REINHOLD ENVIRONMENTAL Ltd.

2011 APC Round Table
& Expo Presentation

July 11-12, 2011, in Cleveland, OH / Hosted by FirstEnergy

Steps to Evaluate Existing ESP Upgrade Options to meet IMACT or UMACT

July 12, 2011

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Background

Compliance with ever more stringent emission regulations is a mandate for both industrial & utility boiler operators.

- An existing coal/biomass industrial boiler must meet emissions of 0.039 lb/MBtu (filterable)
- The existing utility boiler proposed rule is 0.03 lb/MBtu total particulate emissions (about 0.015 lb/Mbtu filterable).

ESP collection efficiency is affected by multiple factors external to the PM control device

Consequently, the ability to maintain continuous compliance with existing ESP is dependent on understanding the influence of external factors affecting collection

Basic Design Considerations for Upgrades of any ESP/FF Particulate Collection System

- **Avoid new capital cost equipment/installation**
- **Maximize reuse of existing infrastructure (support steel, ductwork, access, ID fans, ash conveying systems)**
- **Reuse existing components when possible (casing, hoppers, etc)**
- **Avoid footprint extension of equipment**
- **Minimize downtime for installation**
- **Performance that meets customer requirements**
- **Minimize power consumption**

Data Required for Decision Making

- **GA‘s for existing APC equipment**
- **Process data (gas flow, temperature, dust load, fuel characteristics, ash characteristics)**
- **ID fan manufacturer/model/performance curve**
- **PM emissions goal, SO_2 emissions goal, Hg emissions goal, and NOX removal system**
- **Will a DSI system be required and type reagent used?**
- **Does the customer currently sell flyash?**
- **Outage timing & duration**

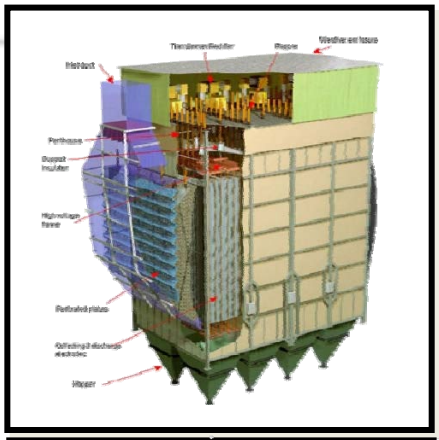
Factors Impacting ESP Performance

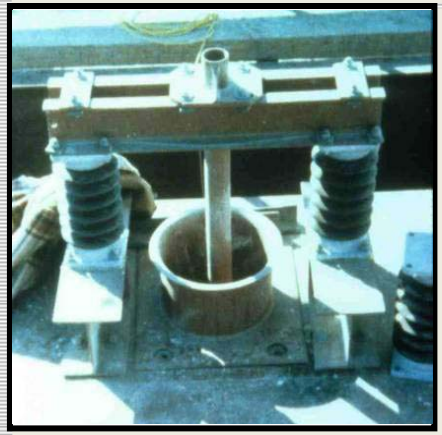
- **Specific collecting area**
- **Particle size**
- **Moisture affects dust resistivity**
- **Acid content affects dust resistivity**
- **Excessive moisture or acids can degrade rapping and increase corrosion**

- **Gas temperature**
- **Gas/dust distribution**
- **Ambient air in-leakage**
- **Number of electrical sections**
- **Effective rapping systems**
- **AVC controls & power supplies**

Potential ESP Upgrades

- **Replace worn out, bowed or corroded internals**
- **Improve rapping systems**
- **Replace all internals; optimize internal collection area, upgrade H.V. electrodes, upgrade T/R sets**
- **Increase electrical sectionalization**
- **Raise plate height (increase SCA)**
- **Add a mechanical field**
- **Model / improve gas distribution**





Implications of Sorbent Injection with Dry ESPs

Sodium based sorbent for HCl, SO_x control

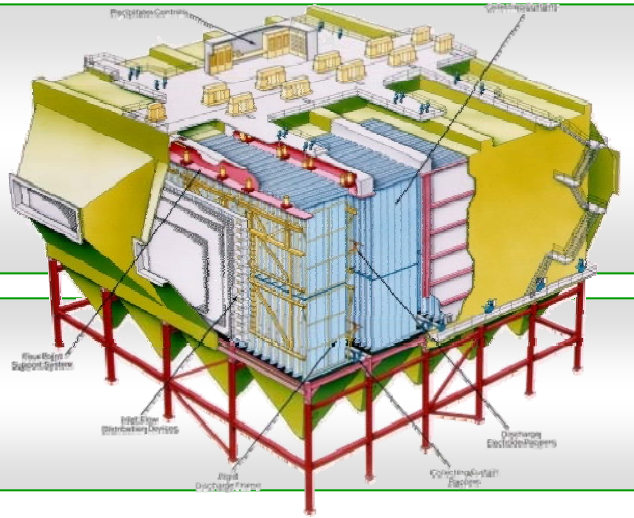
- **Decreases Flyash Resistivity**
- **Increases ESP Performance / Decreases PM Emissions**

Lime based sorbent for HCl, SO_x Control

- **Increases Flyash Resistivity**
- **Decreases ESP Performance / Increases PM Emissions**

PAC for Hg, Dioxin & Furan control

- **May Increase PM Emissions**
- **Flyash Sales may be Impacted**
- **Not Applicable to Hot Side ESP's**



Sorbent consumption

- **Utilization is lower than for a Fabric Filter**

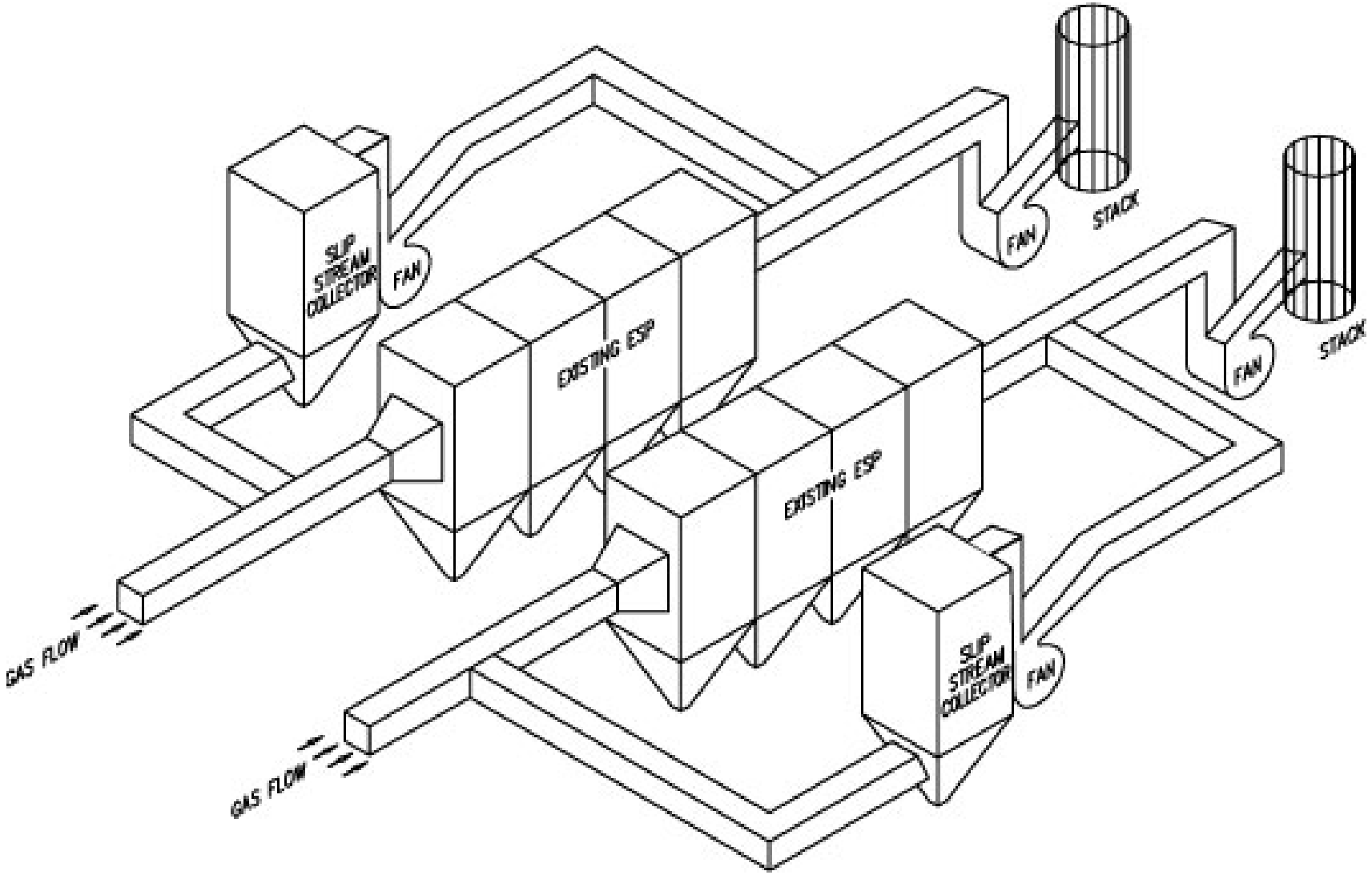
PJFF Used with Existing ESP's

Fabric filters can be applied in two ways to supplement existing ESP's:

- ***Slipstream* – An economical means of recovering de-rate or accommodating fuel switching by treating a portion of total gas volume. Plus low % mercury reduction can be accomplished.**

- ***Polishing* – Treating 100% of gas stream provides maximum reduction in emissions and provides high % mercury reduction**

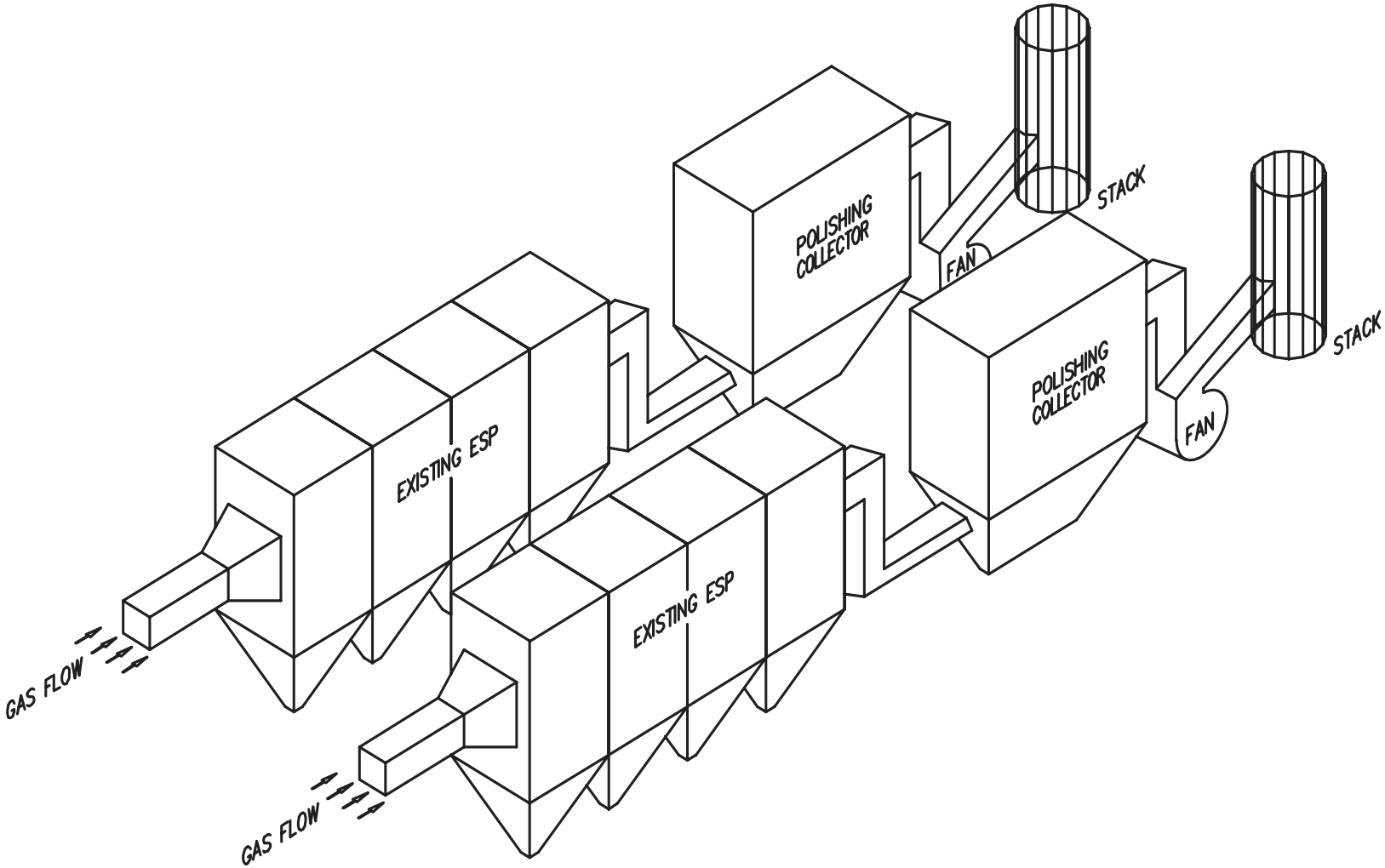
PJFF - Slipstream Application



Application of PJFF as Slipstream:

- **Divert only as much flow as necessary to attain acceptable ESP performance**
- **Blending the ESP and PJFF gas streams can provide very low stack emissions**
- **ESP start-up operation enhanced due to PJFF initially treating 100% of gas volume**
- **Mercury removal can occur in the slipstream PJFF resulting in up to 30% reduction overall. ESP flyash contracts can be maintained**
- **Total cost is lower than polishing unit**

PJFF in Polishing Application (COHPAC™ or TOXECON™)



Application of PJFF as Polishing:

- **Installed at outlet of ESP and treats 100% of total volume**
- **Still must be sized based on total gas volume treated, but can use up to 6:1 A/C ratios to reduce cost**
- **Emissions are very low**
- **Start up emissions negligible with PJFF treating 100% of gas volume even with ESP offline**
- **Mercury removal 90+%, and if carbon sorbents are used, ESP fly ash contracts are not affected (TOXECON)**