Mercury pollution in China and Tsinghua-Washington University Collaboration

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Outline

- Mercury Pollution in China
- Tsinghua-Washington University Collaborations
- Faculty and Student Exchange
- Further collaboration
GDP and Energy Consumption in China
Energy Consumption in China

- Energy consumption of China: 18% of the world
- Support a largest country by products, but not a largest country by value

Outputs of more than 100 products ranking #1 in the world

Steel output = the summation of OECD
Cement output = the summation of all other country in the world
China’s Future Energy Use

The next 15 years is the critical period for China to complete the capital-intensive industrialization and the peak time of China’s population.

Reference: world outlook 2007
Coal combustion is the most important source of mercury emissions in China. Mercury emission from coal combustion is over 300t per year.
Mercury Pollution: an Global Issue

Transport of mercury pollution has caused global attention

Layer 1  HgZ

z=gem_2001_mar_5_12.nc

March 5, 2001 0:00:00
Min = 0.8 at (150, 70), Max = 8.4 at (36, 38)

Lin et al., 2006
Mercury Control: China is Acting

- **Oct 2009**: Integrated Control Program for Heavy Metal Pollution
- **May 2010**: Guidance Document to Advance the Joint Prevention and Control of Atmospheric Pollution for Improving Regional Air Quality
- **Sept 2010**: Workshop on Mercury Pollution Control Demonstration in Coal-fired Power Plants (MEP, Huadian Power, China Power Investment Corporation, State Power, Huaneng Power, Datang Power)
Mercury Control: China is Acting

Co-benefit of mercury removal by SO2 control measures during 2005-2008

With no control: increase by 21.7 t
FGD installed for newly built units: decrease by 12.8 t
FGD installed for old units: decrease by 13.4 t
Shutting down small units: decrease by 7.7 t

The total mercury emission in 2005 is 108.6 t
The total mercury emission in 2008 is 96.5 t
Life cycles of metals in coal combustion: metal release and capture, speciation in fly ash, and transformations during ash reuse and storage
Tsinghua-Washington Univ. Collaborations

Combustion system at Washington Univ.  Combustion system at Tsinghua
Life cycles of metals in coal combustion: metal release and capture, speciation in fly ash, and transformations during ash reuse and storage

Bench-Scale Measurements on Mercury Speciation and Fine-Particle Formation in the Flue Gas from the Combustion of Chinese Coals

Lei Zhang, Michael Daukoru, Sarah Torkamani, Pratim Biswas, Shuxiao Wang, and Jiming Hao

1. Introduction
Coal combustion is the dominant anthropogenic mercury emission source of the world [1]. Plenty of onsite measurements [2-10] have been conducted in coal-fired powerplants to evaluate the mercury removal efficiency of air pollution control devices (APCDs). Electrostatic precipitator (ESP) can remove over 99% of the particulate mercury ($\text{Hg}_0$), and wet flue gas desulfurization (WFGD) can retain 67–98% of the
Tsinghua-Washington Univ. Collaborations

Mercury removal technology and demonstration
Faculty Visits from St. Louis
Faculty Visits from Tsinghua
Student Exchange

International Experience in Environmental, Chemical, Engineering, 2008

Melisa working on Distributed Power Generation Options for Rural China: Trip to Xinjiang Province
Student Exchange

Six former Tsinghua students have studied for PhD degree at Dept. of Environmental, Chemical, Engineering, Washington University at St. Louis
Further Collaboration

1. Propose to China utilities to do slip stream test in a full scale power plant:

   Testing of mercury capture with various sorbents – inorganic oxide and carbon based.

   Fly ash capture efficiency in bag house and electrostatic precipitator. Prove new design of ESP more effective in removing ultrafine particles.
Further Collaboration

2. Air pollution and climate change: emissions from biomass-burning

3. Teaching: Aerosol Science & Technology

   Principal of Energy and Environment

4. Student exchanges, etc
Thanks for your attention!