Boiler and Combustion Systems Impact on FGD Plant Operation

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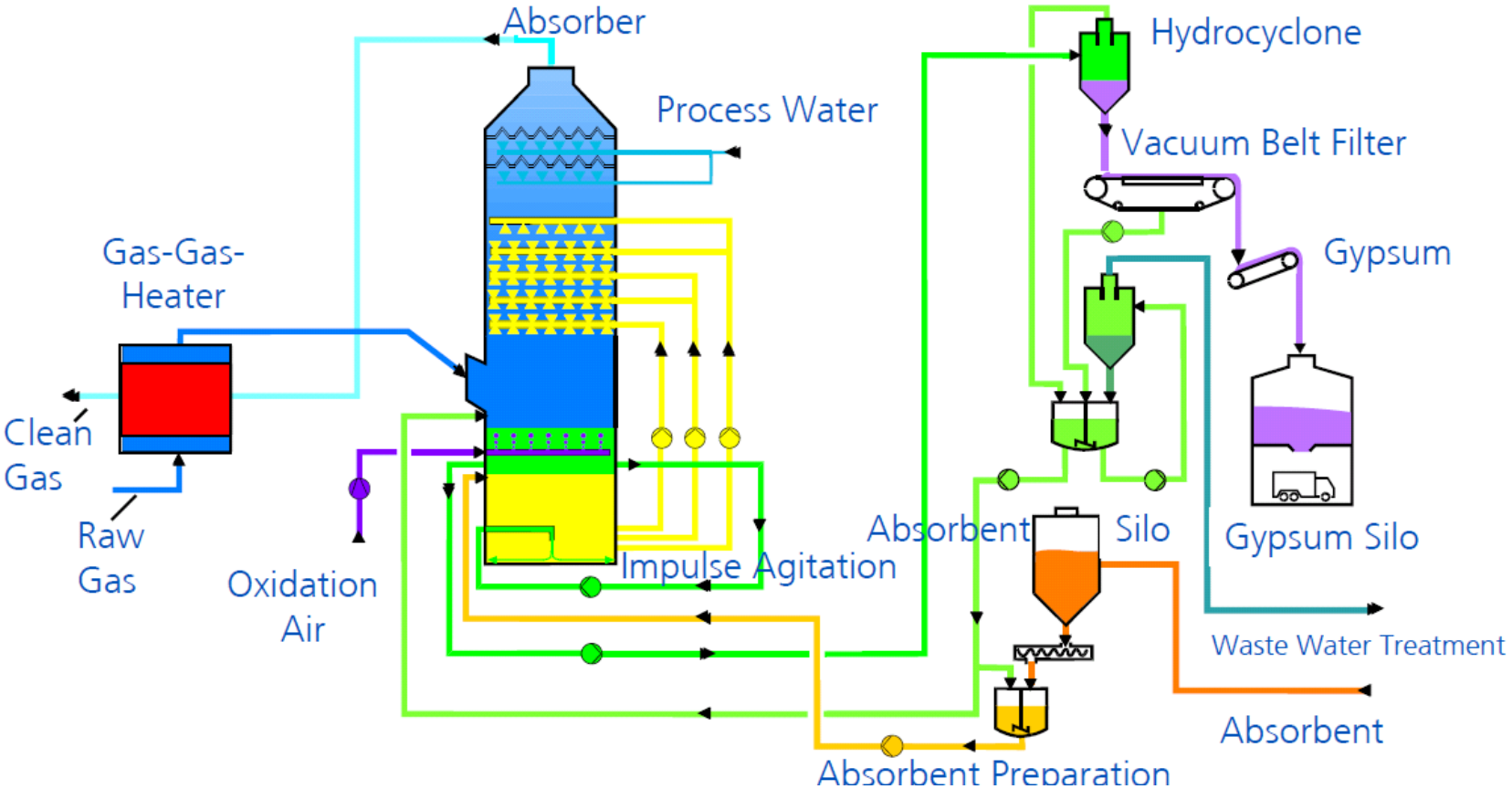
Agenda

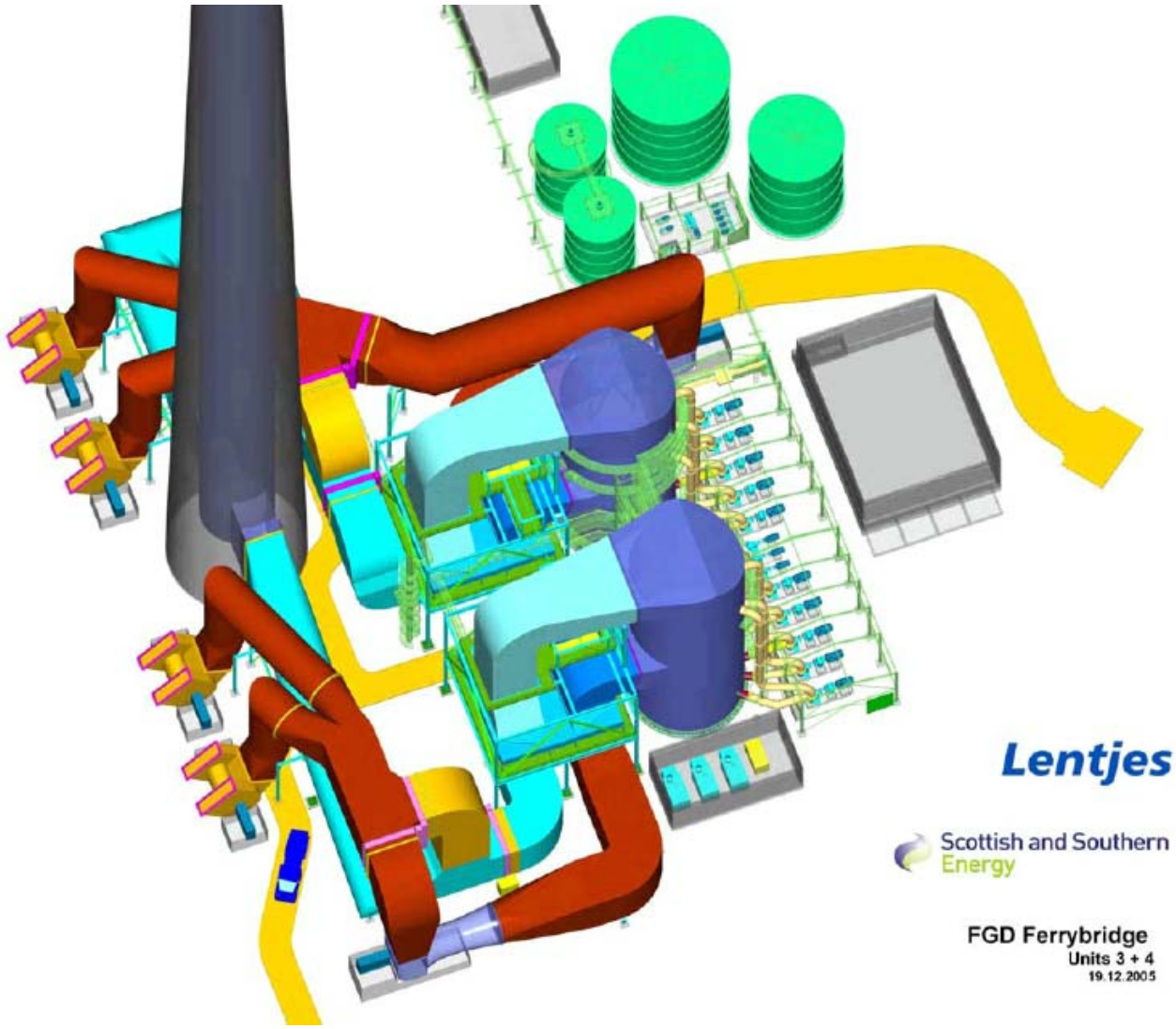
- Overview of the Ferrybridge Boiler and FGD
- Requirements of the Boiler for FGD system
- Consequences of not meeting FGD requirements
- Engineering Developments
- Other Challenges

Overview of Ferrybridge FGD

Principle Flow Sheet of Wet Limestone / Lime FGD (Example):

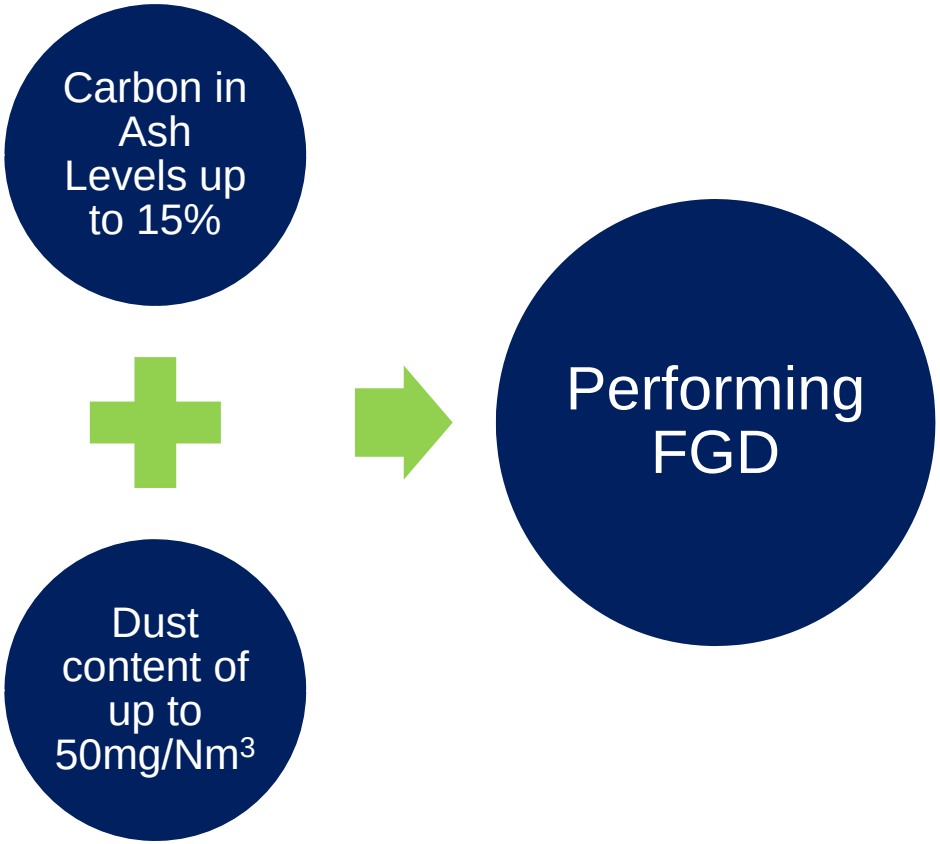


Overview of Ferrybridge FGD



Requirements of the Boiler for FGD system

In order for the FGD to perform as designed the flue gas that is produced by the Boiler combustion system must have the following characteristics



Consequences of not meeting FGD requirements

Carbon in Ash

The main issues is obtaining the correct colour gypsum, CIA produces a grey or sometimes tan coloured gypsum. This is not an acceptable product to process and often has to blended to become lighter. The desirable colour is “as white as possible”.

If the FGD produces a significantly dark gypsum then we are forced to send it to landfill incurring additional cost and loss of sales.

Dust Content

If the dust content regularly exceeds the limit within a certain time period the FGD will trip to bypass. This could result in potential breech of emission legislation with respect to Dust and SOx

Engineering Developments

Instrumentation

The upgrading of online instrumentation will allow the continuous monitoring and subsequent analysis of Carbon in Ash.

Benefits of the Greenbank G-CAM carbon in ash monitor

- **Accurate and repeatable carbon in ash measurement**
- **Latest microwave absorption and phase shift measurement techniques**
- **Suitable for all coal types**
- **No load cells or density measurement**
- **Low maintenance**
- **Rapid iso-kinetic sampling**
- **Up to 6 multi-point sampling capabilities**
- **Increased handling rate up to and over 2Kg per hour**
- **Touch screen control**
- **Self protecting against boiler oil burning shut down and start up**
- **Automated, sample segregation for lab analysis**
- **Reports duct temperature at collection points for analysis of ash behaviour**
- **Unaffected by change in coal type or colour**

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Combustion Optimisation

Reassessing the combustion system with regard to changes in plant, emission limits, fuel flexibility.

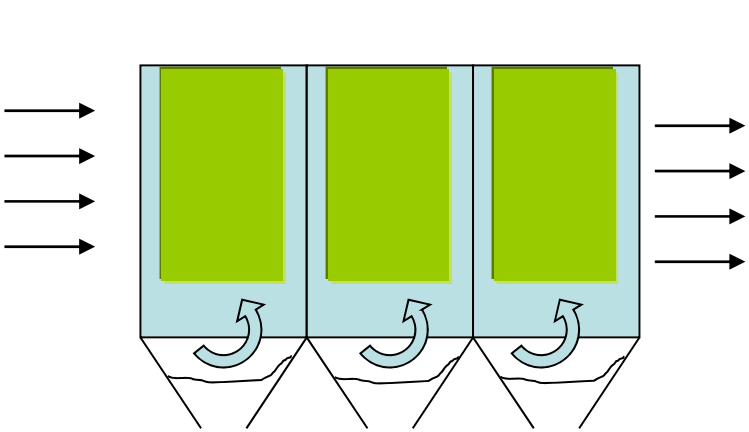
PF Distribution Testing and Analysis	• Verification of the position of HVARBS • Verification of the Rotorprobe testing method on our pipework layout
Air Distribution Testing and Analysis	• Verification of the location of air across the burners • Verification of the location of the air within the burner
Burner CFD	• Verification of the combustion dynamic within the burner
Boiler CFD	• Verification of the combustion dynamic in the furnace including the effect of BOFA
Mill Grinding Data	• Reassess the sampling method.

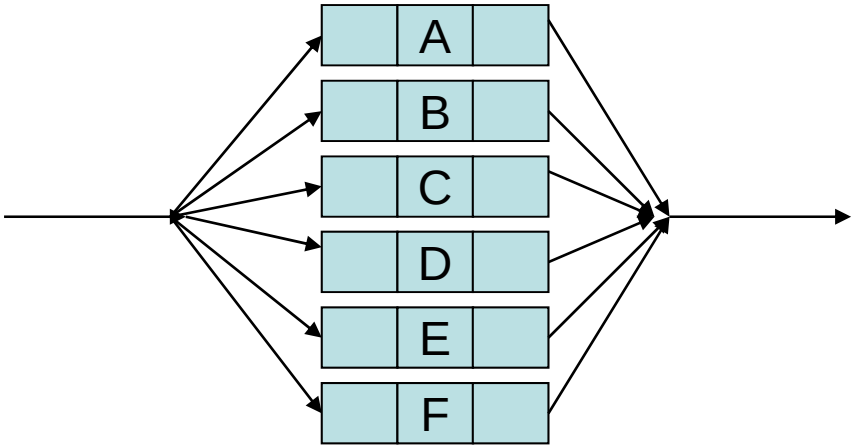
Dust Reduction

Our major problem is dust spikes, we are investigating various rapping programmes for precipitators also considering reinstallation of mechanical grit collectors / bag filters.

Rapping Programme

- Originally A, B & C, then addition of D & E, lastly F.
- Re-entrainment of particles
- Higher CIA = Higher resistivity of Ash





Operational Challenges

Meeting Header temperatures	•Operating to ensure that Header Metal Design temperatures are not exceeded (creep life of material reduced)
Meeting NOx limits	•Operating the units within the NOx limits, predominantly controlled by amount of air on the unit which affects the amount of dust produced
Turbine Issues	•For example, if a HP or LP feed water heater is out the Boiler has to fire harder to make up the heat loss
Coal	•Predetermined by Traders / varying characteristics
Meeting Generation requirements	•Two shifting and short running does not give sufficient time to “fine tune” the units in order to achieve optimum operation
Tube leaks	•Dealing with the unexpected.

Summary

- PF Distribution Testing and Analysis
- Air Distribution Testing and Analysis
- Burner CFD
- Boiler CFD
- Mill Grinding Data
- Rapping Programme

- Meeting Header Temperatures
- Meeting NOx limits
- Turbine Issues
- Coal
- Meeting Generation requirements
- Tube leaks