

Fate of Mercury in Coal Combustion Products

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EPRI/DOE Project

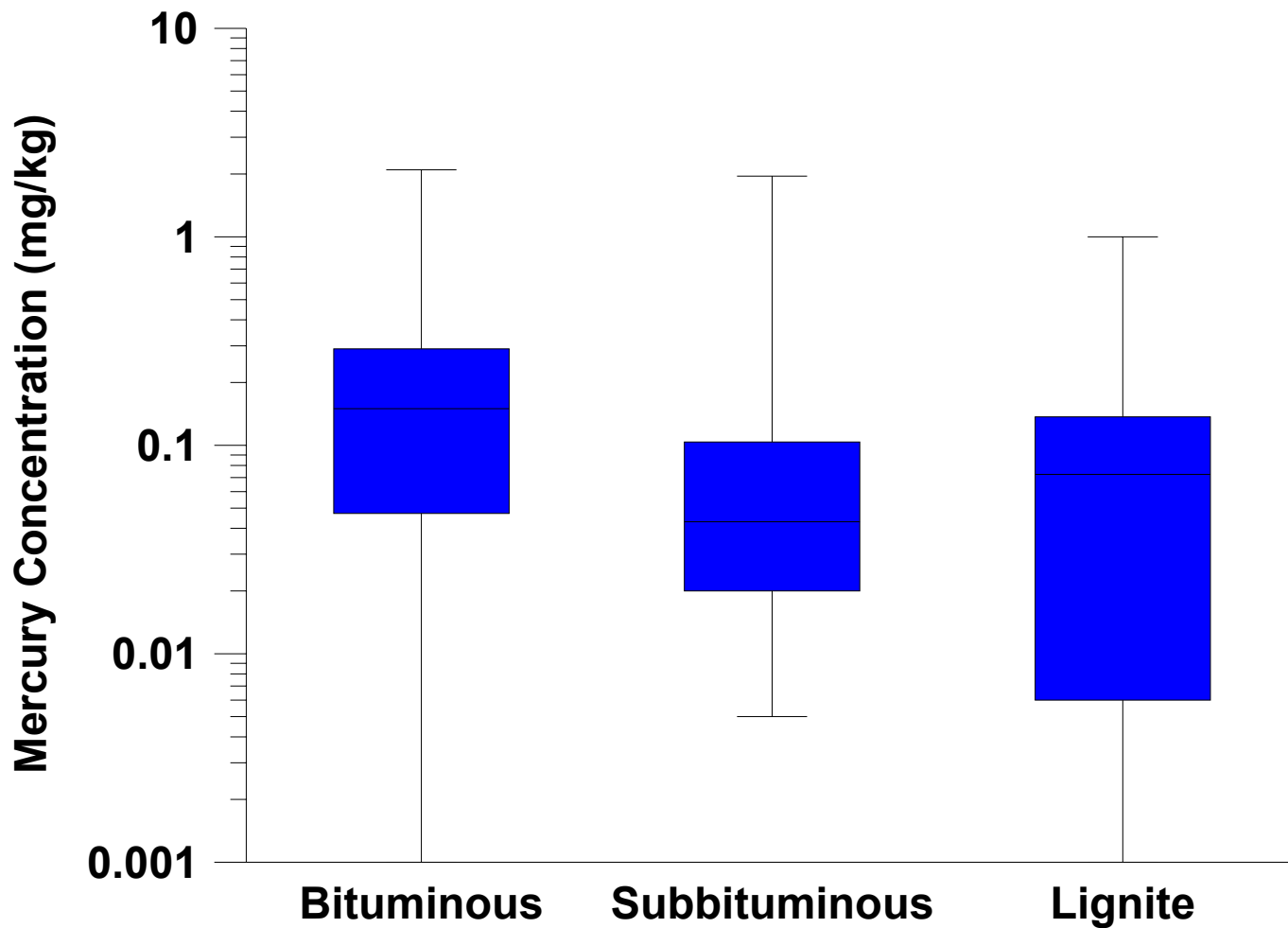
“Speciation and Attenuation of Arsenic and Selenium at Coal Combustion Product Management Facilities”

- Leachate Characterization at 25 sites
 - Speciation of As, Se, and Cr
 - Speciation of Hg at 5 sites
- Attenuation Studies of As and Se Species at 3 Sites

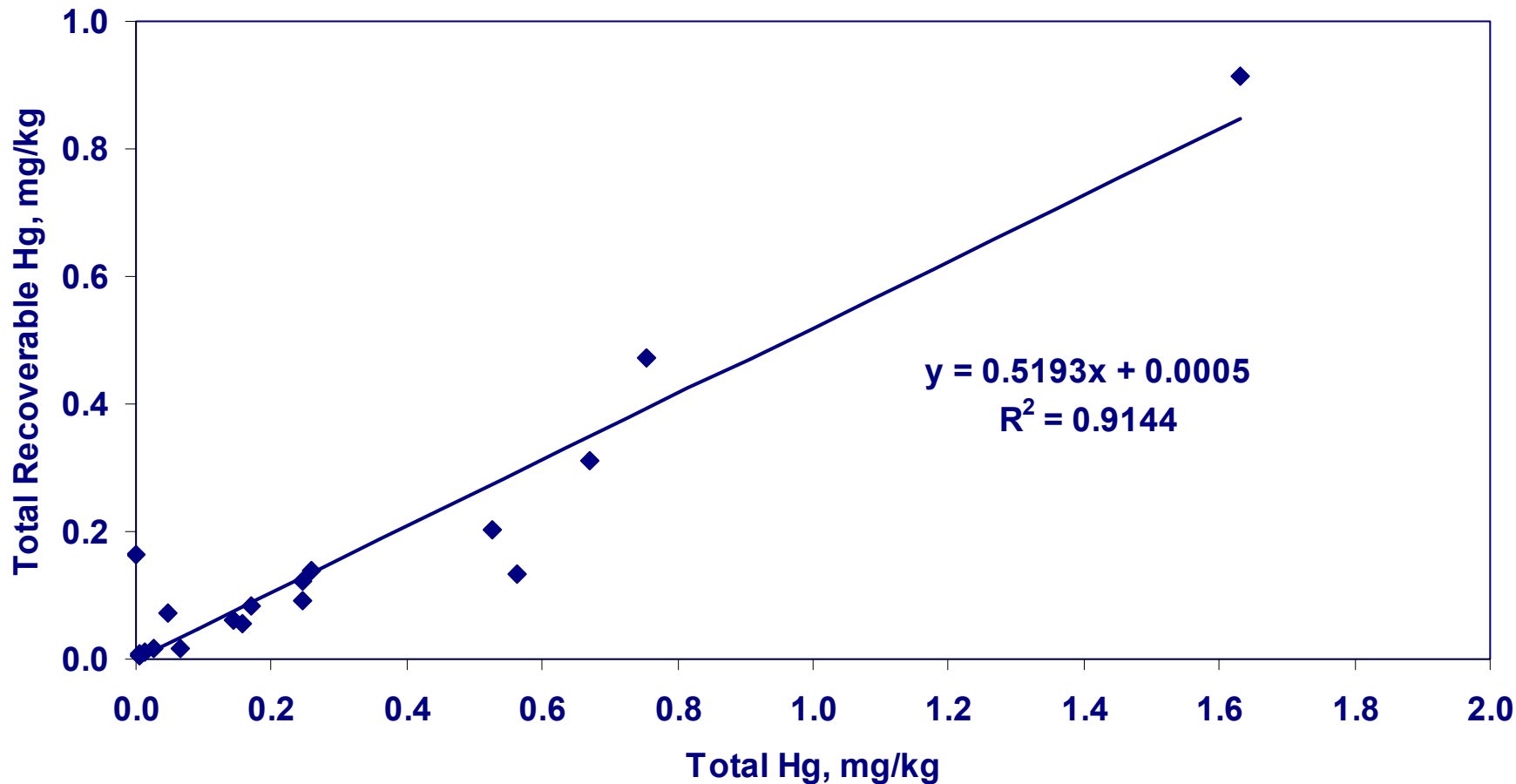
EPRI Research on Mercury in CCPs

- **Research Drivers**
 - Enhanced Hg Capture
 - Regulatory Determination Questions
- **Areas of Interest**
 - Concentrations in CCPs
 - Concentrations in laboratory and field CCP leachate
 - Mercury flux to air, laboratory and field
 - Effect of Hg control technologies
 - Effect of ammonia addition on mercury leaching
 - Methylation potential at CCP management sites

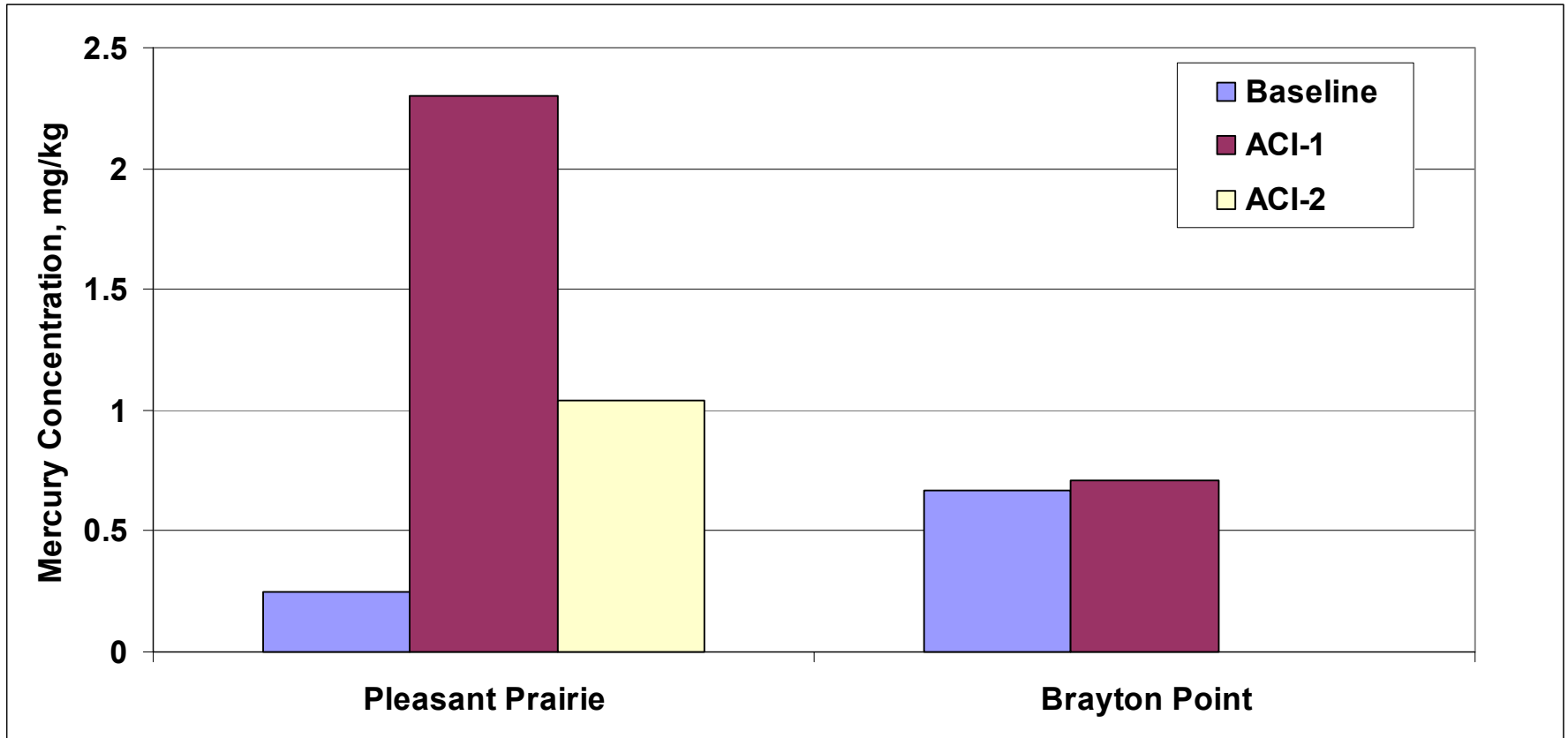
Mercury Concentrations in Fly Ash Historical Data



Mercury Concentrations in Fly Ash Recent Data



Mercury Concentrations in Fly Ash Activated Carbon Injection Demonstrations



Mercury Concentrations in Lab Leachates

Historical Data

	Number of Samples	Percent Below Detection Limit	Maximum Detected Value (µg/L)
Ash	172	76%	0.94
FGD Solids	30	87%	0.60

Results reflect a variety of leaching procedures

Detection limit typically 0.1 - 0.5 µg/L

Mercury Concentrations in Lab Leachates

Low Level Data

- SPLP Leach Test
- Detection Limit < 1 ng/L
- 19 Conventional Fly Ash Samples
 - 5 samples below detection limit
 - maximum value of 11 ng/L (replicate average)
- 3 Fly Ash Samples from Activated Carbon Injection Demonstrations
 - 2 samples below detection limit
 - 1 sample value of 5 ng/L (replicate average)

Mercury Concentrations in Field Leachates

- 2003 - 2004
- 5 - 10 Ash /FGD Management Facilities
- Primary Focus is Porewater
- Clean Sampling, Low Detection Limits
- Mercury Species:
 - Dissolved & Total Hg
BrCl digestion & CV-ICP-MS, DL ~0.1ng/L
 - Dissolved & Total Methyl Hg
Lab distillation & TD-GC-ICP-MS, DL ~0.02ng/L
 - Dimethyl Hg
Field purge/dry & TD-GC-ICP-MS, DL ~0.01 ng/L



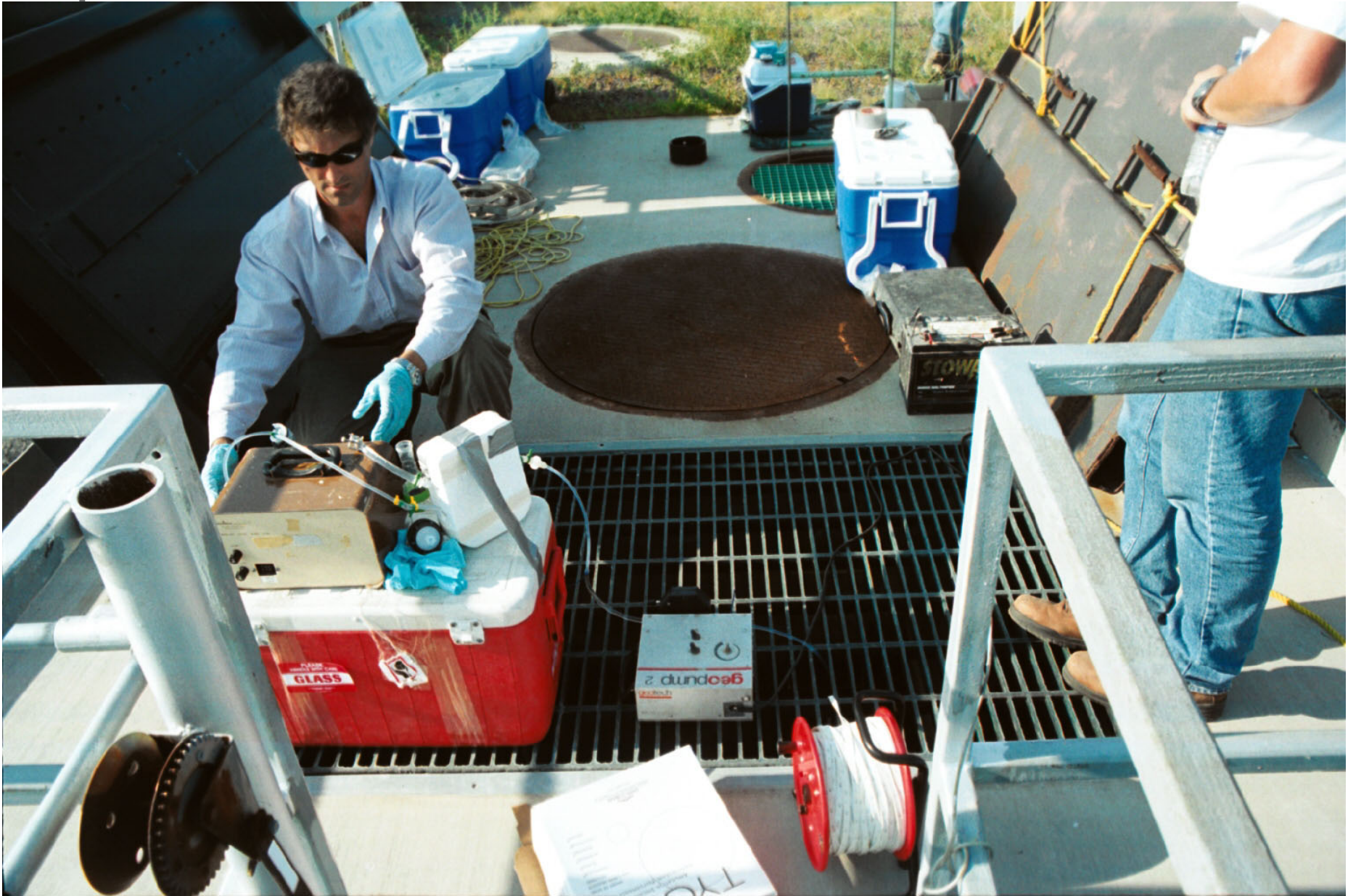










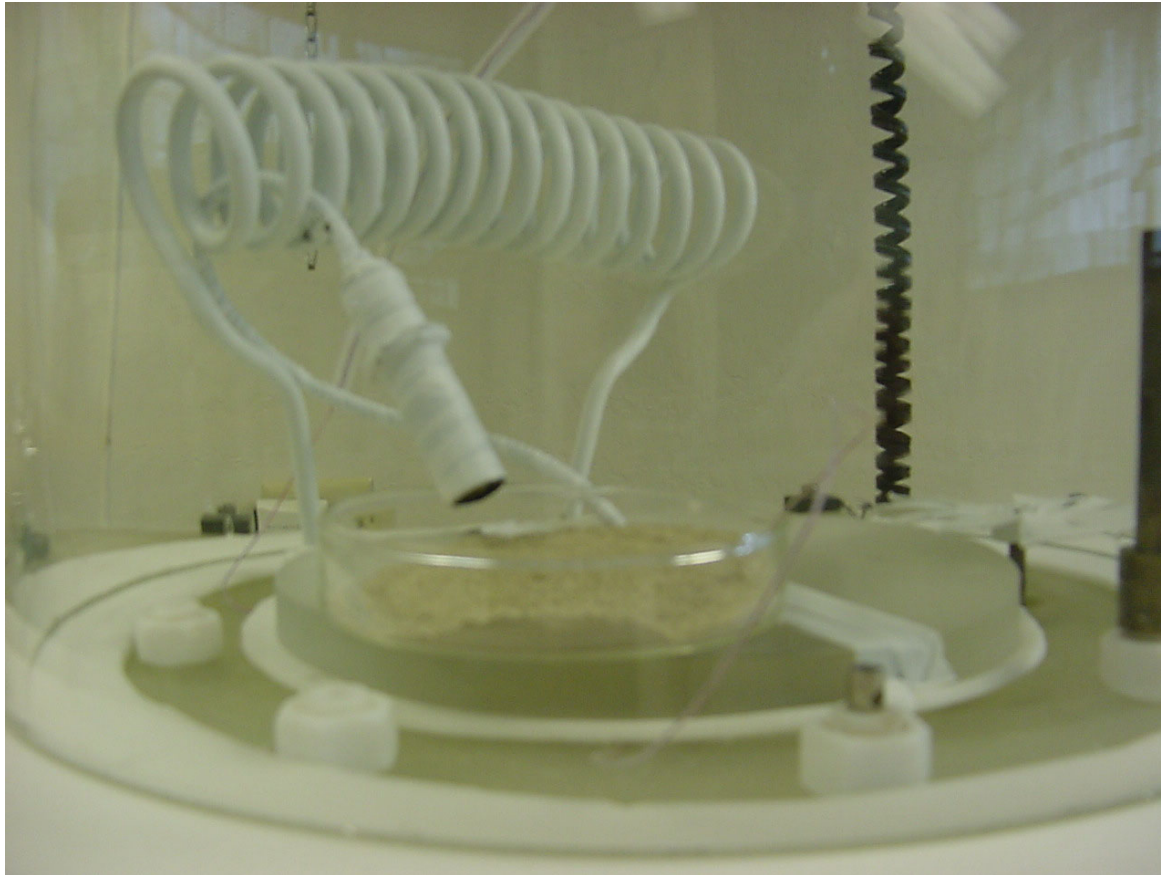


Mercury Release to Air from Fly Ash

Flux Chamber Experiments

- Method developed for soils
- Low detection limits
- Laboratory
 - 23 fly ash samples tested
 - 10 bituminous, 6 subbituminous, 7 lignite
 - Pleasant Prairie, Brayton Point ACI demonstrations
- Field
 - Two operating landfills (bituminous)

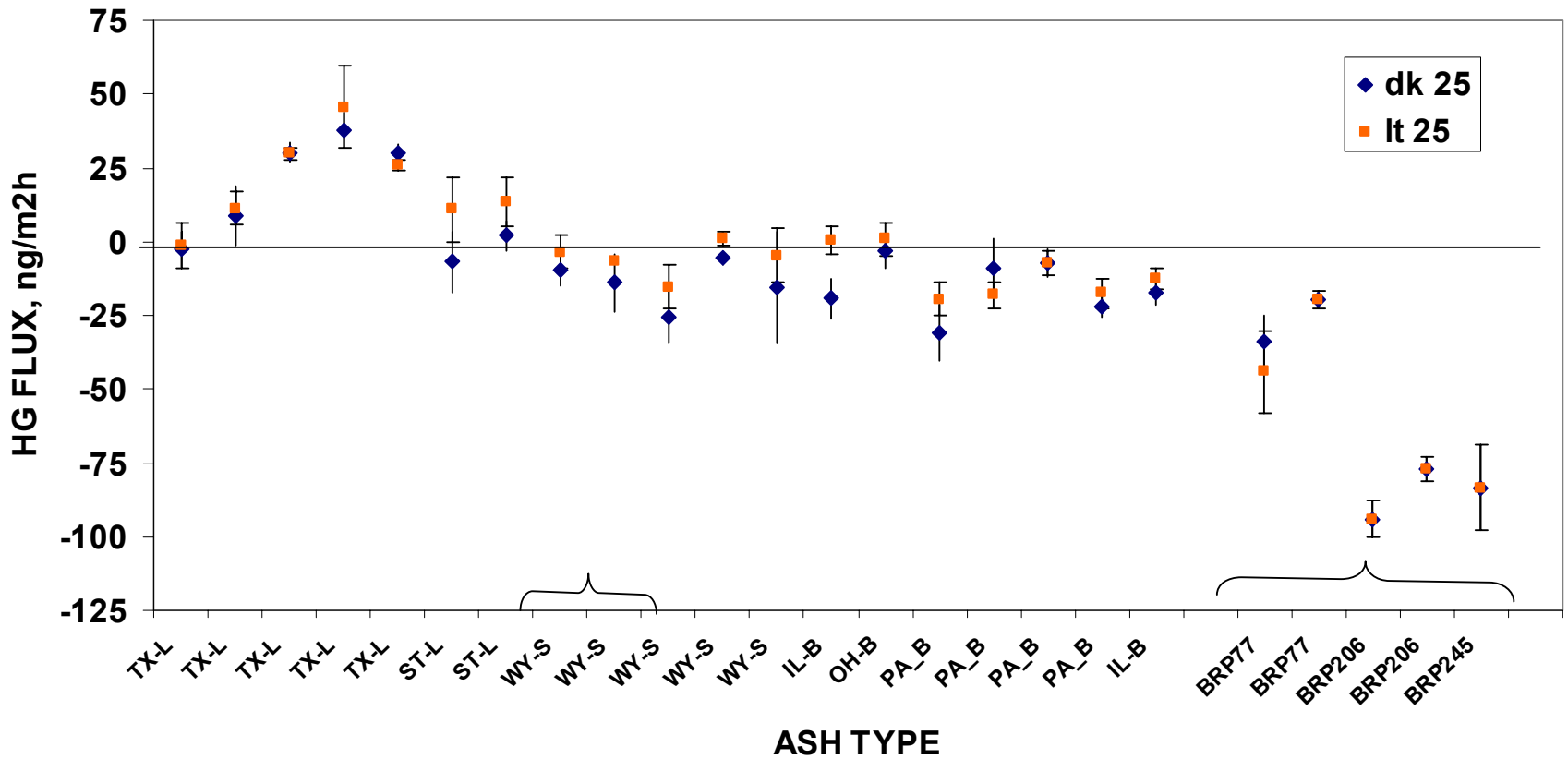
Mercury Release to Air from Fly Ash



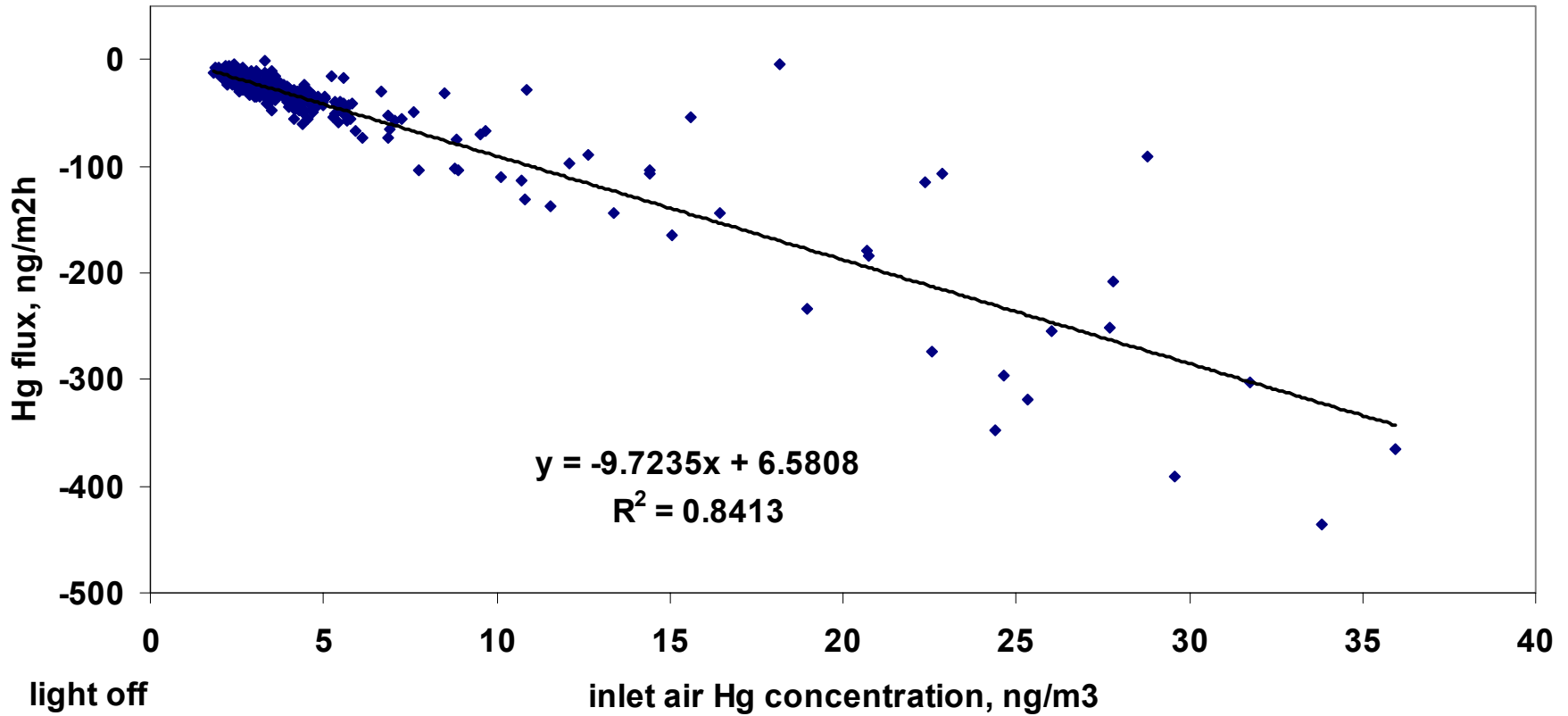
Flux Chamber

- Controlled
 - Light
 - Temperature
 - Air Flow
 - Air Hg
 - Moisture
- Tekran Analyzer

Mercury Release to Air from Fly Ash



Mercury Release to Air from Fly Ash



Mercury Release to Air from Fly Ash

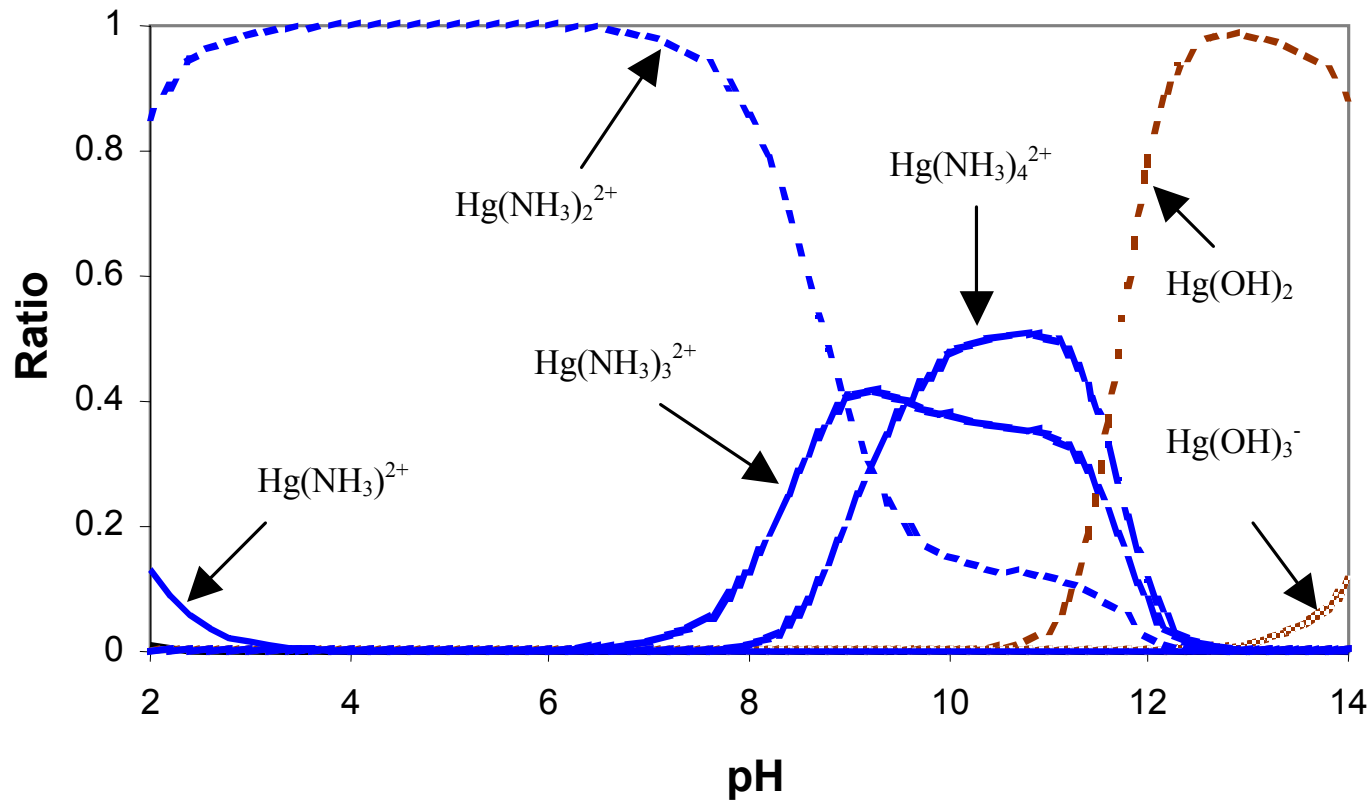
Field Study

- High mercury concentrations in ash (>1 mg/kg)
- Measurements
 - Over one week period
 - Continuous 24-hour measurements
 - Micrometeorologic data and ambient air mercury concentrations
- Results
 - Flux varied with air concentrations and light/dark cycles
 - Net negative flux (mercury deposition)
 - Reemission of deposited mercury

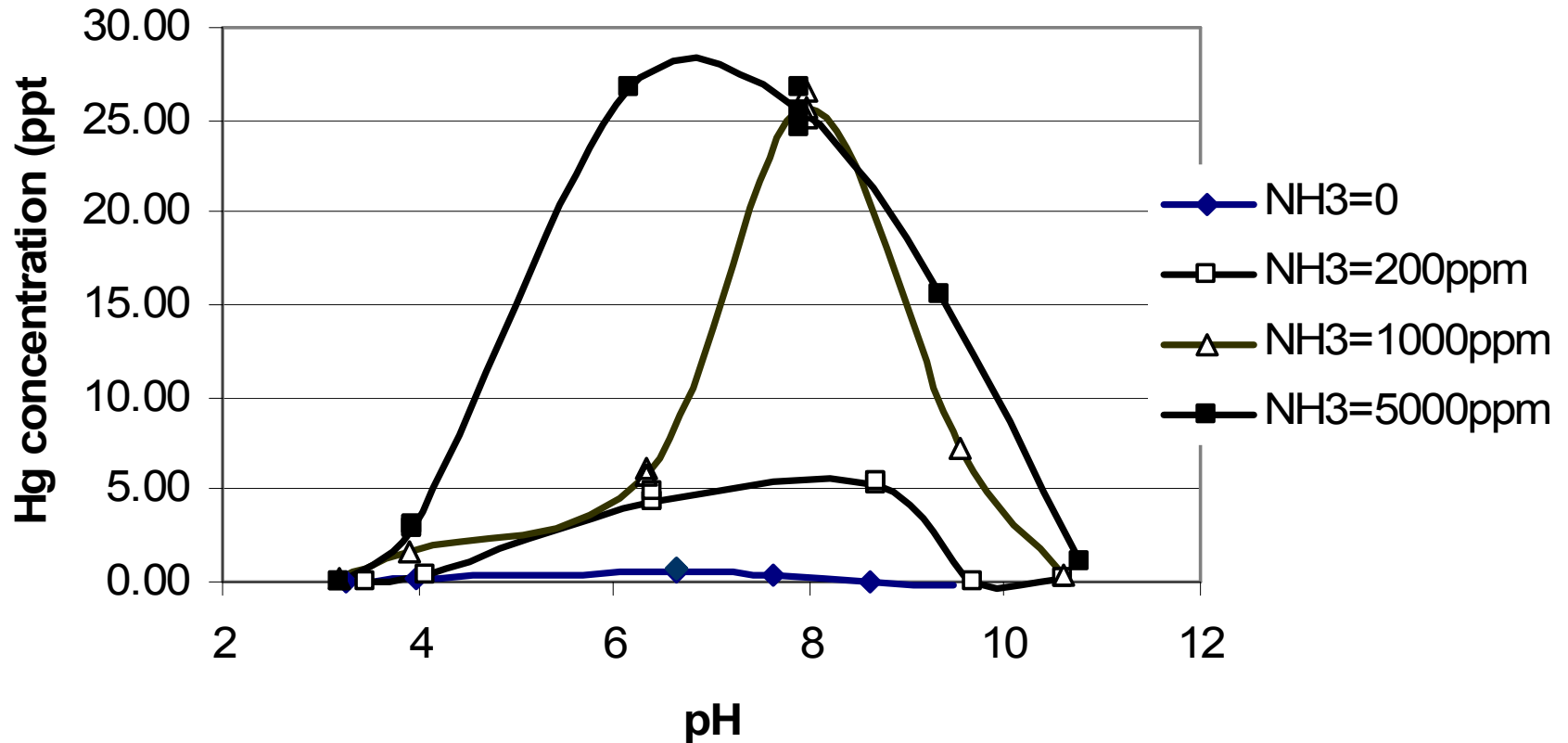
Effect of Ammonia Addition on Hg Leaching

- Ammonia slip from SCR/SNCR yields highly soluble ammonia compounds in fly ash
- Ammonia forms water soluble complexes with heavy metals
- Equilibrium calculations suggest potential for ammonia to affect mercury leaching from ash
- Laboratory work on ammonia complexation of mercury proposed for 2003-2004

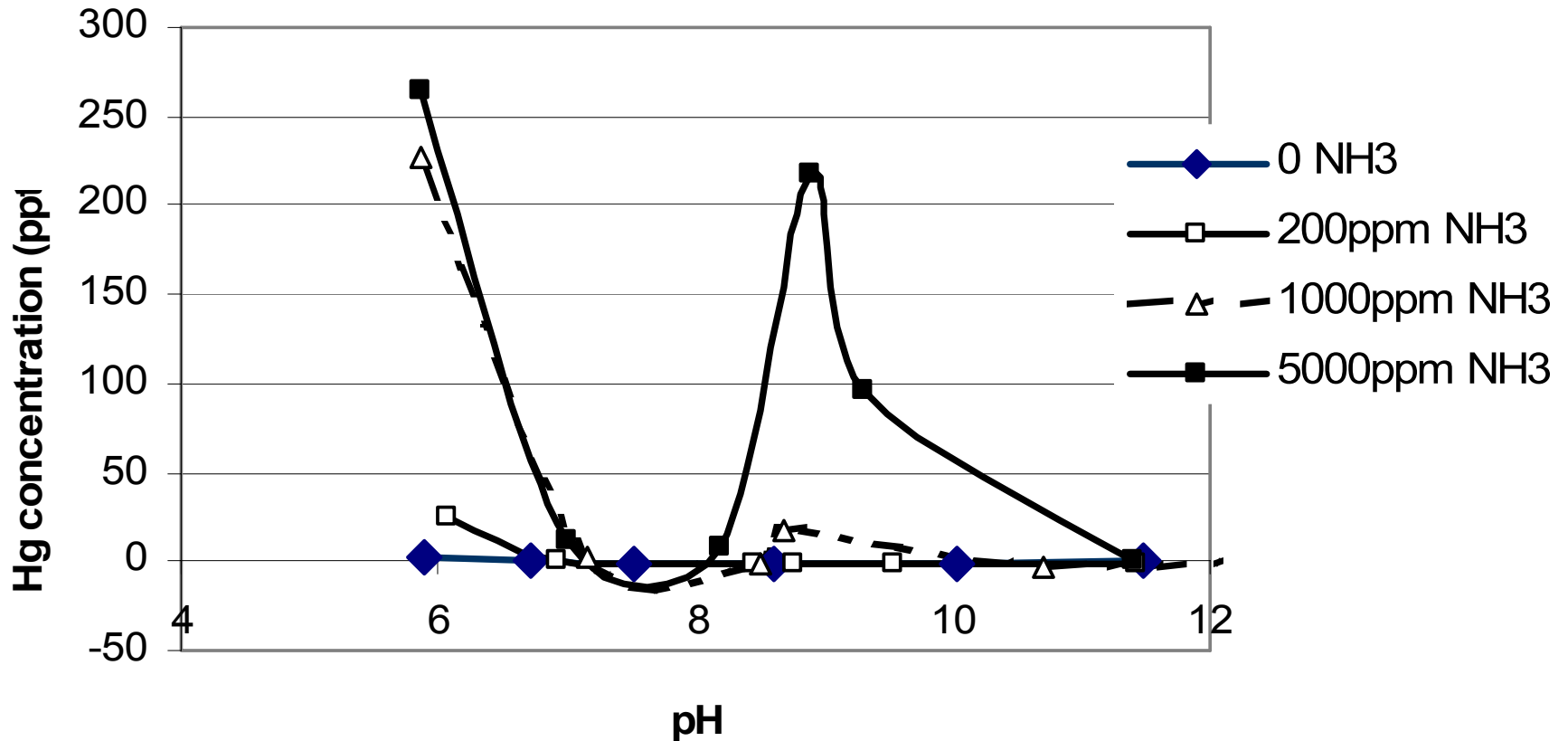
Effect of Ammonia Addition on Hg Leaching



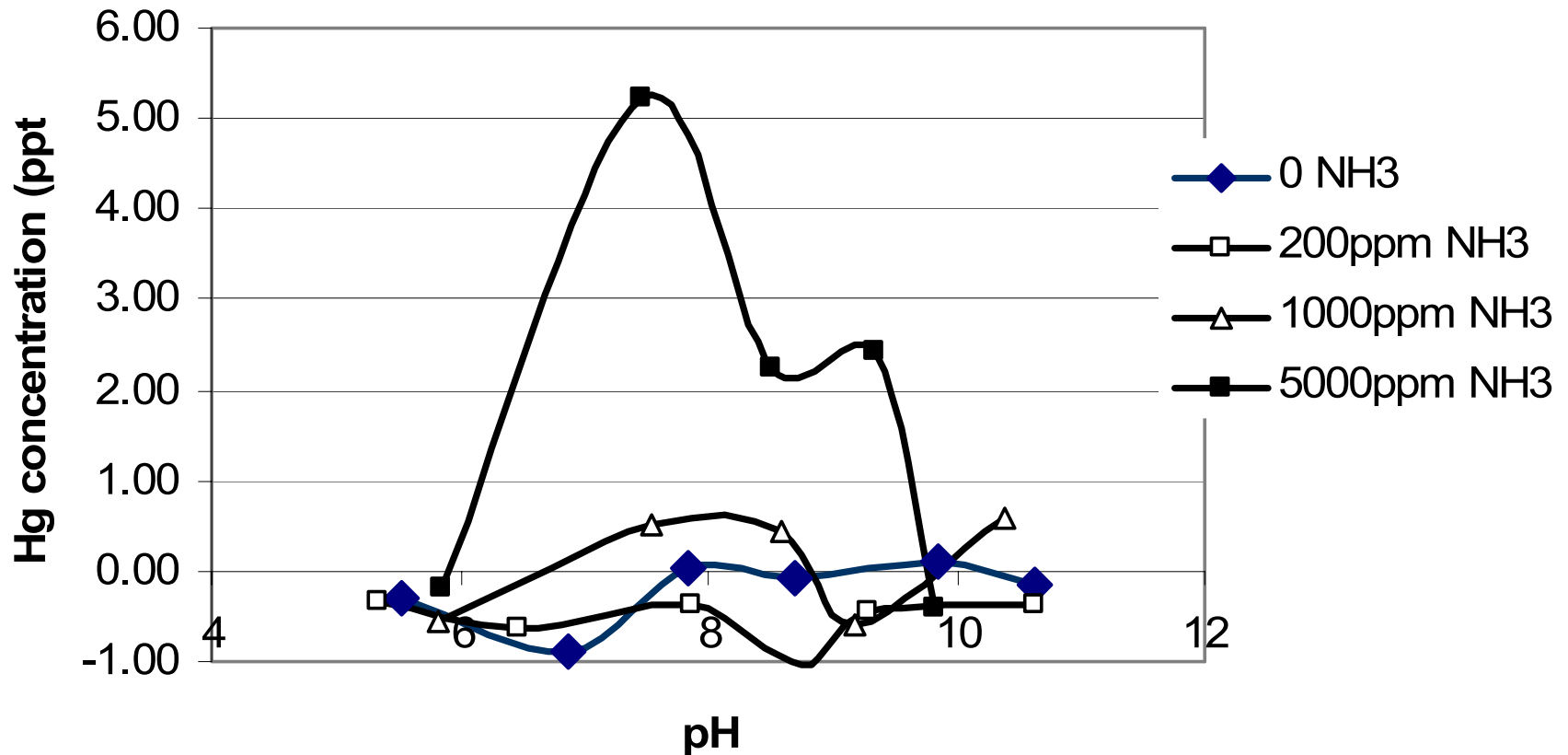
Effect of Ammonia Addition on Hg Leaching



Effect of Ammonia Addition on Hg Leaching



Effect of Ammonia Addition on Hg Leaching from High Carbon Ash



Future Research Directions

- Mercury Speciation in Field Leachates
- Methylation Potential
- Effects of Control Technologies on CCP Characteristics
- FGD Solids/Liquids