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Research and Development

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Project Summary

Effects of Changing Coals on the Emissions of Metal Hazardous Air Pollutants from the Combustion of Pulverized Coal

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Tests were conducted at the U.S. Environmental Protection Agency's Air Pollution Prevention and Control Division (APPCD) in Research Triangle Park, NC, to evaluate the effects of changing coals on the emissions of metal hazardous air pollutants from coal-fired boilers. The objectives of the tests were to determine how the emissions of metal hazardous air pollutants would change if low sulfur coals were substituted for higher sulfur coals and to measure the correlation between emissions from a small scale combustor and emissions from a full scale utility boiler burning the same coal. The tests were funded by the Illinois Clean Coal Institute.

This Project Summary was developed by EPA's National Risk Management Research Laboratory's Air Pollution Prevention and Control Division, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Overview

The small scale tests were conducted on APPCD's 29 kW (100,000 Btu/hr) Innovative Furnace Reactor (IFR), and samples were taken prior to any pollution control equipment to allow application of different control efficiencies to the uncontrolled emissions. Six coals were burned in the IFR under similar combustion conditions, and each coal was sampled for 10 metals: antimony, arsenic, beryllium, cadmium, chromium, lead, manganese, mercury, nickel, and selenium. Each of these metals is on the list of 189 compounds and compound classes listed as hazardous air pollutants under Title III of the 1990 Clean Air Act Amendments. The six coals included two Illinois bituminous coals with an average sulfur content of 2.23% (the high sulfur coals in this test program), two western subbituminous coals with an average sulfur content of 0.57%, and two other coals used in full scale test programs. The final two coals were chosen to allow a direct comparison of the small scale results to full scale emissions tests.

No general correlation was found between sulfur content and metals emissions for the six coals tested. This result is in agreement with previous results that have noted no general correlation between sulfur content and metal content in coals. The small scale IFR emissions correlated well with emissions from a full scale utility boiler burning the same coal, although the IFR results tended to be consistently lower. The difference is likely due to physical differences in the two systems, such as the volume to surface area ratio, and the sharpness of turns in the gas path.

The results of the IFR tests showed that changes in the uncontrolled emissions tended to correlate well with the corresponding changes in the as-fed metal content of the coals for arsenic, mercury, and selenium. For beryllium, chromium, manganese, and nickel, changes in the uncontrolled emissions with different coals

did not correlate well with the changes in the as-fed trace metal contents. The remaining three metals, antimony, cadmium, and lead, did not show conclusive results when comparing emissions to as-fed trace metal contents. The factor that determines the degree of correlation between the as-fed trace metal concentration and the uncontrolled stack emissions appears to be the vapor pressure of the metal. Metals that have high vapor pressures tend to exhibit strong correlations between the as-fed metal concentration in the coal and the uncontrolled emissions, while metals with low vapor pressures tend to show a much weaker correlation. In summary, the study illustrates that predictions of metal emissions based only on the trace metal content of the coal are not accurate in all cases. Such predictions cannot be used with any confidence for refractory metals, but do have some degree of validity for the more volatile metals of interest.

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The complete report, entitled "Effects of Changing Coals on the Emissions of Metal Hazardous Air Pollutants from the Combustion of Pulverized Coal," (Order No. PB95-246385; Cost: $19.50, subject to change) will be available only from:

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone: 703-487-4650

The EPA Project Officer can be contacted at:

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