

U.S. Department of Energy • Office of Fossil Energy
National Energy Technology Laboratory

Major Environmental Aspects of Gasification-Based Power Generation Technologies

Final Report



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Mercury Emissions Control

Several commercially available technologies, using sorbents such as activated carbon, have already been successfully applied to gasification applications, as well as other gaseous hydrocarbon streams.

Mercury Emissions Control

- UOP Corporation has a commercial product that is in wide use in natural gas/NGL and LNG (liquified natural gas) plants called HgSIV.
- It is a molecular sieve (MS) that removes very low levels of elemental mercury from natural gas or syngas via a regenerable adsorption process.

Mercury Emissions Control

- Eastman Chemical Company has developed and successfully applied activated carbon-based mercury control technology at their Chemicals from Coal Facility located in Kingsport, Tennessee.
- Eastman has been operating Chevron Texaco gasifiers at this facility since 1983 to provide syngas for the production of acetyl chemicals.

They utilize Calgon's HGR-P sulfurim pregnated, pelleted activated carbon beds with the following performance characteristics:

- Operating conditions: Approximately 30oC (86o F) and 900 psi
- Gas contact time in bed: Approximately 20 seconds (based on total packed volume)
- Removal efficiency: Ranges from 90 to 95%
- Carbon lifetime: 12 to 18 months based on a buildup in pressure drop, a buildup in water in the bed, or a buildup of other contaminants.
- Eastman Chemical operates their carbon beds ahead of the sulfur recovery unit. The use of dual beds, (i.e., two beds in series) should be capable of achieving carbon removal levels of greater than 99%.

Cost of Mercury Control

- Based on Activated Carbon Adsorption
- \$3,412 per pound of mercury removed

TABLE 2-22. COMPARISON OF AIR EMISSIONS FROM GASIFICATION-BASED AND COMBUSTION-BASED POWER GENERATION TECHNOLOGIES

CRITERIA POLLUTANTS, IONIC SPECIES AND CARBON DIOXIDE	CONVENTIONAL PC-FIRED PLANT WITH ADVANCED POLLUTION CONTROLS ^a	AFBC ^b (WITH SNCR)	PFBC ^c (WITHOUT SNCR)	IGCC PLANT ^d (WITHOUT SCR)	COMBUSTION-BASED REGULATORY LIMIT
SO ₂ , lb/10 ⁶ Btu (lb/MWh)	0.2 (2.0)	0.4 (3.9)	0.2 (1.8)	0.08 (0.7)	1.2 (N/A)
NO _x , lb/10 ⁶ Btu (lb/MWh)	< 0.15 (< 1.6)	0.09 (1.0)	0.2 – 0.3 (1.7 – 2.6)	0.09 (0.8)	0.5 (N/A) (after 1978) 0.15 (1.6) (after 1997)
PM10, lb/10 ⁶ Btu (lb/MWh)	< 0.03 (< 0.3)	0.011 (0.12)	0.015 – 0.03 (0.13 – 0.26)	0.011 (0.10)	0.03 (N/A)
Chloride as HCl (lb/MWh)	0.01	0.71	0.65	0.007	None
Fluoride as HF (lb/MWh)	0.003	0.05	0.05	0.0004	None
Cyanide as HCN (lb/MWh)	0.0003	0.005	0.005	0.00005	None
Ammonia (lb/MWh)	0	0.001	0.001	0.004	None
CO ₂ , lb/kWh	2.0	1.92	1.76	1.76	None