas being used for energy generations, and accurately the use of gasification to creating a syngas for use in electricity generation, and potentially accessible heat. The energy Industry has a able-bodied authentic specific set of safety issues related to steam pressure, combustion, turbines, power distribution and generators, which are well controlled and well understood with techniques, and standards in place. Though, the Gasification

introduces an accomplished new series of issues in safety akin more towards chemical process plants.

## **TECHNICAL SAFETY DISCUSSION**

### **Syngas Plant Features Relevant to Process Safety**

This includes the features accordant to safety of the process which is common to plants of syngas which converts natural gas into a product gas. This includes biomass gasification. The combustible syngas produced during gasification and pyrolysis is made up of carbon monoxide and hydrogen. Temperatures in process of gasification are typically high, and comparable to the conventional incineration, higher in some cases." During start-up and shutdown of the gasification reactor, syngas quality may not be adequate for combustion in the downstream boiler (alternatively, gas turbine or gas engine), in which case flaring will be required" (Elsdon, 2011) Whilst incineration and pyrolysis processes typically work at around atmospheric pressure, pyrolysis and process of gasification pressure can range from a little sub-atmospheric to comparatively high pressure. Processes Pyrolysis operates in the absence of oxygen, and in a static atmosphere like nitrogen. In process of gasification, oxygen addition is controlled to give a ratio of stoichiometric less than one to achieve limited oxidation. Schemes would involve alternatively the use of an gas engine or gas turbine generator in place of the steam turbine generator and fired boilers.

### **Challenges in the Development of a Basis of Safety**

The use safety techniques in process industry have identified numerous key issues relating to design of syngas plant." It is important that the necessary

features have been incorporated into the design at an early stage to ensure that the plant is safe, and meets the standards which are applicable to the hazards present." (Elsdon, 2011)The most serious process safety issues related to syngas plants are hazards of explosion, fire hazards and toxic gas. Special requirement is also required for start-up and shutdown.

## **Explosion hazards**

Internal explosion, external explosion and overpressure are relevant here. Due to different scenarios overpressure could arise. The chance of either internal or external explosion depends on whether the gasifier operates at under pressure or overpressure respectively. In case of under pressure, there is a risk of air ingress and an explosion may occur in a particular plant section. Sources of ignition within equipment are expected to be, a key for explosion prevention measure like gasifier is avoidance of an explosive environment. Oxygen is required to syngas level in addition being in filmable range, in order for an explosion to occur. An alarming situation may occur in case of uncontrolled intake of air, plant start-up or plant shutdown, due to leakages for instance. Another Important prevention measure to avoid air intake is gas tightness, which may lead to the creation of an explosive blend inside equipment." Appropriate protection measures are design for containment and explosion venting. A single vessel operating at atmospheric pressure would need to be able to withstand an explosion/deflagration pressure of at least 7 bar (i. e. the maximum for hydrogen)." (Elsdon, 2011)There is a risk of escape of gas to the atmosphere, which may cause an external explosion. So to avoid gas escape, gas tightness is very important

and the use welded connection is preferred to achieve gas tightness in particular hot pipes.

## **Fire hazards**

Due to the formation of the flammable mixtures outside and inside the equipment, possible fire hazards arise. Gasification process nature means that controlled localized " combustion zones" and ignition sources are usually present within the equipment. In case of under pressure, there is a risk of air ingress and an explosion may occur in a particular plant section. In sections of plant where build up pressure exists, there is a risk of escaping of gas to atmosphere, which causes an external fire." Syngas from gasification can auto-ignite at temperatures above about 600 - 650°C." (Elsdon, 2011)

## **Toxic gas**

The process of syngas produces highly flammable gaseous components, including carbon monoxide and which contains a very toxic gas, hydrogen. Where pressure build up exists in sections of plant, a risk of escaping gas to the atmosphere, which may cause toxicities in the atmosphere. So here also, gas tightness is very important to make sure control and avoidance releasing toxic gas. To prevent explosive atmosphere the outside areas of the equipment must be sufficiently ventilated, but also to make sure that there is no toxic atmosphere to cause poisoning the employees from carbon monoxide. To detect possible leaks there should be detection equipment provided. Though the main risk is due to toxic liquids and toxic gas, solids are also related.

## **Start-up and shutdown aspects**

At start-up afterward a continued shutdown, oxygen needs to be detached from the plant by purging. Afterward shutdown, the gasification area of the plant will about be aloft the auto-ignition temperature. Unless a hot restart can be agitated out in a short time, purging is required to ensure the plant is captivated in a safe state of shutdown." In the gasification process, oxygen, often in the form of air, is deliberately introduced into equipment which contains a flammable gas. Any leak can either admit air to the flammable gas, or allow flammable/toxic gas to escape." (Elsdon, 2011) During shut down and start up of the reactor, syngas quality may not be able for agitation in the downstream boiler; in that case flaring is required. Typical automatic plant emergency shutdown measures, like in the high temperature in the section of gasification, would be shutdown of the gasifier itself, including continually decay increase and shutting off the supply of air.