Worldwide Pollution Control Association

ESKOM Scrubber Seminar

April 12th – 13th, 2007

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Planning, Construction and Operating Scrubber Experience

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The Planning Process Is Like a Tree

- As one climbs certain branches, it is no longer possible to reach the other parts of the tree.
- Each time one makes a choice, certain options may be no longer available, so one needs to start at the lowest level and work their way up the tree.

The first major branch in the decision tree is whether to use a dry or a wet FGD process.

The next slides show some of the differences depending on which choice is made.

Number of Absorber Towers

- For dry scrubbing multiple absorber towers will be needed based on the size of the rotary atomizer used.
- For wet scrubbing single absorber towers have been used on units of your size.

Location of Absorber Towers

- For dry scrubbing the absorber towers need to be located ahead of a particulate removal device.
- For wet scrubbing the absorber towers need to be located after the particulate removal devices.

Effect on Particulate Removal Devices

- For dry scrubbing the flue gas will be cooled to near saturation temperature before it enters the particulate removal device.
- For wet scrubbing the pressure in the particulate removal device may change depending on what decisions are made regarding fans.

Effect on Fly Ash Properties

- For dry scrubbing the alkaline removal products will end up in the fly ash in the downstream particulate removal device.
- For wet scrubbing there is no effect on the fly ash since the absorber is downstream of the particulate removal devices.

Effect on Chimneys

- For dry scrubbing the flue gas will be cooler, so the plume may not rise as well.
- For wet scrubbing the flue gas is saturated and corrosive so the existing chimney will need to be modified or a new chimney constructed.

Materials of Construction

- For dry scrubbing carbon steel can be used for most of the components.
- For wet scrubbing high grade stainless steels, nickel alloys, rubber, masonry, FRP, resin based linings, etc. must be used due to the corrosive/erosive nature of the slurry .

Reagents Used

- For dry scrubbing lime is used.
- For wet scrubbing lime, limestone, ammonia, or sodium compounds are used.

Reagent Utilization

- For dry scrubbing a significant excess of reagent is required to obtain the desired SO_2 removal.
- For wet scrubbing a stoichiometric ratio of less than 1.1 can typically be obtained while obtaining the desired SO_2 removal.

SO_2 Removal Efficiency

- For dry scrubbing the SO_2 removal efficiency is dependent upon how close to the saturation temperature one operates.
- For wet scrubbing, systems have been guaranteed to reach 98% - 99% SO_2 removal efficiency.

It may be difficult to find vendors interested in bidding on your systems.

- The FGD system suppliers are experiencing an unprecedented amount of business.
- They do not have the expertise in house to handle too many jobs at one time.
- They are having trouble finding the people to detail out all the jobs they currently have.

Some components may be difficult to obtain by a certain date.

- Mergers and acquisitions have reduced the number of suppliers.
- Supplier's shops have a large back log due to all the systems being installed in the United States and China at this time.

Certain metals have become very expensive and all have delivery issues.

- The surcharge on nickel, chrome, and molybdenum have made nickel based alloys very expensive.
- The duplex stainless steels can give equal performance at lower cost in certain areas.
- Many of the mills are running at capacity.

It takes a lot of coordination to retrofit FGD systems on existing units.

- There will be a lot of work going on around operating equipment.
- Most of the new system will have to be built before any old equipment can be removed and the new system tied into the existing unit. (This is especially true with ducts and fans)

It takes a lot of coordination to retrofit FGD systems on existing units.

- Care must be taken during excavation not to undermine the foundations of existing equipment or to cut through underground pipes and cables.
- The vibrations caused by pile driving can effect existing equipment.
- Existing equipment may cause overhead obstructions that will effect pile driving operations.

It takes a lot of coordination to retrofit FGD systems on existing units.

- If the old chimney must be upgraded, it may be more economic to build a new chimney.
- If the induced draft fans must be upgraded to larger fans, it may be more feasible to install booster fans rather than upgrade the existing fan foundations.

It takes a lot of coordination to retrofit FGD systems on existing units.

- Duct is bought by the meter. The cost can add up quickly (especially for ducts handling saturated gas) as the length of duct runs increase. So there can be a large financial incentive to keep new equipment close to existing equipment. But there must be adequate room to erect and maintain equipment.

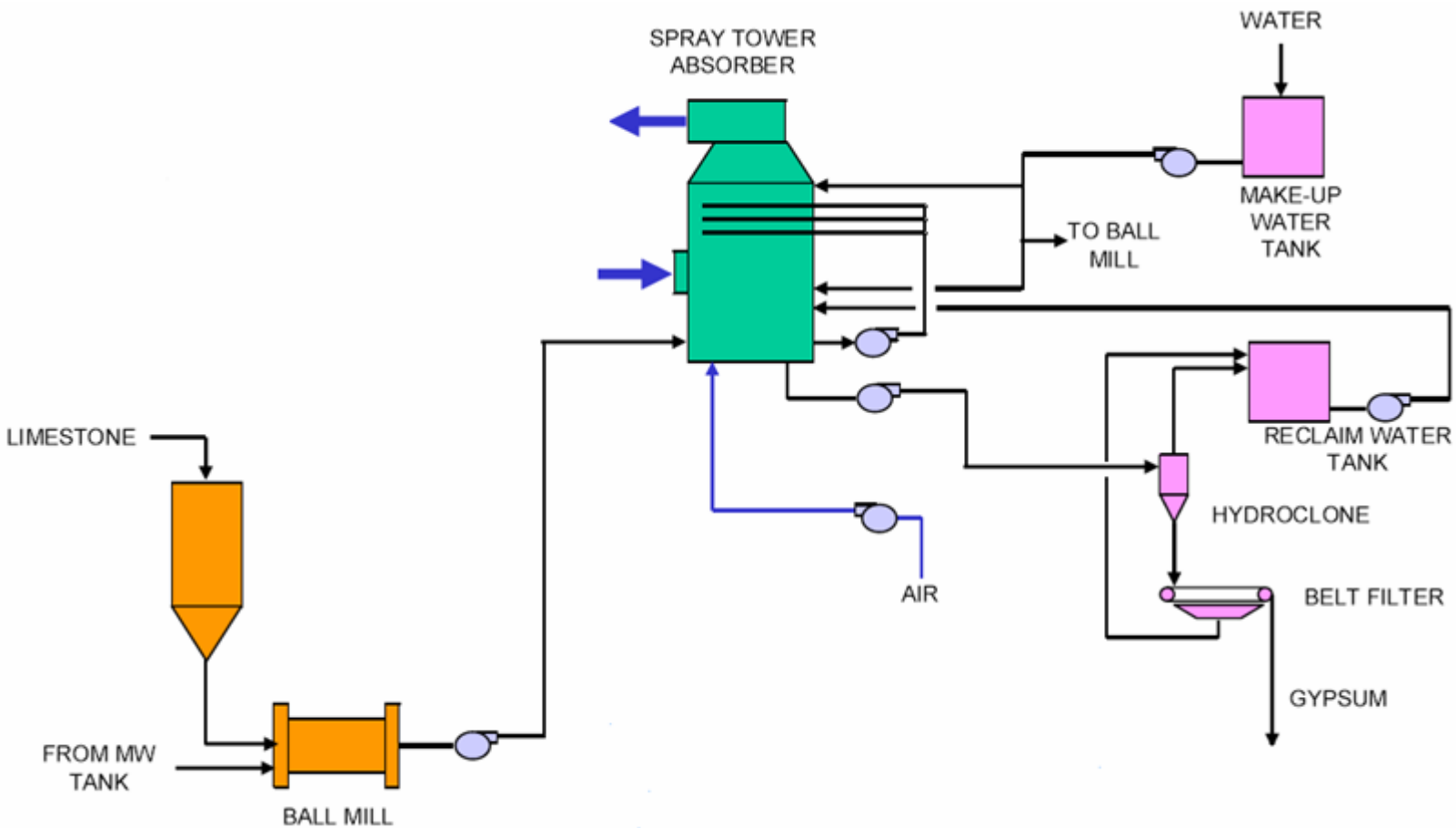
It takes a lot of coordination to retrofit FGD systems on existing units.

- There may be shortages of certain construction craft workers (especially qualified welders for high alloy metals).
- Some materials of construction choices in the United States were made based on the fact that another trade besides boilermakers could be used to erect the absorber towers.

Most wet FGD designs are an integrated closed loop process.

- This means much thought and planning needs to go into the plan on how each component is going to be commissioned.
- Commissioning must proceed in a sequential manner so that the needed liquid and gas flow paths are available coming to and leaving the component that is being commissioned.

Closed Loop Flow Paths



An FGD system is a chemical plant, NOT a piece of boiler auxiliary equipment.

- The parameters that control the process are chemical reactions.
- Much of the equipment and materials of construction are different than those typically used in power stations.

An FGD system is a chemical plant, NOT a piece of boiler auxiliary equipment.

- The operators don't need to be chemical engineers, but they do need to receive training in some basic chemistry principals and the specific chemical reactions that make the FGD system function properly.

An FGD system is a chemical plant, NOT a piece of boiler auxiliary equipment.

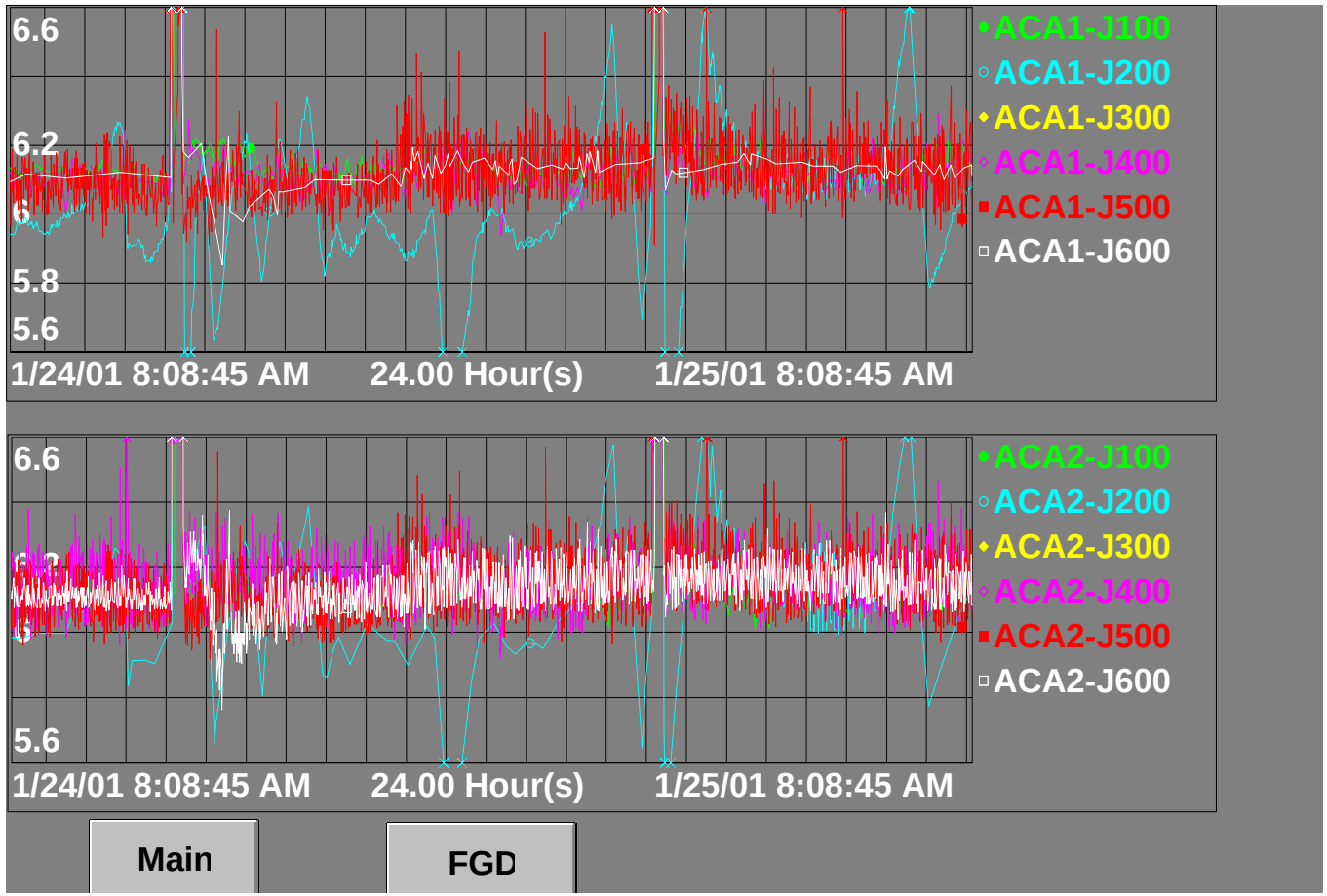
- The maintenance personnel need some training in the proper maintenance of the specialized equipment.
- They also need instruction in the proper handling of the materials of construction.

An FGD system is a chemical plant, NOT a piece of boiler auxiliary equipment.

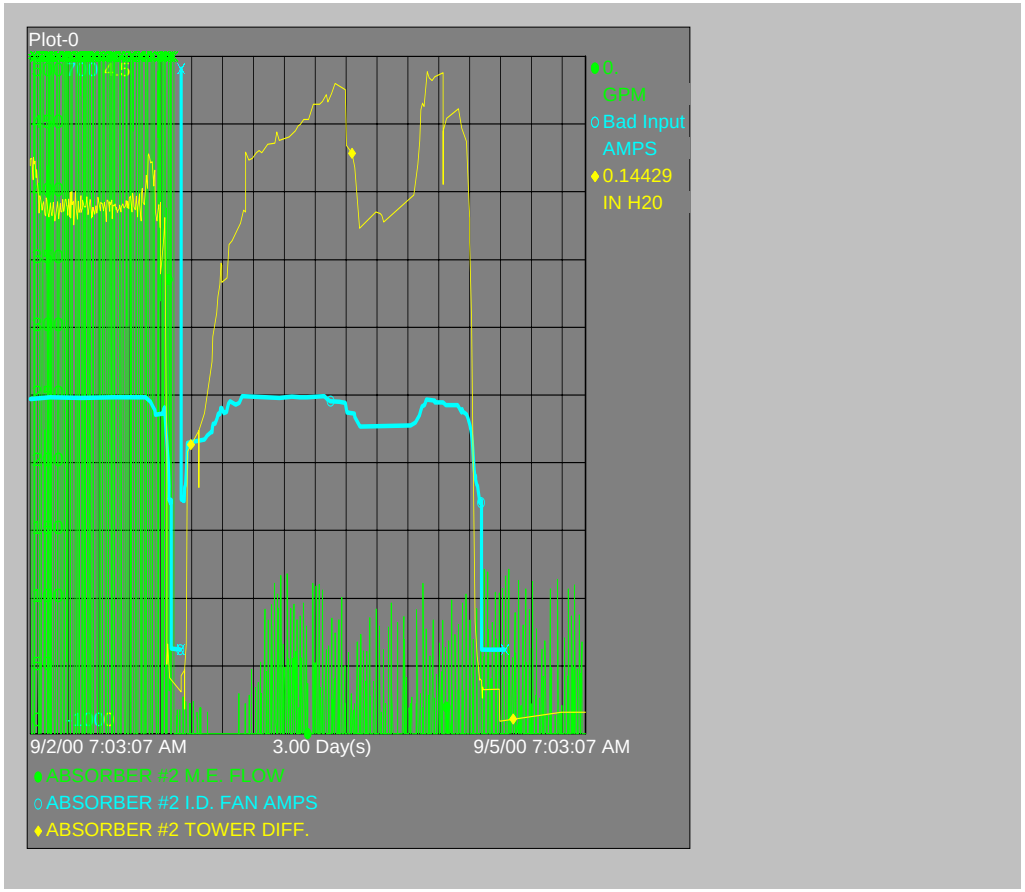
- Everyone at the power station needs training in the chemical safety issues.
- There are also other safety issues depending upon the specific design of the FGD system that they need to be aware of.

The latest generation of DCS control and data aquistion software give both the operators and the engineers powerful tools to recognize problems and find solutions if they are used properly.

A pH Control Issue



A Mist Eliminator Wash Issue



Thank You For The Opportunity to Visit Your Beautiful Country.

I Hope This Information Will Be a Help To You as You Proceed With This Important and Enormous Task You Are Undertaking.

For Further Info, please contact…

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