Blast Furnace Top Gas Water Treatment

EKO – Stahl
Eisenhüttenstadt
Germany

Manufacture of pig iron in blast furnaces, as well as most other crude iron manufacturing methods, produces process gas that is heavily contaminated with dust and always contains large amounts of carbon monoxide (CO) as a result of the highly reducing process conditions, together with hydrogen cyanide (HCN) and carbon dioxide (CO_2). Process gas cleaning by wet scrubbing results in the wash water absorbing appreciable quantities of these gases along with the dust. In view of strict environmental pollution control requirements all modern blast furnace plants employ a closed-circuit wash water recirculation system. A plant of this type was designed and constructed by Lurgi Bamag as a turnkey project for No. 5A blast furnace at EKO Stahl GmbH in Eisenhüttenstadt, Germany.

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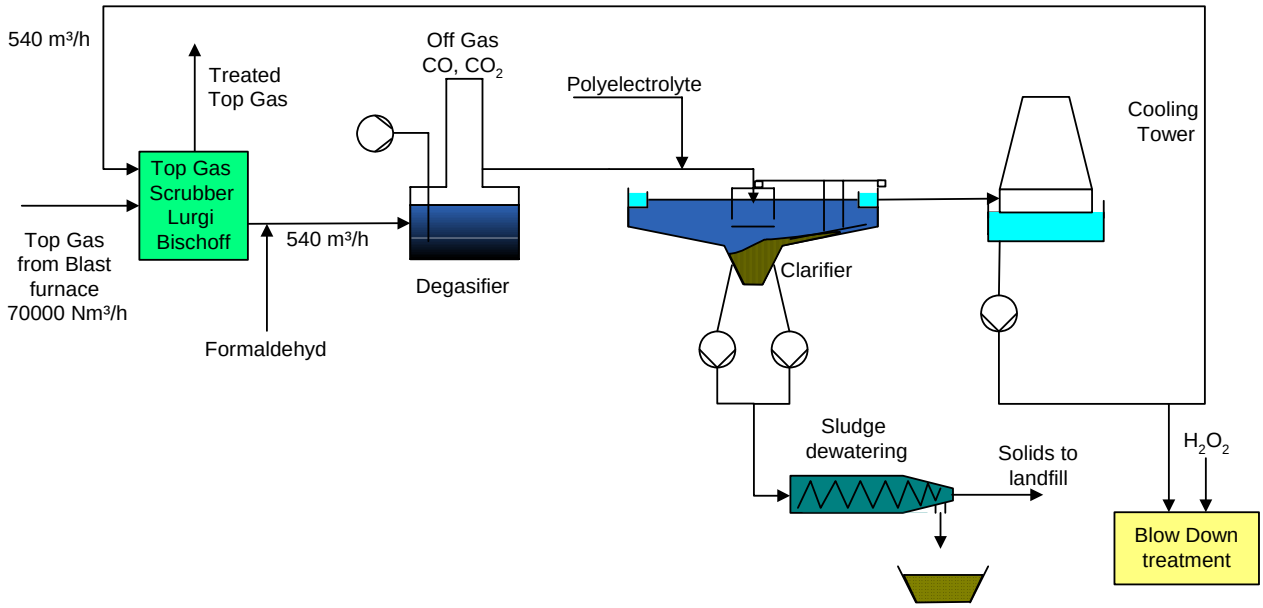

1. Objective

Treatment of the scrubber water of a hot blast furnace top gas cleaning system.

2. Plant concept

Process steps:
Degasification, Sedimentation, Cooling, Sludge dewatering
Brief description

2.1 Degasifier

The wash water first enters a de-gasifier, in which the containing highly toxic carbon monoxide and free carbon dioxide are removed by an upward flow of stripping air. The off-gas is discharged to a safe place through a stack.

2.2 Clarifier

After leaving the degasifier, the water is flocculated with poly-electrolyte and routed to a clarifier-thickener, in which the suspended flocculated solids settle out by sedimentation.

2.3 Cooling Tower

The clarified water runs to an evaporative cooling tower and is cooled to a temperature below 30°C. From the cold well, to which fresh make-up water is added at a controlled rate to compensate losses, the clean wash water is recirculated to the scrubbing process by a pump, thus closing the circuit.

2.4 Carbon monoxide degassing

Connection between the top gas scrubber and degasifier is made by an enclosed pipe installed on a bridge and fitted with cleaning ports. Following degassing, the CO measurable above the open water surfaces is no more than trace level (less than 2 ppm), quite in contrast to treatment systems that have no degasifier, where the CO level can frequently exceed 50 ppm or much higher in wafts of gas.

Containing the CO-contaminated wash water exiting the blast-furnace top gas scrubber in an enclosed pipe - as distinct from common past practice of using open channels allowing free escape of the gas - and degassing the water with controlled release of the off-gases through a stack at a safe height makes a very substantial contribution to workplace health and safety.

2.5 Carbon dioxide degassing

Free carbon dioxide is also stripped from the water in the degasifier, reducing scale formation in the cooling tower to a level at which it can readily be controlled by chemicals (antiscalants). This adds considerably to the reliability of blast furnace operation.

2.6 Hydrogen Cyanide Removal

Before entering the degasifier, the wash water is measured for free CN-ions by a novel analyser system used for the first time for continuous industrial monitoring. Formaldehyde solution is added to the wash water at a controlled rate to chemically combine the free CN- ions, forming glyconitrile which gradually decomposes in the aqueous solution to carbon dioxide and water, both harmless products.