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NCG INCINERATION SYSTEM FOR PULP MILL

SITUATION

In 1992, Louisiana-Pacific Corporation in Samoa, California purchased a non-condensible gas (NCG) incineration system for odor control and steam generation in the pulp mill. The system was designed to handle a maximum heat release of 28 mm btu/hr from the combustion of natural gas, non-condensible waste gas containing malodorous sulfur compounds, turpentine, and (future) No. 2 fuel oil.

Adjusting the natural gas flow based on combustion temperature controls combustion. The incinerator is equipped with a waste heat boiler and economizer to produce 160 psig steam and a caustic scrubber to remove sulfur dioxide from the flue gas.

According to Louisiana-Pacific plant personnel, the existing burner system was less than satisfactory. The design reportedly experienced flashbacks (not uncommon with highly flammable NCG's), frequent plugging requiring shutdowns, and premature deterioration. Since Louisiana Pacific was planning to redesign the NCG collection system, they decided to look at replacement of the burner at the same time.

The new NCG system would provide three separate streams: high concentration NCG's, stripper off gas, and low concentration NCG's. Each would require a separate burner type (in a common wind box) with supplemental natural gas firing.

Name: Louisiana-Pacific Corporation
Location: Samoa, California
Process: Incineration of Non- Condensable Gases
New Burner: Coen DAZ-20 with Gas Ring, Interzone Scroll, Center Fired Nozzle, and External Scroll
Fuels: High Concentration NCG's
Low Concentration NCG's
Stripper Off-Gas
Natural Gas
No. 2 Oil (future)
Heat Release: 28 MM BTU/HR

SOLUTION

After two meetings with Louisiana-Pacific plant personnel and their consulting engineering firm, an order was placed for a new custom Coen burner to replaced the existing model. The unit is designed to reuse the existing primary and secondary air fans.

The high concentration NCG's are burned in an interzone scroll. The low concentration dilute NCG's are injected in a multitude of external ports, each one in the middle of a secondary air port, and a relatively low quantity of stripper off-gas is burned in a center fired nozzle as shown in the above diagram. The existing flame safety and control system was modified and reused.

RESULTS

Initial start up and operation to date have been very successful. ***All three streams have been burned in widely varying ratios with no problems***. There have been no reports of combustion instability, flashback, plugging or premature failures of any type.

TECHNICAL DATA ON NCG'S

Disposal of malodorous NCG's from the kraft paper making process in pulp and paper mills is always a concern if present and future environmental regulations are to be met. The present technology for treating these NCG's involves incineration in the lime kiln, the power boiler, the recovery boiler, or as in this case a stand alone thermal oxidizer.

The human detection threshold is as low as one part per billion (ppb) for reduced sulfur gases. NCG's are not only noxious but also very hazardous due to their wide limits of flammability, low auto-ignition temperature, and high flame speed. NCG's are also highly corrosive due to the sulfur compounds and water vapor in the stream.

The primary sources of NCG's in a kraft mill are digesters, evaporators and turpentine recovery systems. Kraft mill odor can be attributed to four reduced sulfur gases, namely: hydrogen sulfide (H_2S), methyl mercaptan (CH_3SH), dimethyl sulfide (CH_3SCH_3), and dimethyl disulfide (CH_3SSCH_3). Collectively they are referred to as total reduced sulfur (TRS) gases.

Volatile organic compounds (VOC) other than those containing sulfur are also emitted during digester relief. Typical constituents are alcohols, terpenes, and phenols. Table I shows a typical analysis of an NCG stream, and Table II is a summary of combustion properties.

NCG streams can be produced in either batch or continuous digesters. They are typically in either a concentrated or dilute state to avoid explosive mixtures. Concentrated NCG's (LHVC - Low Volume, High Concentration) are usually conveyed by steam eductors. Dilute NCG's (HVLC - High Volume, Low Concentration) are diluted with air and usually conveyed by fans. Many NCG incineration systems need to handle both streams from either a continuous flow or a non-continuous flow from a batch process.

FLOW DIAGRAM NCG INCINERATION SYSTEM

Table I
Typical Non-Condensible Gas Analysis By Volume, %

H_2S	1.7
CH_3SH	2.1
CH_3SCH_3	2.1
CH_3SSCH_3	1.7
Turpentine	0.1
Methanol	0.2
Water Vapor	6.0
Nitrogen	77.2
Oxygen	8.9

Table II
Combustion Properties of
Non-Condensible Gases (2,3)

	Explosive Limits in Air			
Compound	Lower Volume %	Upper Volume %	Flame Speed, ft/s	Auto-Ign. Temp. F
H_2S	4.3	48.0	---	500
CH_3SH	3.9	21.8	1.8	---
CH_3SCH_3	2.2	19.7	---	400
CH_3SSCH_3	7.8	50.8	---	---
-pinene	0.8	--- 500	486	
Methanol	6.7	38.5	1.6	878
*NCG	2.0	50.0	---	---

*Generally accepted value for combined gases

REFERENCES
Design Considerations for High-Concentration, Low-Volume Noncondensible Gas Systems, TAPPI Journal, Vol. 67, No. 9, Sept. 1984

Firing of Non-Condensible Waste Gas Streams in Stand Alone Modular Incineration Systems, R. Santos & J. Backlund 1992 Incineration Conference, Albuquerque, New Mexico

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