BROOKS RAND LABS

MEANINGFUL METALS DATA

# Analyzing Flue Gas Desulfurization Wastewater for Trace Metals

In order to meet individual state regulations and air quality standards set by the US EPA, coal fired power plants are required to remove sulfur dioxide emissions from the flue gas they generate. Over 85% of flue gas desulfurization (FGD) systems use wet scrubbers that employ a limestone-forced-oxidation process, spraying slurry over flue gas to convert gaseous sulfur dioxide to calcium sulfate particulates. Once the level of suspended solids in the slurry reaches a certain limit, it is purged from the scrubber for dewatering to separate the calcium sulfate, or gypsum, from the purge water.

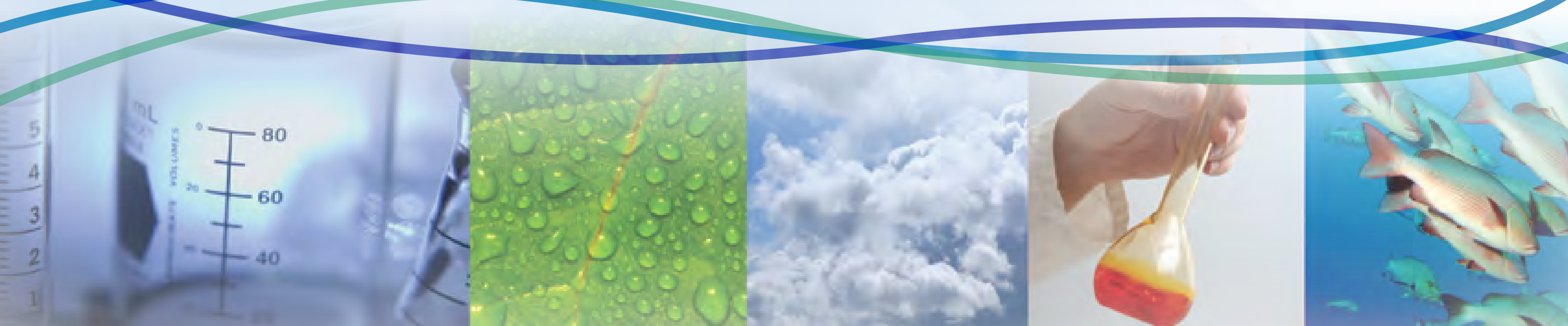
The composition of the resultant FGD wastewater (WW) is highly variable, depending in turn upon the composition of the coal and limestone, the design of the scrubber, the dewatering process, etc. The composition may vary widely between stages of treatment as well as between individual power plants. Effective optimization of FGD WW treatment facilities requires analyzing samples from each stage in the process for characterization and the evaluation of removal efficiencies.

The unusual and constantly shifting composition of FGD WW presents circumstances that would otherwise rarely be encountered in analyzing wastewater samples. In addition to elevated levels of suspended and dissolved solids, FGD WW can have extremely elevated concentrations of chloride, carbon, sulfur, bromine, and alkali earth metals (sodium, calcium, potassium, magnesium), which can result in substantial polyatomic interferences when analyzed for trace metals by standard ICP-MS techniques.

Inaccurate data, like that produced for many analytes that are affected by polyatomic interferences when analyzed by standard ICP-MS, can lead to confusion about the actual concentration of trace metals in FGD WW and the effectiveness of treatment techniques, investigation or implementation of unnecessary treatment technologies, and costly delays.

## Example Composition of FGD WW

| Matrix Constituent | Sample A | Sample B | Sample C | Sample D |
|---|---|---|---|---|
| Ca | 731 | 4900 | 737 | 765 |
| Cl | 1900 | 13000 | 10000 | 3700 |
| Mg | 391 | 3590 | 7640 | 4940 |
| Na | 22 | 2020 | 1460 | 792 |
| $SO_4$ | 450 | 2000 | 19000 | 17000 |
| TDS | 3900 | 37000 | 48000 | 68000 |
| TOC | 5.2 | 1100 | 320 | 73 |
| TSS | 45 | 60 | 120 | 58 |

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*"…timely, professional, and knowledgeable… Brooks Rand Labs stands out as one of the best in client services."*

*Forrest Dierberg, Ph.D.*
*Vice President and Laboratory Director*
*DB Environmental, Inc.*

Comparisons of results derived from analyses of FGD WW samples by standard ICP-MS with those from the significantly more accurate, precise, and expensive sector-field, or high-resolution, ICP-MS (HR-ICP-MS) method demonstrate how significantly these interferences can affect the quality of data when no actions have been implemented to mitigate them.

Brooks Rand Labs, in close cooperation with representatives of the electric utilities, university research groups, and environmental engineering firms, has conducted extensive research and investigation to develop reliable analytical methods/techniques for the determination of many trace metals in FGD WW that overcome the matrix-associated interferences without incurring the prohibitive costs of HR-ICP-MS.

Analysis by ICP-MS – when coupled with Dynamic Reaction Cell™ (DRC) technology, an advanced chemical resolution system optimized with the appropriate reaction gasses – can eliminate many of the polyatomic interferences associated with the analysis of FGD WW, producing accurate data and at a fraction of the cost of analysis by HR-ICP-MS. At Brooks Rand Labs, these ICP-DRC-MS methods are tailored to the FGD WW from each plant.

*To learn more about the innovative analytical methods Brooks Rand Labs has developed to accurately assess the concentrations of trace metals in FGD WW, contact us today.*

## Example Results for FGD WW by Analytical Methods (µg/L)

| Analyte | Standard ICP-MS | HR-ICP-MS | ICP-DRC-MS |
|---|---|---|---|
| As | 3210 | 11 | 13 |
| Cr | 267 | 3.2 | 3.1 |
| Cu | 56 | 18 | 18 |
| Ni | 175 | 130 | 135 |
| Se | 14100 | 6270 | 6220 |
| V | 131 | 50 | 49 |
| Zn | 4840 | 4600 | 4640 |