Mercury Impacts on By-Products

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Hg/ATE Impacts to CCBs Project Partners

Sponsors

- Cinergy
- EERC Center for Air Toxic Metals Affiliates
- EPRI
- Great River Energy
- North Dakota Lignite Research Council
- U.S. Department of Energy National Energy Technology Laboratory
- Utility Solid Waste Activities Group

Research Team

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Hg/ATE Project Objectives

To evaluate the impact of mercury and other air toxic elements on the management of CCBs.

Supporting objectives:

1) Determine the release potential of selected air toxic elements
2) Increase information on Hg/ATE releases for CCBs
3) Develop comparative laboratory and field data
4) Establish appropriate laboratory and field protocols

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Mercury Stability

- Leaching
- Short- and long-term stability/mobility of mercury associated with CCBs at ambient temperatures.
- Thermal desorption of mercury and mercury compounds at temperatures from ambient to 700ºC.
- Microbiologically mediated leaching and vapor-phasrelease.

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Total Hg

ID No.	Fuel Type	Plant Configuation	Hg Conc. µg/g
185	Western bit.	pc, low-NO_x, FF	0.461
186	Western bit.	pc, low-NO_x, dry FGD, FF	0.565
187	ND lignite	pc EERC pilot-scale and FF	0.677
188	PRB subbit.	Dry FGD and FF	0.112
189	Blended PRB subbit. and petcoke	Cyclone and ESP	0.736
190	PRB subbit.	pc, FF, duct injection FGD	<0.002
191	Blended PRB subbit. and eastern bit.	pc with ESP	0.008
192	PRB subbit.	pc with ESP	0.026
193	PRB subbit.	pc with ESP	<0.002
194	PRB subbit.	PRB subbit., pc fly ash, ESP	0.059
195	ND lignite	pc, ESP, and wet FGD	0.002
263	Eastern bit.	pc and ESP	0.004
266	Eastern bit.	pc and ESP	0.138
267	Eastern bit.	pc with multicyclones and ESP	0.191

Leaching Results

ID No.	Sample Type	Bulk (µg/g)	Calc. Max. (µg/L)	18 hr (µg/L)	4 week (µg/L)	4 week pH
185	Fly ash	0.461	46.3	< 0.05	< 0.05	12.6
186	Fly ash	0.565	56.9	0.24	< 0.05	12.7
187	Fly ash	0.677	67.8	0.12	< 0.05	12.1
188	FGD ash	0.112	11.2	< 0.05	< 0.05	12.1
189	Fly ash	0.736	73.8	< 0.05	< 0.05	11.3

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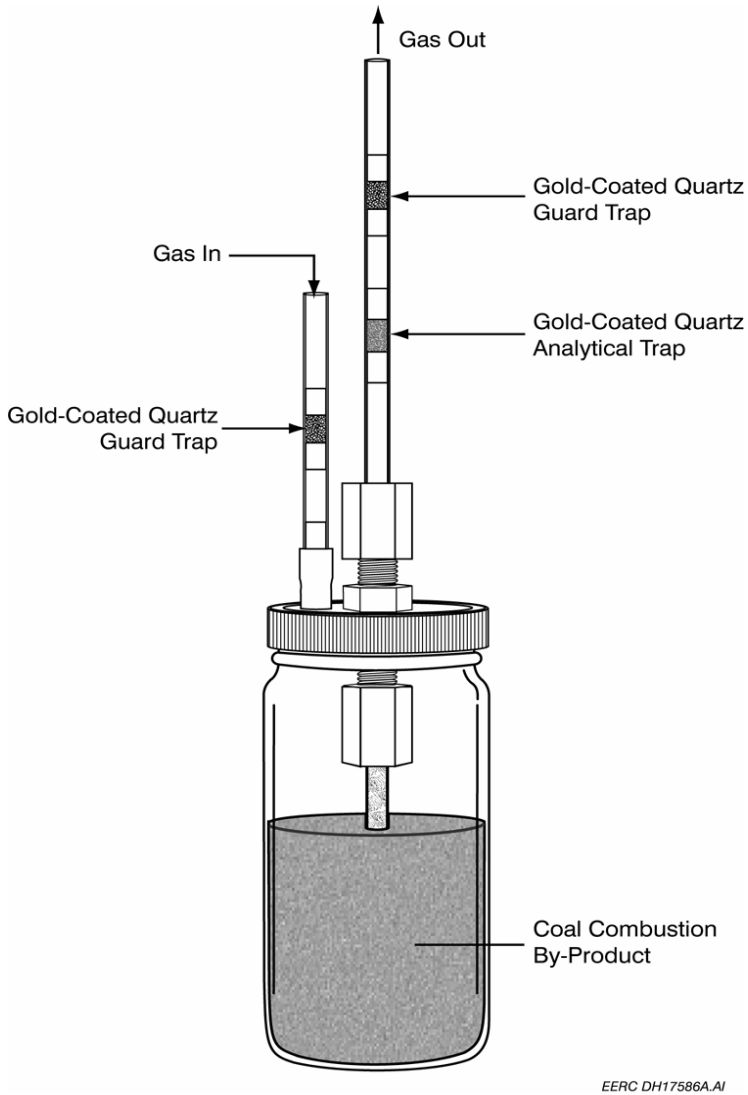
Ambient Experiments



- Six samples were selected containing relatively high concentrations of mercury.
- 150 grams of each sample was placed into an apparatus designed for desorption experiments.
- Air was passed through the ash at an ideal rate of 2 mL/minute.
- Mercury release was determined at regular intervals.

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Ambient Results

ID No.	17 days	13 days	30 days	24 days	90 days	90 days	Total (264 days)
99-188	0.63	0.07	0.23	0.16	1.30	1.54	3.94
99-189	0.03	0.01	0.03	0.02	0.02	0.01	0.14
99-692	0.02	0.01	0.04	0.02	0.03	0.02	0.14
99-693	0.01	0.01	0.05	0.02	0.03	0.02	0.14
99-722	0.07	0.10	0.26	0.19	0.39	0.21	1.22
99-724	0.03	0.03	0.11	0.08	0.30	0.18	0.72
Blank	0.09	0.11	0.34	0.23	1.35	1.18	3.31

*picograms of mercury per gram of ash, 2-8-02 to 11-4-02

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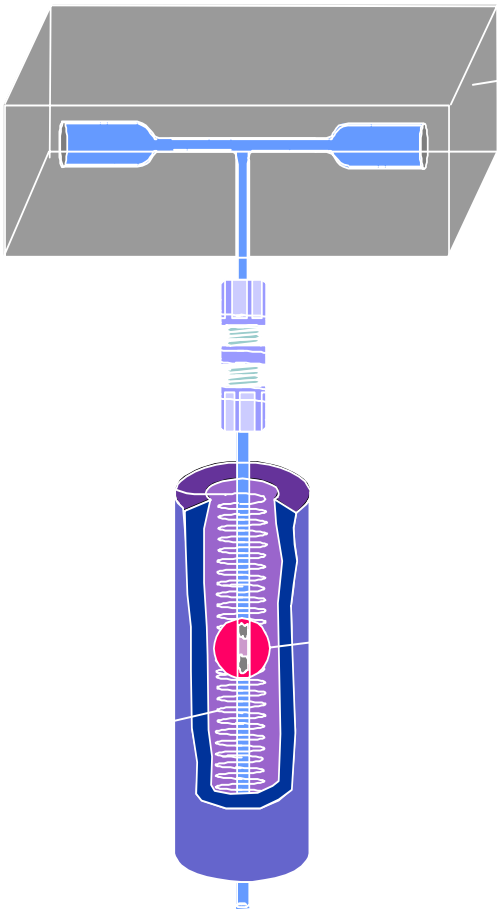
Thermal Desorption



This apparatus was designed to study the thermal desorption of mercury and mercury compounds from CCBs at temperatures from ambient to 700°C.

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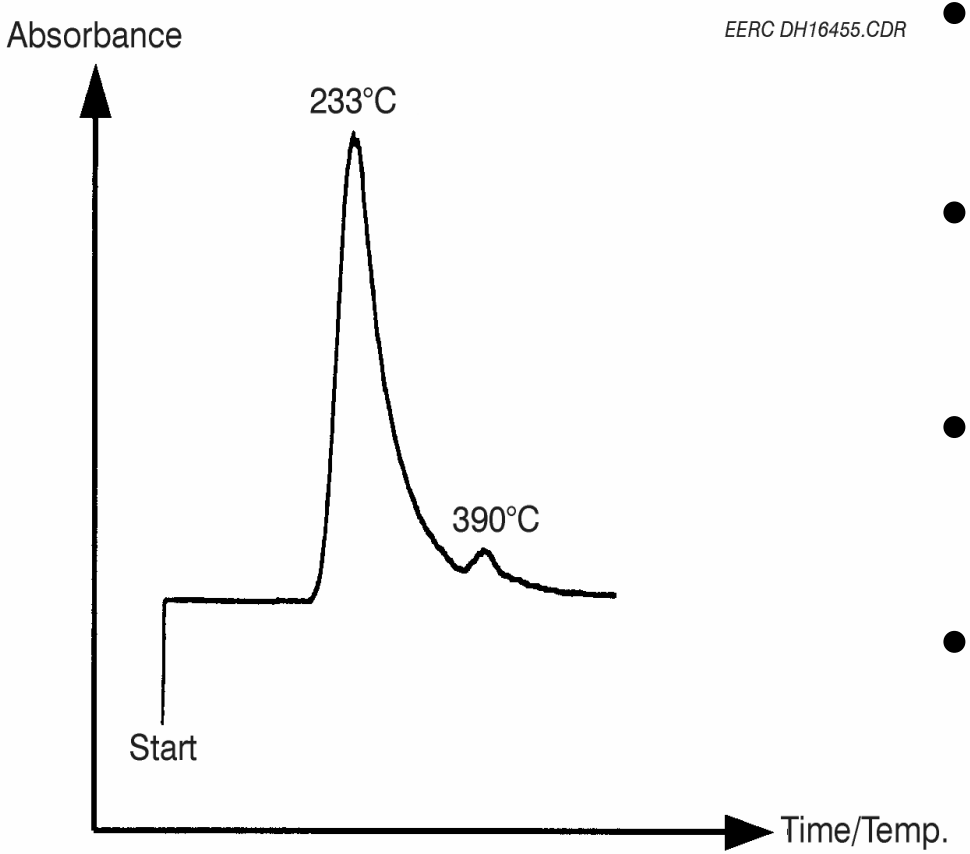
Thermal Desorption Results



- PRB ash spiked with HgO desorbed at 355°C.
- The same ash spiked with $HgCl_2$ desorbed at 220°C
- HgO decomposes at 500°C.
- $HgCl_2$ volatilizes unchanged at about 300°C.

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Microbiological Results

Anaerobic	pg/g	Aerobic	pg/g
Starved	2.19	Starved	2.01
Starved	0.40	Starved	1.03
Starved	0.59	Starved	2.18
Glucose	1.17	Glucose	7.41
Glucose	4.00	Glucose	12.24
Glucose	5.44	Glucose	34.15

*Ash 99-189, May 2002

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Conclusions

- Coal ash samples leached only very low concentrations of mercury.
- Thermal desorption indicated little potential for environmental impact because no significant mercury peaks were detected at temperatures below ~200°C.
- Ambient temperature desorption work has shown very low release rates.
- Microbiological work has indicated an increased mercury desorption rate compared to release rates seen in ambient and near-ambient temperature work.

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A typical coal-fired power plant produces 200,000 tons of fly ash per year, which is equivalent to the mass of 185,657,451,327 dollar bills.

200,000 tons of fly ash has the potential to release 0.26 grams of mercury, which is equivalent to the mass of a ¼ of a dollar bill.

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