B&W’s Wet ESP Technology Milestones

- Western Precipitation installs their first wet precipitator on a smelter in Selby, California (1907)
- B&W acquired the pollution control business of Joy Environmental, which included that of Joy Western and Western Precipitation (1995)
- B&W entered into a contract with FLS to supply WESPs for supply of (2) power plant capturing sulfuric acid mist ESPs for a power plant complex totaling 1,050 MW of generation (2003)
- B&W licensed all of FLS’ WESP technology for all applications on a world-wide basis (2004)

The B&W Company offers WESP products based on the technology, experience and know-how of Western Precipitation, Joy, Fluid Ionics, FLS and Preciptech (purchased from GE-BHA in 2010).
Why the Wet ESPs have an increasing role in Smelter Sulfuric Acid Plants?

- Requirements for dust and fume emissions are ever tightening
  - Total dust + metal fume levels below 1.2 mg/NM³ being sought
  - Particulate wet scrubbers unable to achieve this limit even at high pressure drops
- Well designed Wet ESPs are the last line of defense
  - Candle filters are not the right application due to high dust content in process gas

Particulate Wet Scrubbers
**System Approach to Maximize Wet ESP Operational Effectiveness**

- Specific corona power versus mass emissions requirements for fumes, mist and dust
- Size the Wet ESP (residence time) based on specific power requirements
- Keep the Wet ESPs well aligned & well cleaned. Lower inlet dust content, through dry ESPs operating well

**Specific Corona Power**

\[ \text{Specific Corona Power} = \text{SCA} \times \text{Corona Power Density} \]

- SCA defined as ft²/acfm (or M²/M³/hr)
- Corona Power Density as watts/1000 ft² (or watts/M²). Sp. Corona Power as watts/1000 acfm or watts/M³/hr
- Specific Corona Power maximized by proper Discharge Electrode design and WESP geometry
**Many different wet ESP Designs in Commercial Practice**

- Tubes or Plates
- Circular, Hexagonal or Rectangular tubes
- Downflow or upflow
- Horizontal or Vertical flow for plate type designs

**Wet ESP Tube/Rigid Electrode Design**

Old WESP cells, lead

WESP Hex alloy cells
Wet ESPs: Plate Type Electrodes

(Lurgi) GEA Bischoff Collector Bundle - PVC Tubes
Continuous Fogging Nozzles Typically used
B&W alloy WESP units replacement for lead acid mist units

WESP Hex Tube Bundle arrangement

Installing the WESP Collector Assembly
**B&W alloy WESP replacement for lead acid mist units**

Typical Rigid discharge Electrodes and Hex Collecting Tubes Arrangement

- Hex Collecting Tubes
- Rigid Discharge Electrode

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**B&W alloy WESP units replacement for lead acid mist units**

Typical WESP Upper HV Suspension Frame Arrangement

- Rigid Discharge Electrode suspension frame
- Rigid Discharge Electrode
- Hex Collecting Tube
**B&W alloy WESP replacement for lead acid mist units**

Typical WESP Rigid discharge Electrode Lower Alignment Arrangement

**Different wet ESP Materials of Construction in Commercial Practice**

- Lead collector tubes & discharge electrodes
- Plate type, hexagonal or round polymeric collectors: FRP, etc. Metal DEs
- All Alloy Designs: 904-L, 6 percent Mo, C-276 and C-22 depending on presence of chlorides & fluorides along with low pH (T matters)
Key Factors Affecting Wet ESP Outlet Emissions through low power levels

- Wet ESP cleaning of dust from collector plates
  - Made worse by high dust inlet concentration
  - Sub-optimum cleaning cycle
  - Clogged nozzles

- Poor inter-electrode clearances
  - Pre-mature, low power sparking limitations
  - Made worse by poor wet ESP cleaning

V/I Curves: Indicative of Performance and Maintenance Issues

Normal curve. After corona is formed, current increases with increasing voltage.
V/I Curves (2)

Indicates resistance path to ground. May be due to cracked insulator or loose wire touching tube wall.

V/I Curves (3)

Indicates severe misalignment between emitting electrodes and collecting plates.
**V/I Curves (4)**

Acts like increased radius of emitting electrode (heavy deposits on rounded star wire edges).

**V/I Curves (5)**

Indicates corona quenching due to fumes and mist. Little increase in current with increasing voltage because corona is not well formed.
Current-voltage behavior reflects wet ESP status and performance

- I-V behavior determines total specific power
- Indicative of operational & maintenance issues
- Early warning indicators of upfront process changes: Feed changes, changes in dry ESP/wet scrubber performance, etc
- Are high voltage insulators getting dirty?
- Are the purge air systems operating well?
- Good ESP Performance is driven by maximization of corona power!

Thank You. Questions?

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