R & D facts

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National Energy Technology Laboratory

Gasification Technologies

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Gas Process Development Unit

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Capabilities

The Gas Process Development Unit (GPDU) at NETL fills the strategic role of bridging the gap between past/current small-scale testing and future large-scale demonstrations of bulk sulfur removal from synthesis gas generated in gasification-based processes. With the capability for both fluid-bed and transport reactor contacting, the project provides a site for testing/proving gas desulfurization process configurations and demonstrating sorbent suitability. Process conditions can be adjusted to anticipated commercial applications in terms of temperatures, pressures, gas compositions, gas velocities, and sorbent cycling.

The project uses a coupled configuration with continuous circulation of a desulfurization sorbent between the absorption (fuel gas) and regeneration (air) sides of the process. Specially fabricated high-temperature slide valves in the circulation standpipes regulate the flow (circulation) of sorbent between the absorber and regenerator. Inert gases (steam and/or nitrogen) are used to fluidize the sorbent in the standpipes above the valves and to prevent fuel gas and air intermixing. Removable spool pieces and piping along with other vessel design features (such as submerged/freeboard risers and underflow/overflow standpipes) have been incorporated to expand potential testing capabilities. Since both the absorber and regenerator sides have fluid-bed and transport reactor capabilities, four principle configurational modes of operation are possible. Sorbent is circulated by reactant gases (i.e., fuel gas and air) in transport reactor modes and inert gases in fluidized-bed modes.

A natural gas-fired Syngas generator supplies the GPDU with simulated coal gasification fuel gas. The simulated coal gas is a mixture of partially-combusted natural gas (H_2, CO, CH_4, etc.), water, carbon dioxide, and reduced sulfur species (H_2S, COS).

Opportunities

The GPDU team is interested in developing a partnership, or joining a consortium, to perform testing, research and/or development that will make energy more economical or benefit the environment. Applications other than hot or warm gas desulfurization may require retrofit of the GPDU.

Gas Process Development Unit

Absorber
Fluid bed: 18 in. i.d. x 10-ft bed
Transport: 5.2 in. i.d. x 50-ft length

Regenerator
Fluid bed: 10 in. i.d. x 12-ft bed
Transport: 1.7 in. i.d. x 50-ft length

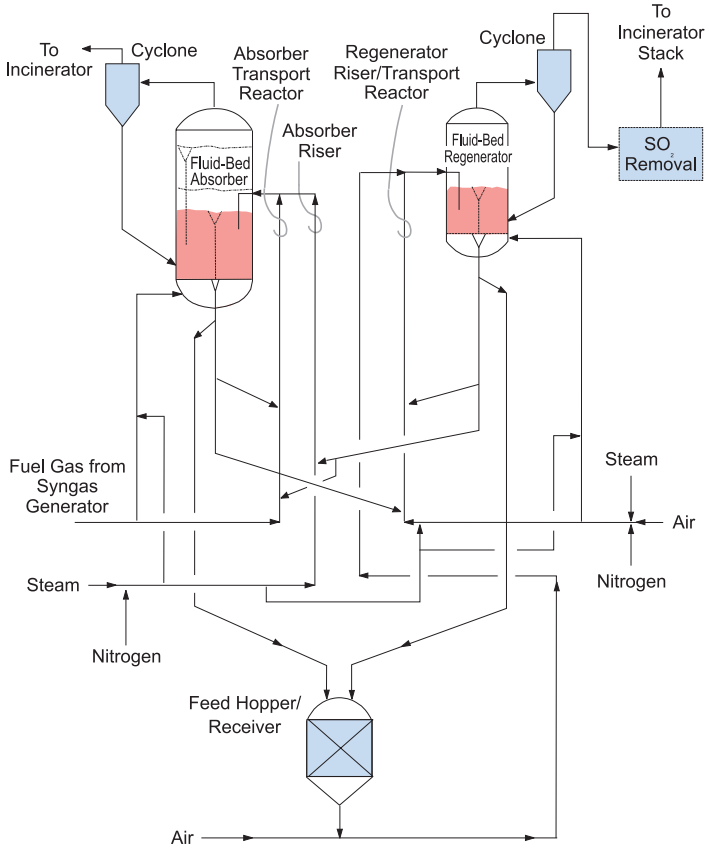
Typical Gas Velocity
Fluid bed: 1-3 ft/s
Transport: 15-20 ft/s

(i.d. = inside diameter)

Key Parameters

Absorption temperature	1,000 - 1,200º F design
Regeneration temperature	1,100 - 1,400º F design
Operating pressure	400 psia maximum
H_2S concentration	0.5 - 1 vol% typical
Sorbent circulation rate	2,000 - 5,000 lb/hr typical
Sorbent inventory	1,000 - 3,000 lb typical
Sorbent cycles per day	50 - 100 typical
Sorbent size	50 - 300 µm typical
Fuel gas flow rate	60,000 - 120,000 scf/h typical (3,700 - 7,500 lb/h typical)

GPDU Flow Diagram



Note: Only major interconnections shown

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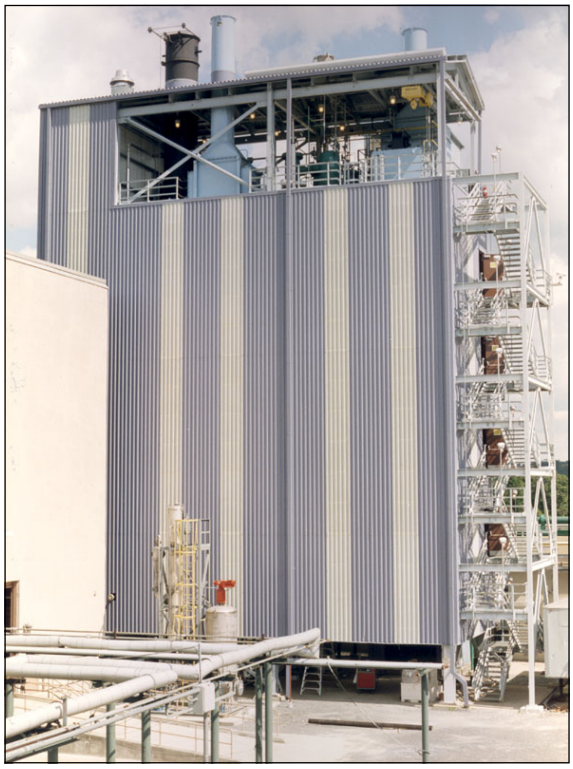

The GPDU