

# Aqueous Stability of Mercury on Fly Ash



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***Mercury Control Technology  
R&D Program Review  
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# Increased Hg Control



- Transfers Hg from gas phase to other phases
- Potentially increases cost of disposal and decreases utilization of CUB

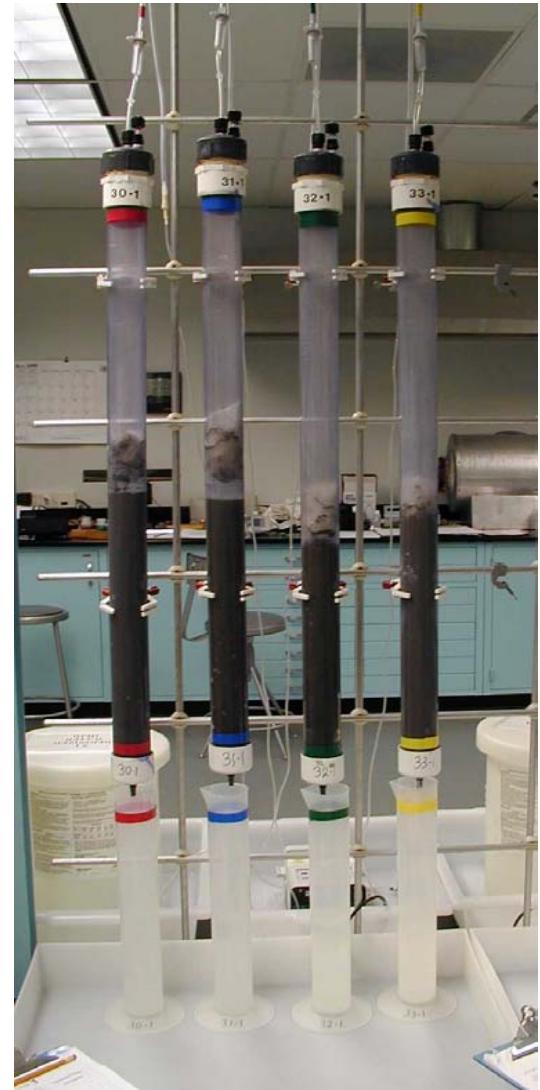
Hg →



How stable is Hg on fly ash?

# Technique - Column Leaching

- **20 columns - 5 cm id by 1 m acrylic**
- **5 leachant solutions**
  - Average flow rate 130 mL/d
- **CUB samples**
  - Sample size: 1 kg/column
- **Duration**
  - 30 to 180 days
- **Sampling frequency**
  - 2 to 3 days
- **Hg Analysis - CVAA**



# Leachant Solutions

| Leachant                | ID                              | # | pH   |
|-------------------------|---------------------------------|---|------|
| Water                   | H <sub>2</sub> O                | 1 | 6.0  |
| Acetic Acid             | HAc                             | 2 | 2.9  |
| Sodium Carbonate        | Na <sub>2</sub> CO <sub>3</sub> | 3 | 11.1 |
| Synthetic Precipitation | SP                              | 5 | 4.2  |
| Sulfuric Acid           | H <sub>2</sub> SO <sub>4</sub>  | 7 | 1.2  |

# Hg Analytical Methods

| Sample   | Method | IDL                   |
|----------|--------|-----------------------|
| Leachate | CVAA   | 0.004µg/L             |
| Solid    | DMA-80 | 0.02 ng<br>600 ng max |

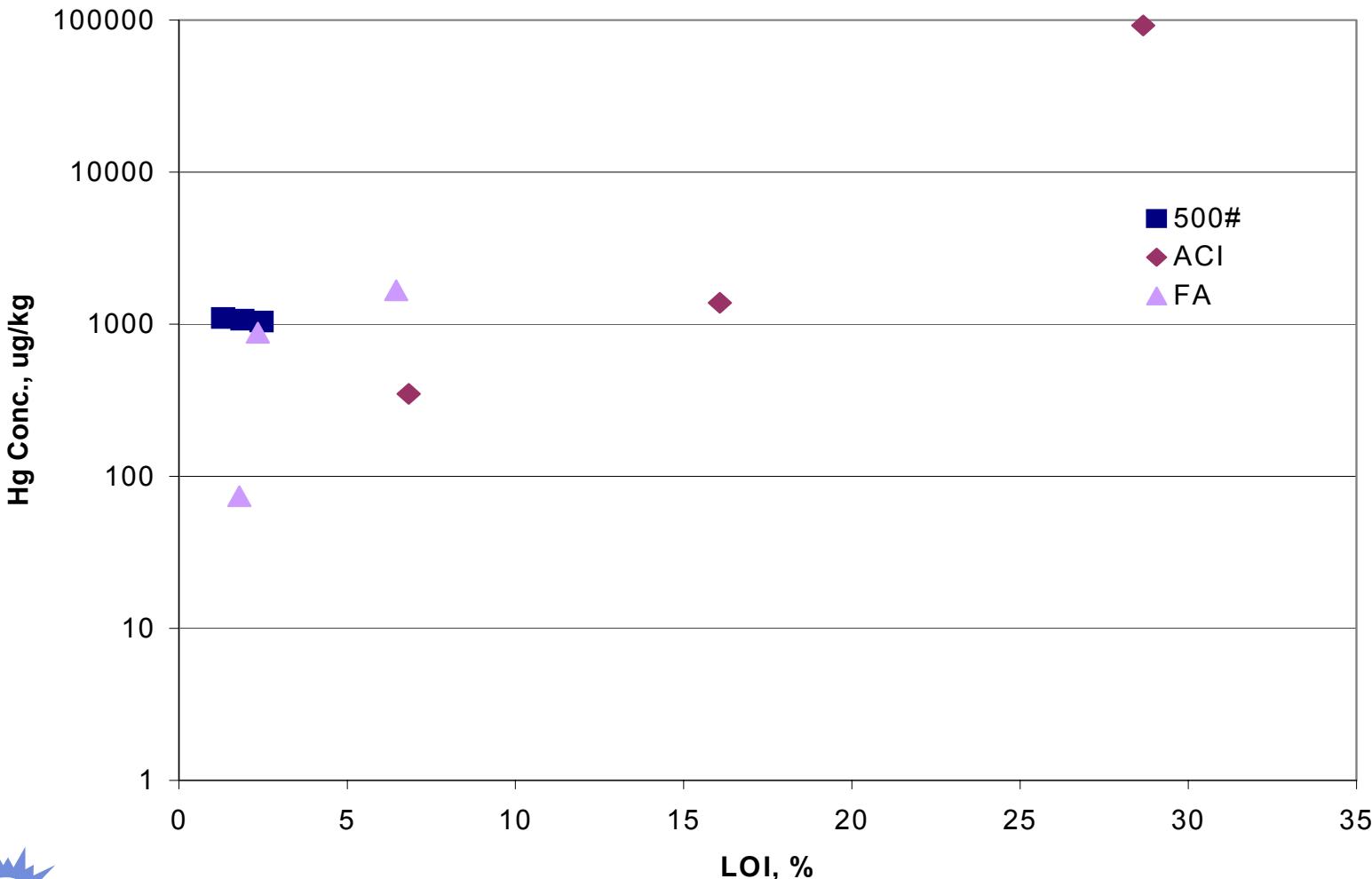
# CUB Samples

| <b>Sample #</b> | <b>Type</b> | <b>Hg Control</b> | <b>Source</b>  | <b>Hg, ug/kg</b> | <b>LOI, %</b> | <b>Hg/C, ug/g</b> |
|-----------------|-------------|-------------------|----------------|------------------|---------------|-------------------|
| FA50            | 500#        | PAC               | NETL           | 1096             | 1.31          | 84                |
| FA53            | 500#        | PAC               | NETL           | 1041             | 2.45          | 42                |
| FA56            | 500#        | PAC               | NETL           | 1069             | 1.89          | 57                |
| FA52            | PC          | PAC               | Gaston Station | 92067            | 28.66         | 321               |
| FA55            | PC          | PAC               | Brayton Point  | 1380             | 16.08         | 9                 |
| FA63            | PC          | PAC               | Salem Harbor   | 348              | 6.83          | 5                 |
| FA51            | PC          | None              | EPRI           | 1669             | 6.46          | 26                |
| FA58            | 500#        | None              | NETL           | 74               | 1.79          | 4                 |
| FA62            | PC          | None              | EPRI           | 878              | 2.34          | 38                |

# Questions

- Is FA Hg concentration related to carbon content?

# Hg Concentration



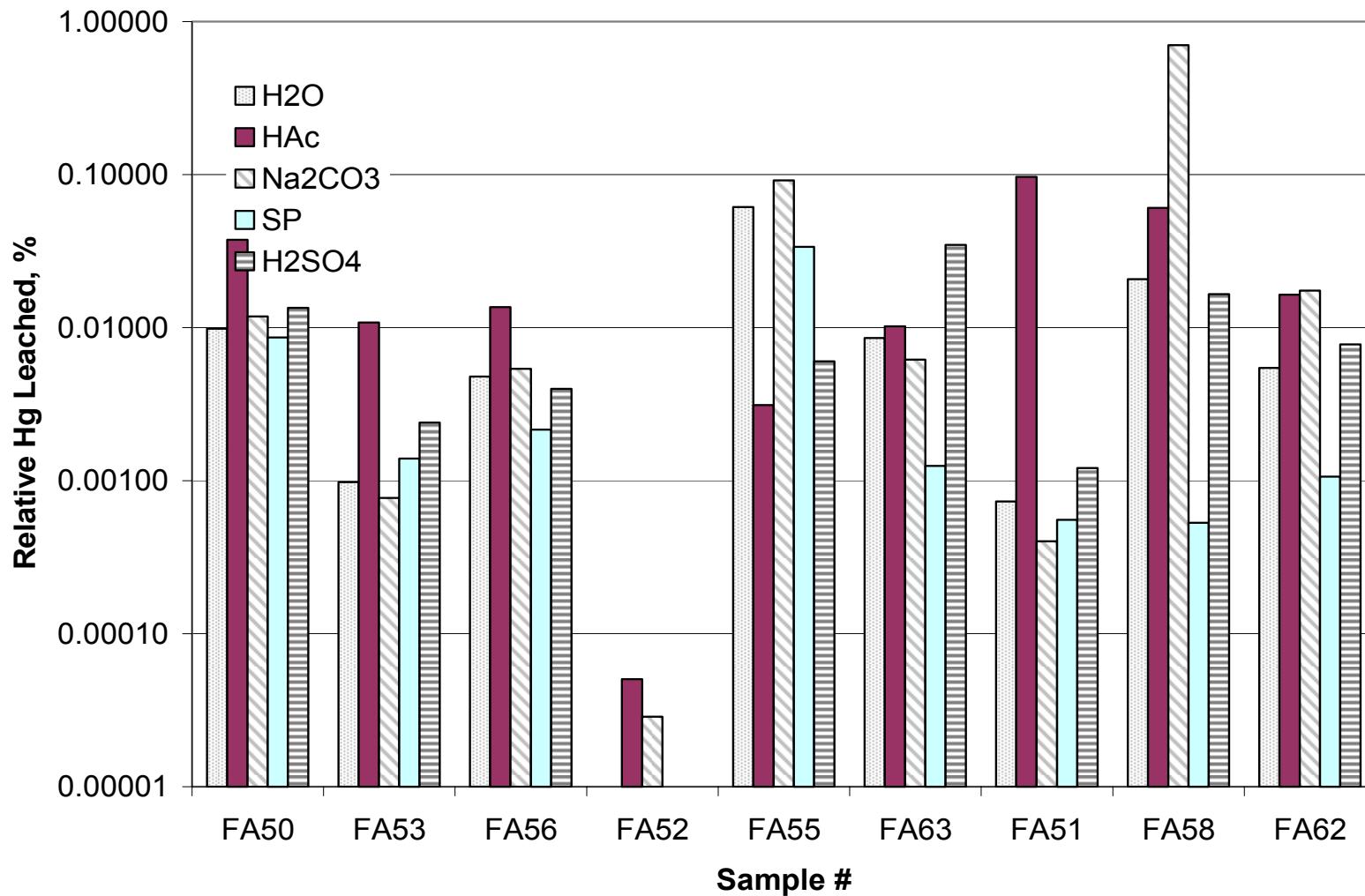
# Questions

- Is FA Hg concentration related to carbon content?
- **How much Hg can be extracted from FA?**

# Cumulative Leached Hg, ng/kg

|      | H2O | HAc  | Na2CO3 | SP  | H2SO4 |
|------|-----|------|--------|-----|-------|
| FA50 | 108 | 410  | 130    | 94  | 148   |
| FA53 | 10  | 112  | 8      | 15  | 25    |
| FA56 | 51  | 146  | 58     | 23  | 43    |
| FA52 | 3   | 47   | 26     | 3   | 4     |
| FA55 | 846 | 43   | 1263   | 465 | 83    |
| FA63 | 30  | 35   | 21     | 4   | 121   |
| FA51 | 12  | 1615 | 7      | 9   | 20    |
| FA58 | 15  | 45   | 517    | 0.5 | 12    |
| FA62 | 48  | 144  | 153    | 9   | 68    |

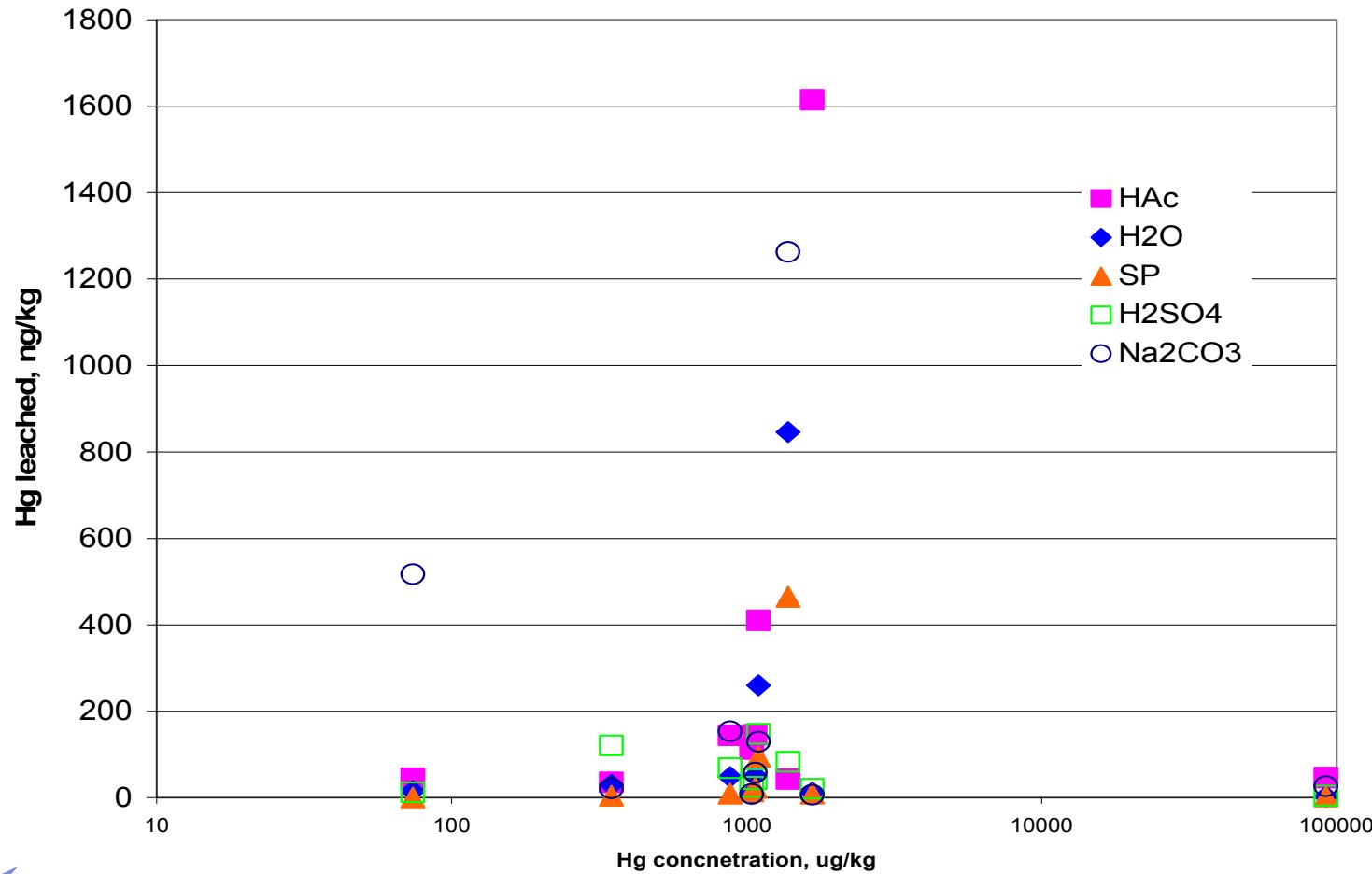
# Relative Cumulative Release



# Questions

- Is FA Hg concentration related to carbon content?
- How much Hg can be extracted from FA?
- **Is release of Hg related to total concentration?**

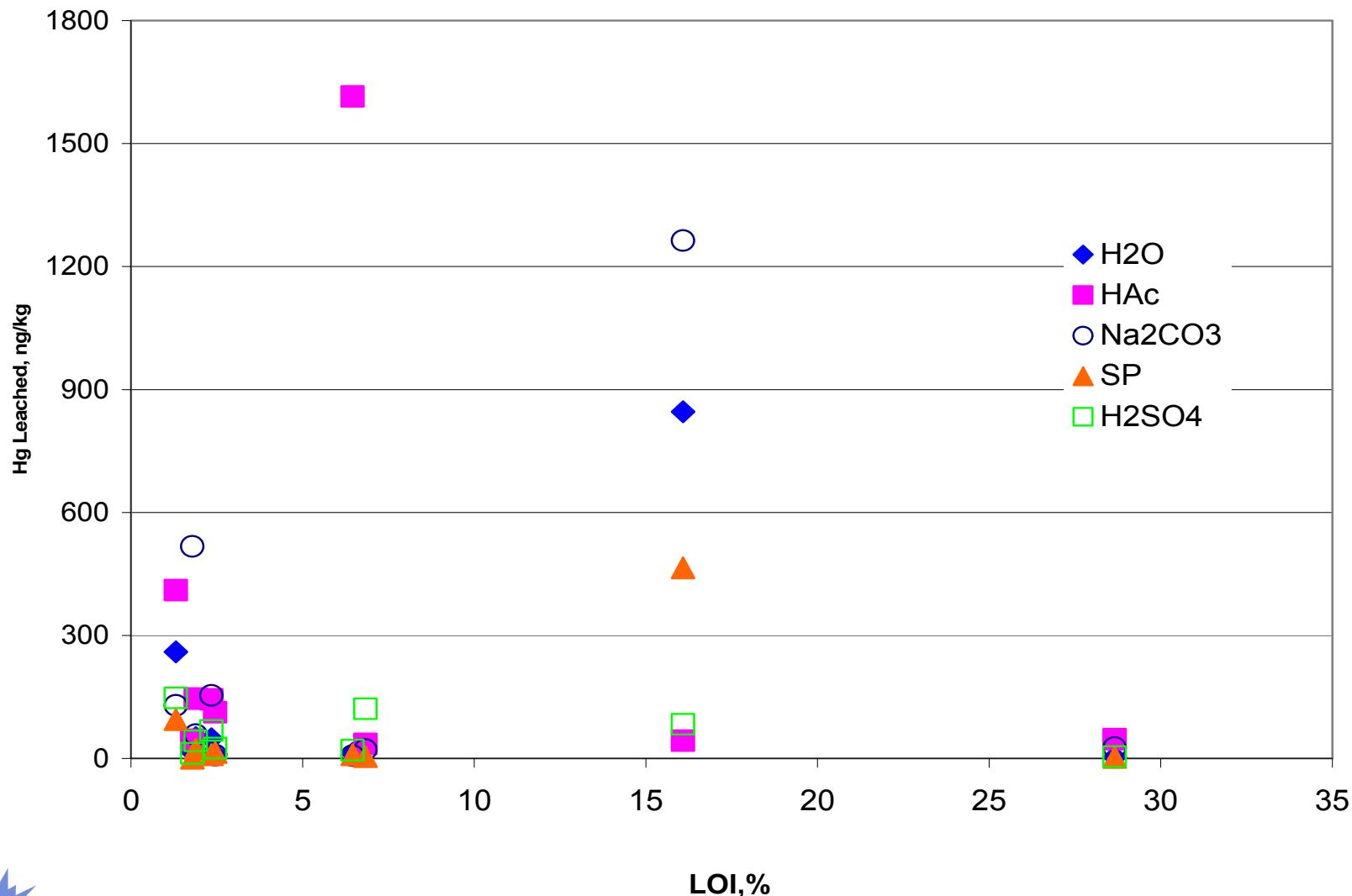
# Leached Hg vs Total Concentration



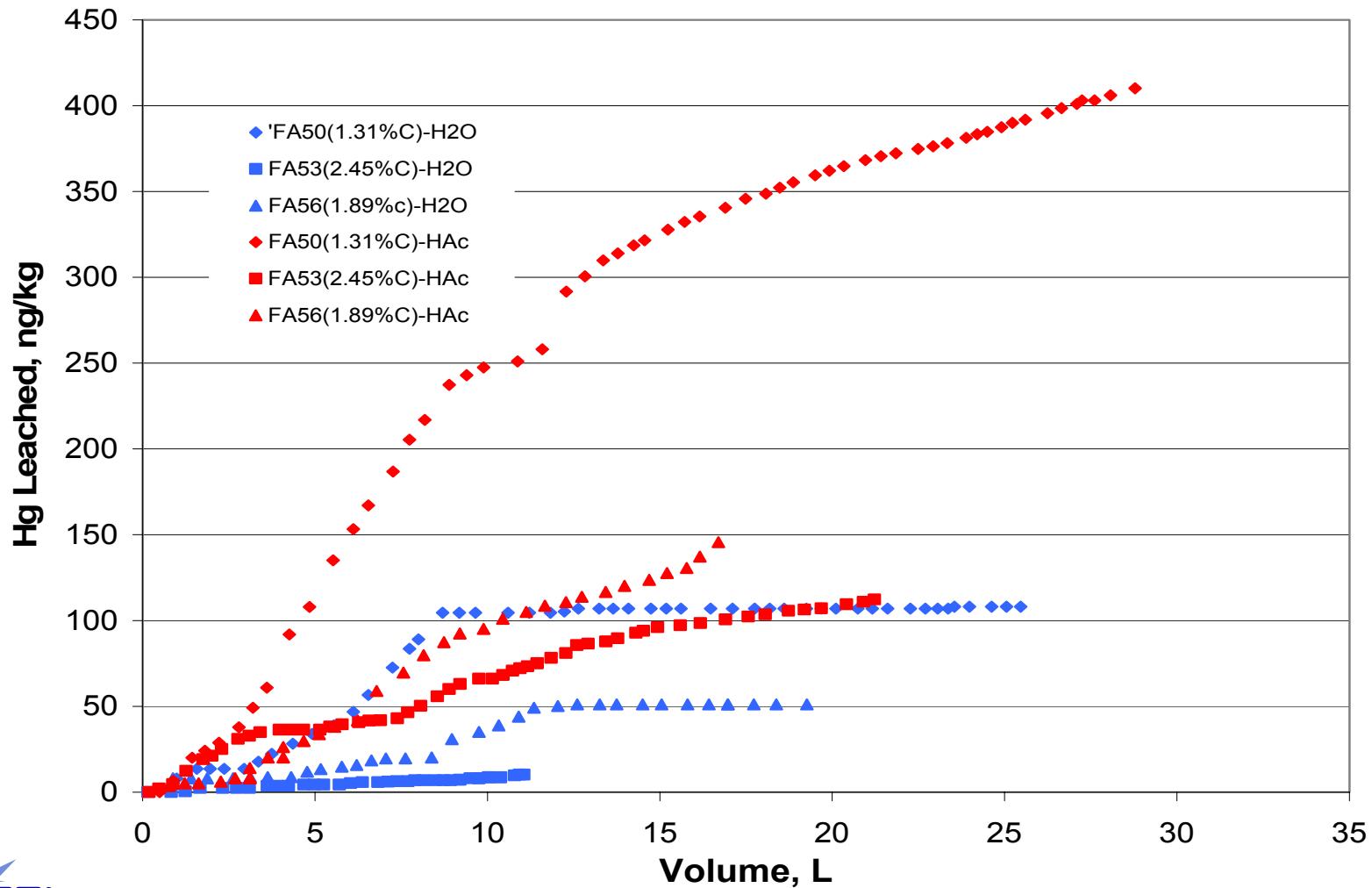
# Questions

- Is FA Hg concentration related to carbon content?
- How much Hg can be extracted from FA?
- Is release of Hg related to total concentration?
- **Is release of Hg a function of carbon content?**

# Leached Hg vs LOI



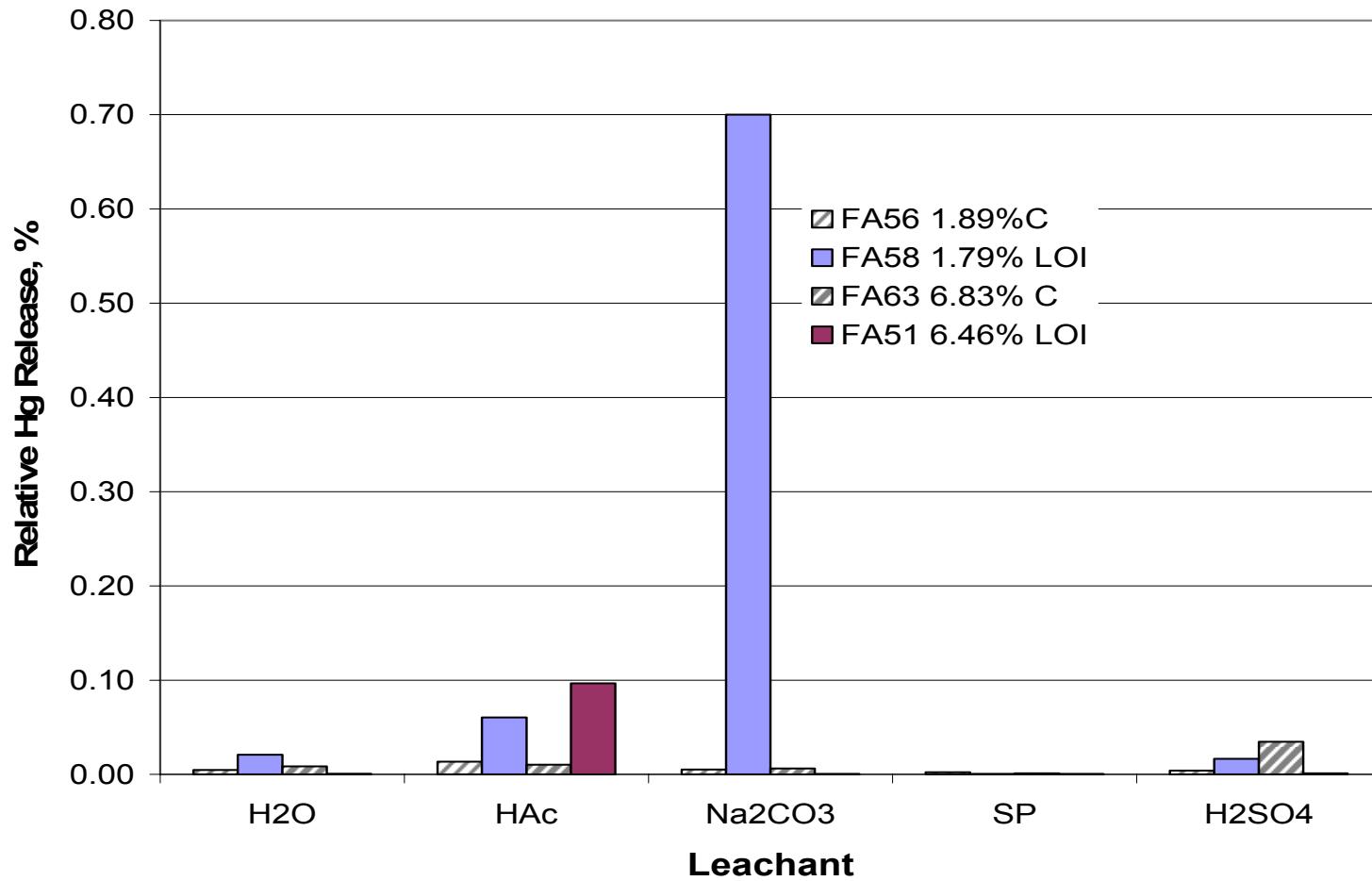
# Cumulative Hg vs C concentration



# Questions

- Is FA Hg concentration related to carbon content?
- How much Hg can be extracted from FA?
- Is release of Hg related to total concentration?
- Is release of Hg a function of carbon content?
- **Is there a difference between AC and LOI?**

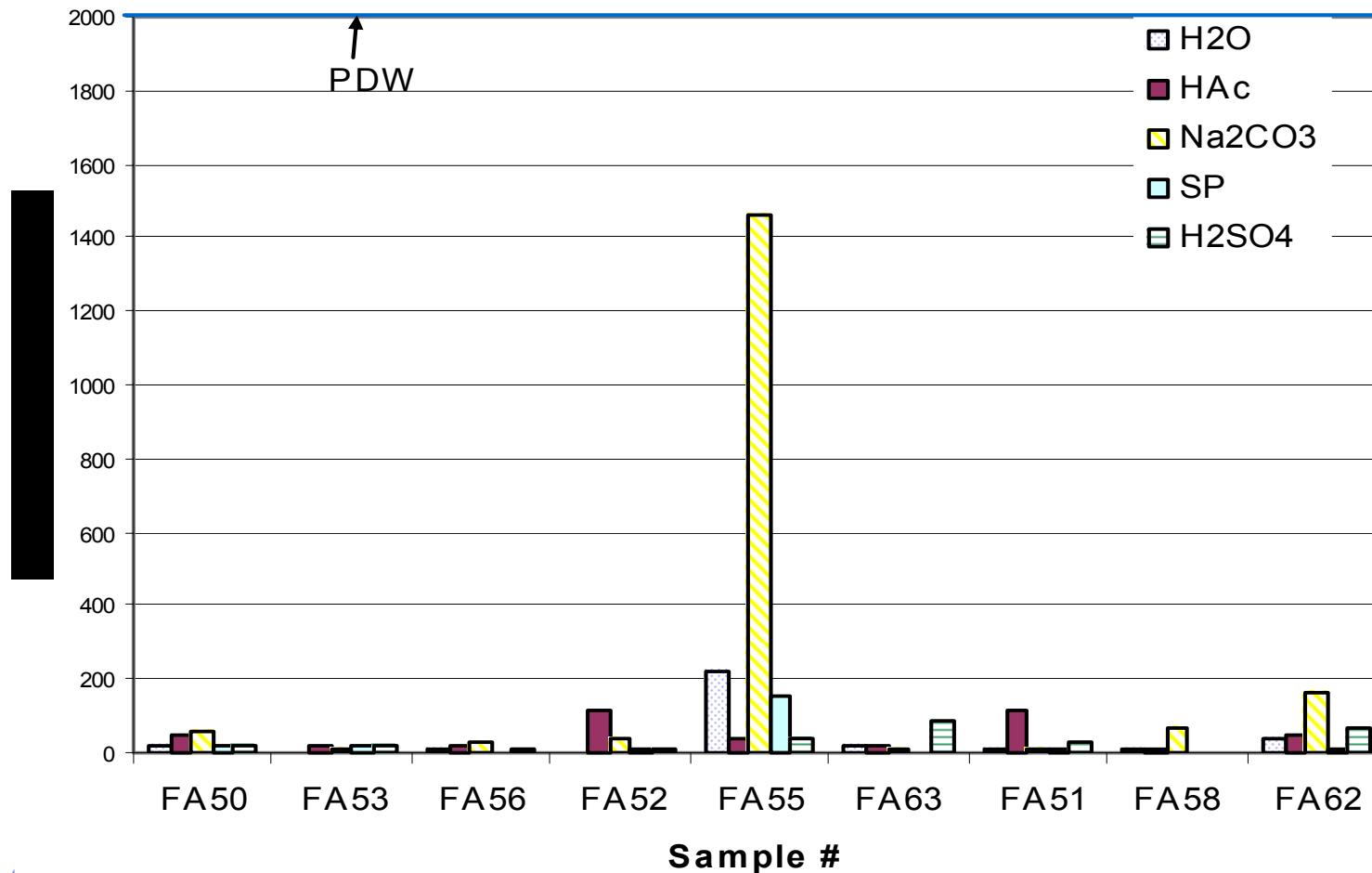
# Cumulative Release vs AC or LOI



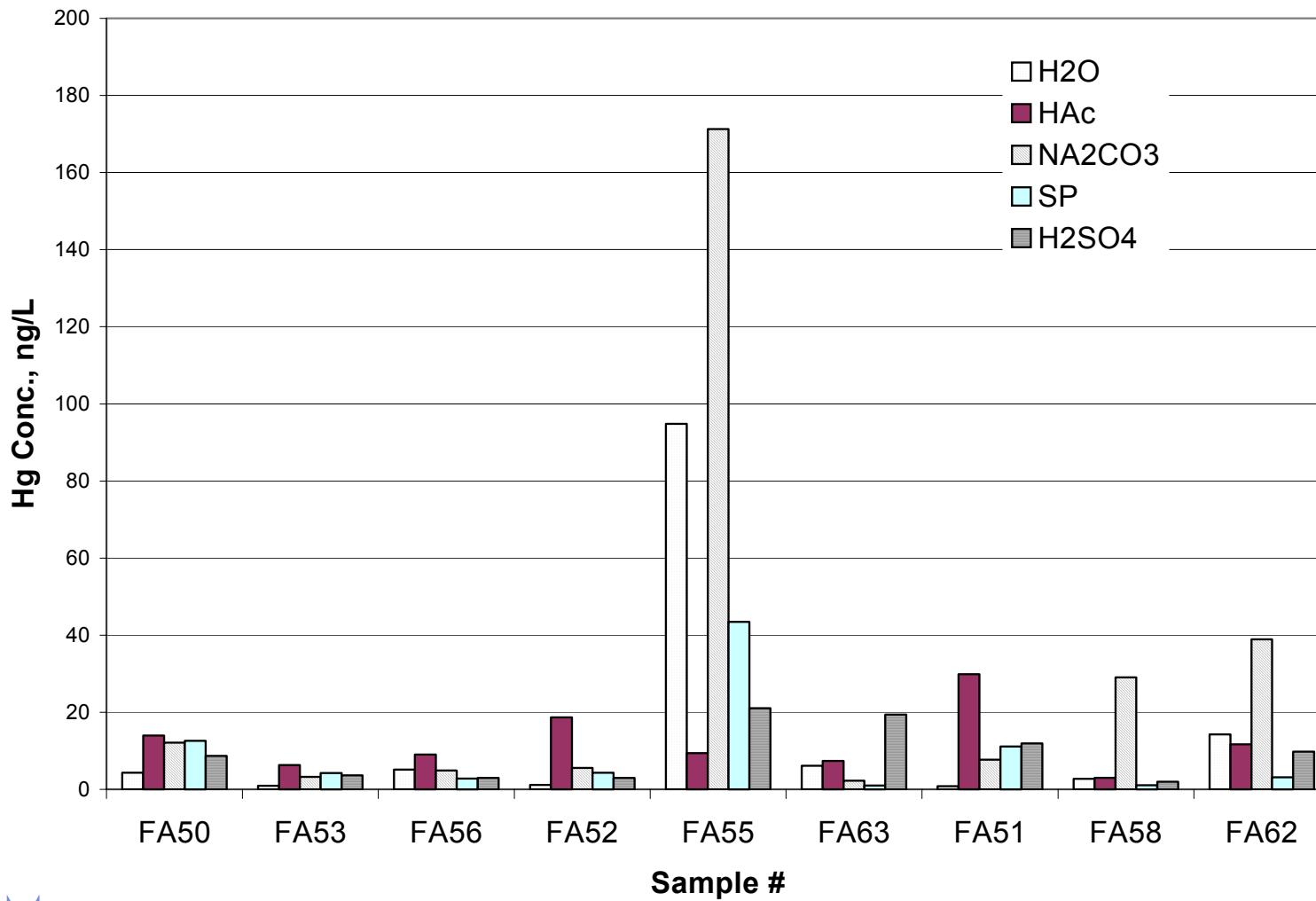
# Questions

- Is FA Hg concentration related to carbon content?
- How much Hg can be extracted from FA?
- Is release of Hg related to total concentration?
- Is release of Hg a function of carbon content?
- Is there a difference between AC and LOI?
- **Can solubility exceed H<sub>2</sub>O standard?**

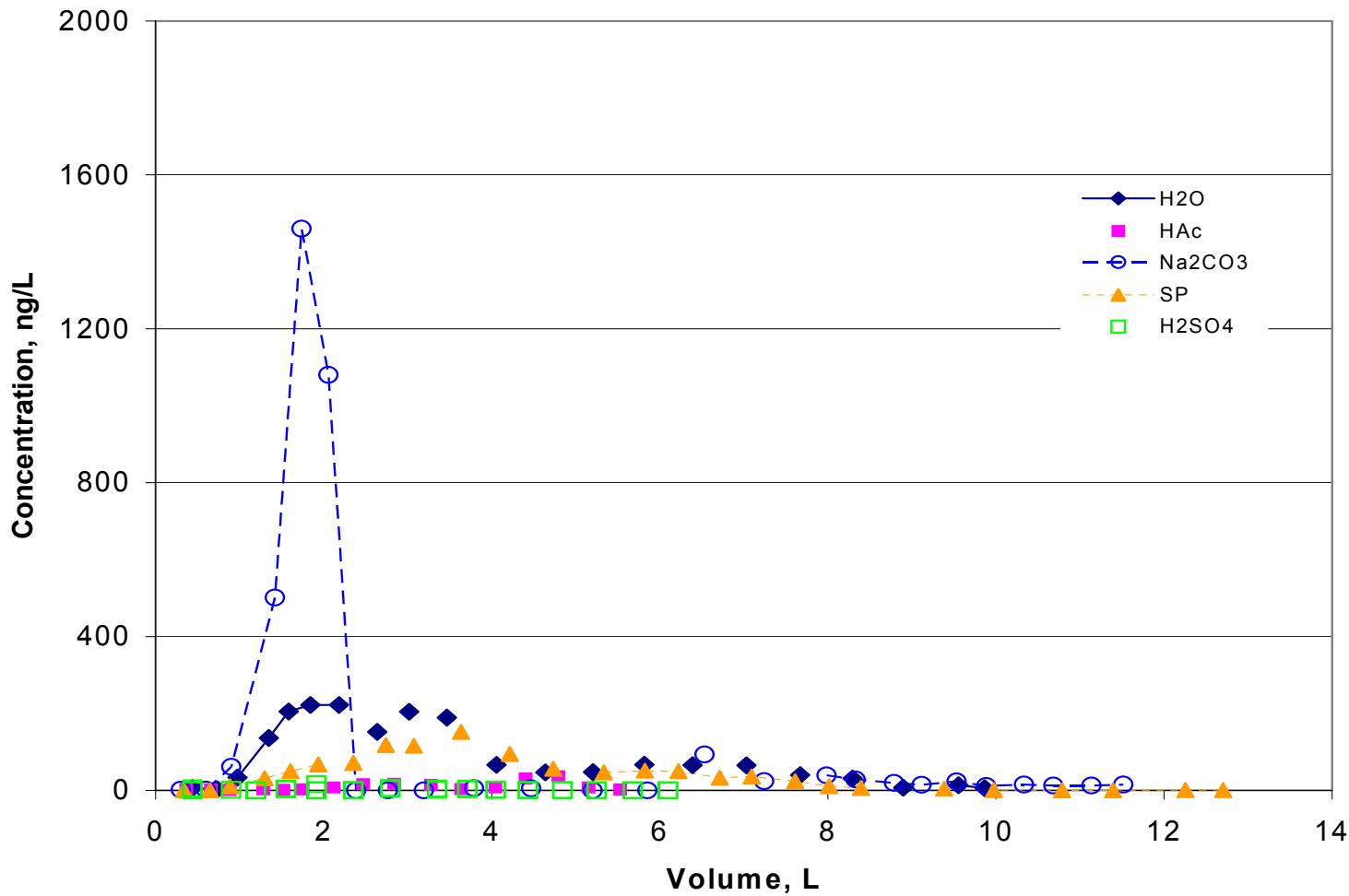
# Maximum concentration, ng/L



# Average concentration, ng/L



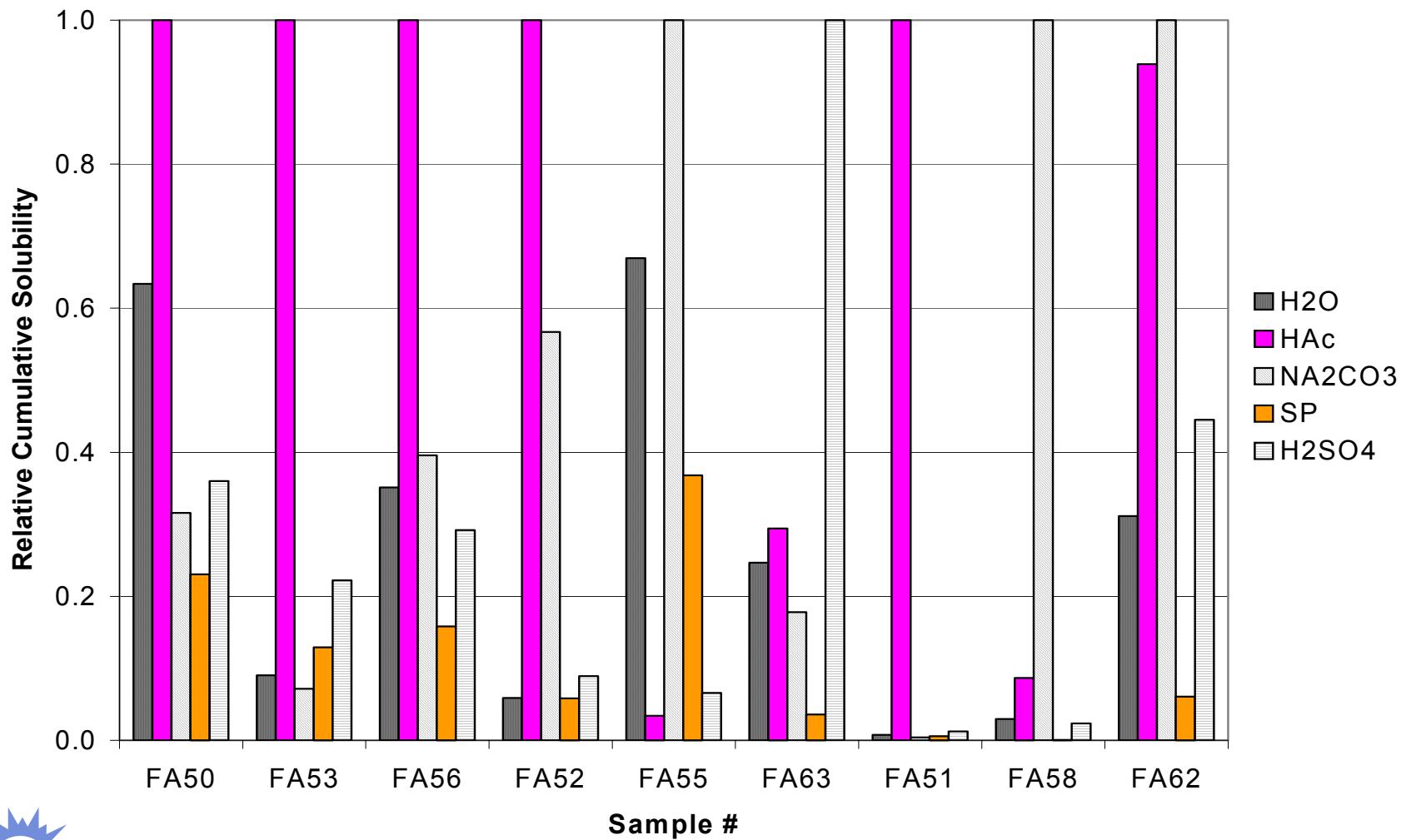
# Leachate Concentration: FA55



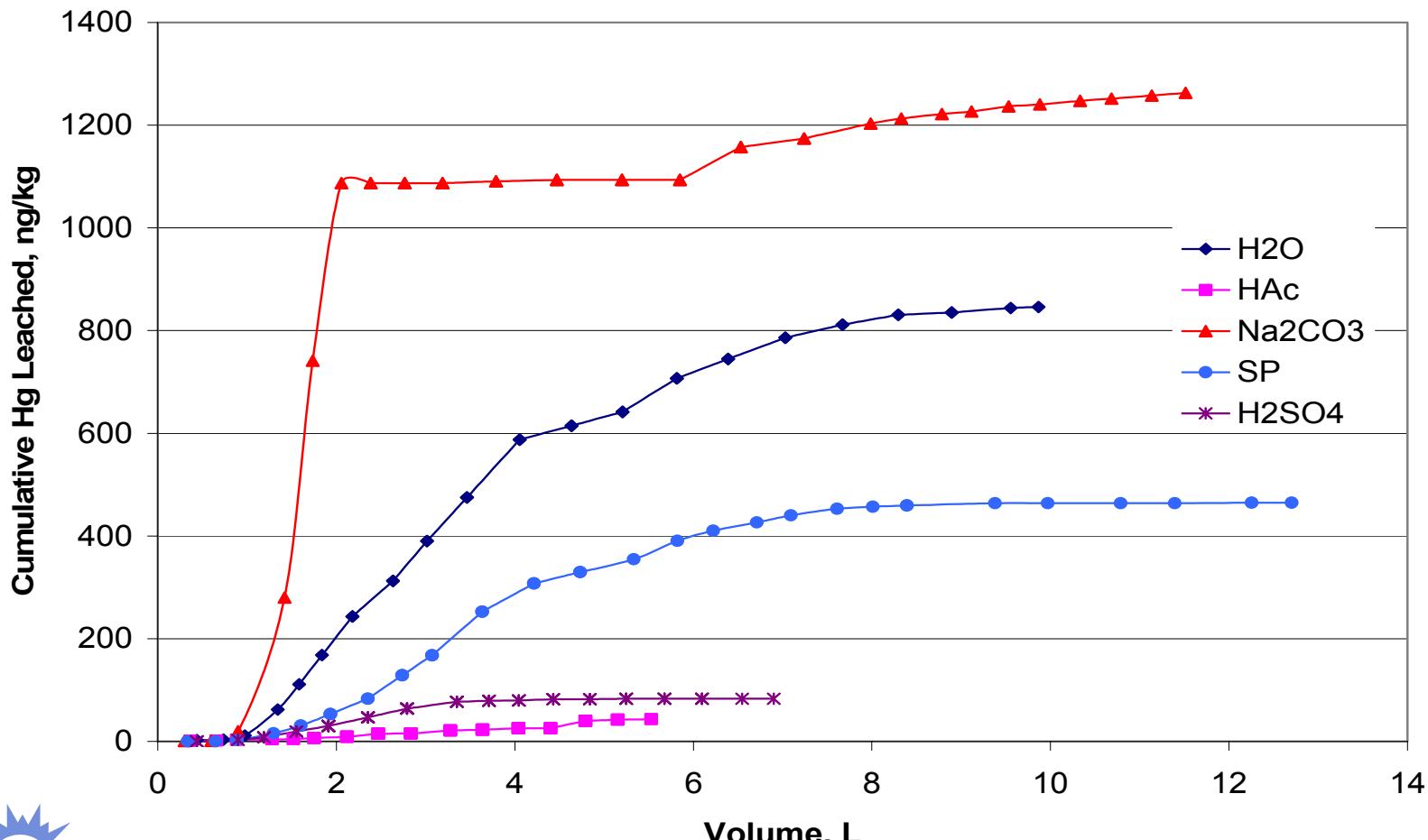
# Questions

- Is FA Hg concentration related to carbon content?
- How much Hg can be extracted from FA?
- Is release of Hg related to total concentration?
- Is release of Hg a function of carbon content?
- Is there a difference between AC and LOI?
- Can solubility exceed H<sub>2</sub>O standard?
- **Is Hg solubility pH dependent?**

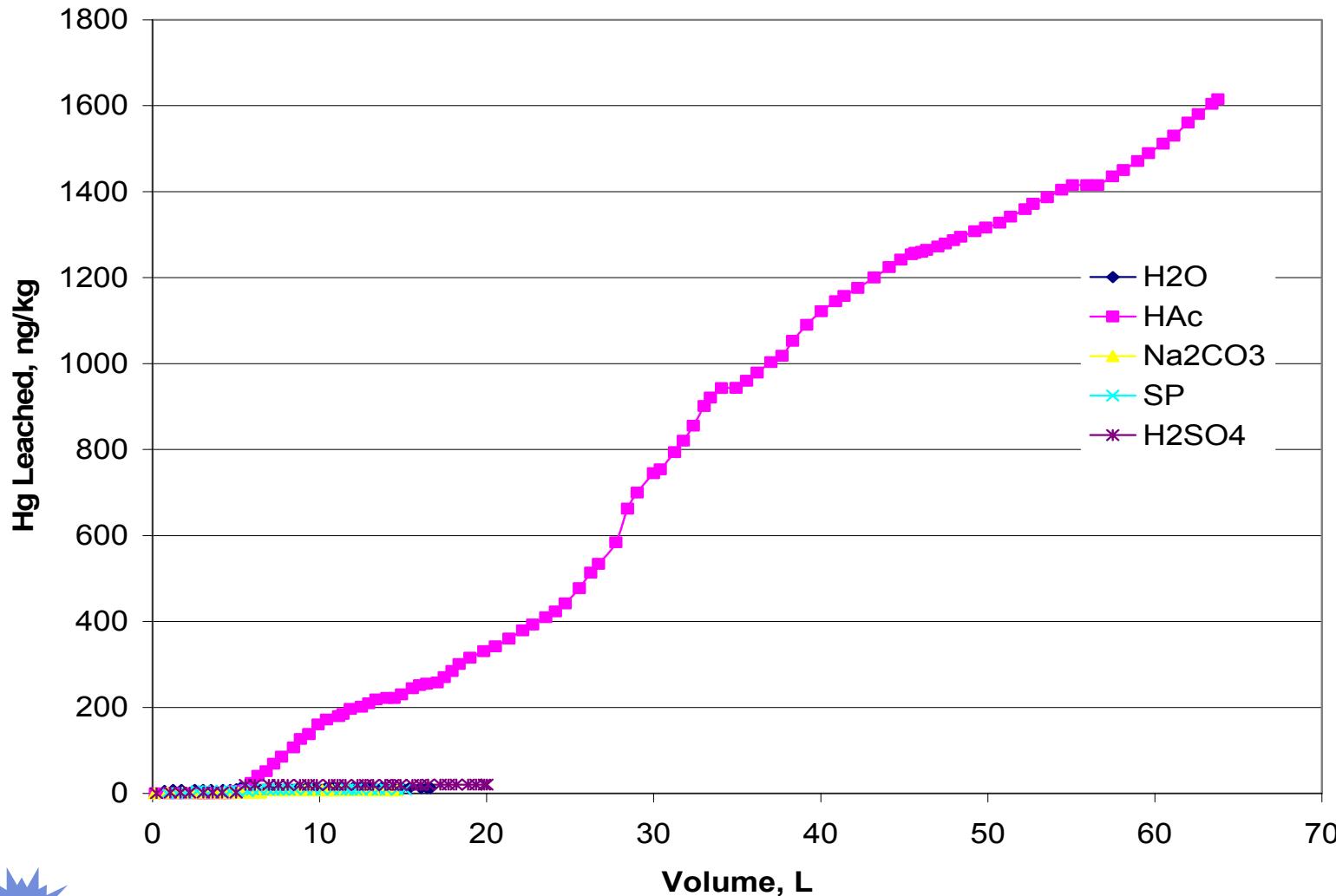
# Leachate Efficiency Relative to Leachant



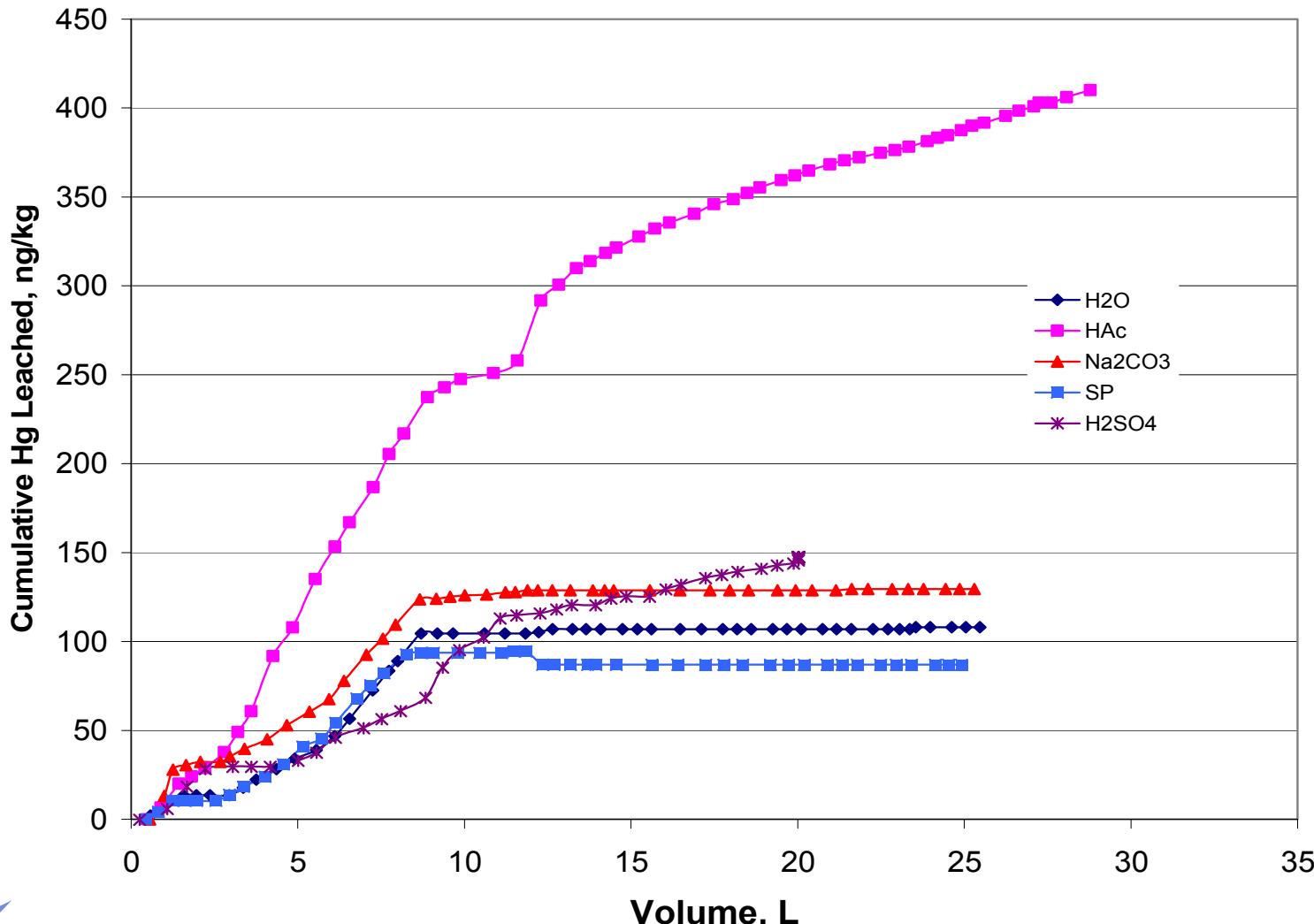
# Cumulative Hg Leached:FA55



# Cumulative Hg Leached:FA51



# Cumulative Hg Leached:FA50



# Questions

- Is FA Hg concentration related to carbon content?
  - Probably to some extent
- How much Hg can be extracted from FA?
  - Very little
- Is release of Hg related to total concentration?
  - Apparently not
- Is release of Hg a function of carbon content?
  - Could be
- Is there a difference between AC and LOI?
  - Apparently
- Can solubility exceed H<sub>2</sub>O standard?
  - Not likely
- Is Hg solubility pH dependent?
  - Yes and No

# Acknowledgements

- **Samples**
  - Bill O'Dowd NETL
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  - George Kazonich NETL
  - Mike Dahlberg NETL



# Questions?