Summary of Studies on Emissions of Polycyclic Aromatic Hydrocarbons (PAHs) and Nitrous Oxide (N2O) and Carbon Monoxide (CO) from Waste Coal Fluidized Bed Combustors (FBCs)

FBC plants operate at lower temperatures than conventional coal power plants. [2,3,4,5] FBC plants use low oxygen (excess air) levels (to reduce NOx formation). [2] Low oxygen levels and the lower temperature range used by CFB plants increases emissions of carbon monoxide. [2] The lower operating temperature leads to far higher emissions of nitrous oxide (N_2O), as much of the nitrogen that would otherwise form nitrogen oxides (NOx) get converted to nitrous oxide, which is a potent global warming gas -- causing FBC boilers to emit 15% more greenhouse gas pollution than conventional boilers. [2,7] High sulfur and high chlorine levels are found in western PA gob. [8]

Most PAHs are known to cause cancer in animals and are suspected to cause cancer, birth defects and a wide variety of other health problems in humans. A waste coal power plant burning western Pennsylvania gob using FBC technology is likely to release higher levels of PAHs, for several reasons:

- Lower oxygen levels used in FBC plants cause increased PAH emissions. [1,2,4,6]
- Lower temperature ranges used in FBC plants contribute to increased PAH emissions. [2,3,4,5]
- Use of limestone injection increases PAH emissions. [1,2]
- High sulfur and high chlorine levels in western PA gob contribute to increases PAH emissions. [1]
- Use of low-rank coal can increase PAH emissions [3,5]

At the low oxygen levels used in FBC plants, the PAHs will mostly affect the local community. [2] Low-rank coal PAH air emissions are far more toxic than high-rank coals. [3] More PAH emissions end up in the air than in the ash.[3,5]

PAHs are not soluble in water and don't show up in leach tests. [3,4] FBC ash has higher surface area than conventional coal power plants (this means more leaching). [4]

Footnotes:

[1] Kunlei Liu, Wenjun Han, Wei-Ping Pan and John T. Riley, "Polycyclic aromatic hydrocarbon (PAH) emissions from a coal-fired pilot FBC system," Journal of Hazardous Materials, Volume 84, Issues 2-3, 29 June 2001, Pages 175-188.

[2] A. M. Mastral, M. S. Calln and T. Garcia, "Toxic organic emissions from coal combustion," Fuel Processing Technology, Volume 67, Issue 1 , June 2000, Pages 1-10.

[3] M. Callen, E. Maranon, A. Mastral, R. Murillo, P. Salgado and H. Sastre, "Ecotoxicological Assessment of Ashes and Particulate Matter from Fluidized Bed Combustion of Coal," Ecotoxicology and Environmental Safety, Volume 41, Issue 1, September 1998, Pages 59-61.

[4] Kunlei Liu, Rebecca Heltsley, Daozhong Zou, Wei-Ping Pan, and John T. Riley, "Polyaromatic Hydrocarbon Emissions in Fly Ashes from an Atmospheric Fluidized Bed Combustor Using Thermal Extraction Coupled with GC/TOF-MS," Energy & Fuels, 2002, 16(2), 330-337.

[5] Ana Mara Mastral, Marisol Calln and Ramn Murillo, "Assessment of PAH emissions as a function of coal combustion variables," Fuel, Volume 75, Issue 13, October 1996, Pages 1533-1536.

[6] Mastral, A. M. ef al. DGMK Tagungsber, "Unwanted volatile organic compounds (VOCs) from coal fluidized bed combustion," 1997, 9703, (Proceedings ICCS '97, Volume 2) 1087-1090. [see first abstract in the list]

[7] "Coal-Related Greenhouse Gas Management Issues," National Coal Council, May 2003, p7.

[8] 1999 Information Collection Request, U.S. Environmental Protection Agency (data includes chlorine and sulfur levels in coals and waste coals throughout he U.S.). Raw data available here: http://epa.gov/ttn/atw/combust/utiltox/utoxpg.html#TECR Summarized data available here: http://www.energyjustice.net/coal/wastecoal/epa-icrdata.html Data shows that western Pennsylvania gob has the second highest chlorine levels of any coal or waste coal in the U.S. and sulfur levels far above national averages for coal and waste coal and 21% above the sulfur levels in western PA bituminous coal.

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