Flue Gas Desulphurization (FGD) plant
2 x 600 MW Coal based Thermal power plant  Cuddalore, Tamil Nadu.

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Introduction

Flue Gas Desulfurization is a process of removing Sulphur from flue gas of Thermal power plant before it is released into the atmosphere.
IL&FS Tamilnadu Power Co. Ltd, uses Limestone Wet Spray type Flue Gas Desulphurisation system.

Our wet FGD system, also called a wet scrubber system, is based on the principle that limestone, in the form of slurry is brought into contact with the flue gas which absorbs the SO$_2$ in it.

Our FGD is designed for 100% BMCR condition with sulphur content 0.8% in Coal and desulfurization efficiency $\geq 95\%$. 
Salient Features

- Wet Type Desulphurisation System Consist Of:
  - Absorber
  - Gas To Gas Heat Exchanger (GGH)
  - Booster Fan
  - Slurry System
  - Gypsum De-hydration & Waste Water Treatment System
  - Ducting System
  - Electrical And Instrumentation
Overview of FGD
Construction details

- **NUMER OF PILES**
  - UNIT # 1 & COMMON SYSTEMS: 773 Nos.
  - UNIT # 2: 280 Nos.
  - **Total**: 1053 Nos.

- **RCC QUANTITY**
  - UNIT # 1 & COMMON SYSTEMS: 9000 Cu.M.
  - UNIT # 2: 3000 Cu.M.
  - **Total**: 12000 Cu.M.
Construction details

- **STRUCTURAL STEEL**
  - UNIT # 1 & COMMON SYSTEMS: 2500 MT
  - UNIT # 2: 1000 MT
  - **Total:** 3500 MT

- **EQUIPMENTS**
  - UNIT # 1 & COMMON SYSTEMS: 2500 MT
  - UNIT # 2: 1000 MT
  - **Total:** 3500 MT
Absorber details

- Absorber is the main equipment where the sulphur is removed from flue gas.

- It is a 41.5 M Height shell of 17.6 M. Dia and total weight of 510 MT

- The internal surface is coated with anti corrosion paint up to 4 mm thickness to protect from corrosion.

- The external surface is protected with thermal insulation.

- The limestone slurry is sprayed inside the absorber through the spray headers and nozzles which comes in contact with the flue gas passing through it and removes the sulphur in it.
Absorber construction
Absorber construction
Absorber construction
Absorber construction
Absorber construction
Booster Fan
Gas to Gas Heat Exchanger

IL&FS Tamil Nadu Power Company Limited
Tanks

COOLING WATER TANK, PROCESS WATER TANK & EMERGENCY SLURRY TANK
Wet Ball Mills
Limestone Slurry Tanks
Slurry Recirculation Pumps
Gypsum Dehydration
Gypsum Dehydration System
Chemical Process

\[ \text{SO}_2 + \text{CaCO}_3 + \frac{1}{2}\text{O}_2 + \text{H}_2\text{O} \rightarrow \text{CaSO}_4\cdot2\text{H}_2\text{O} + \text{CO}_2 \]
The main task of the absorber is to remove sulfur dioxide from flue gas and to produce gypsum as a disposable product.

The gas flows upwards through the absorption zone and is washed counter currently by a spray of slurry droplets, containing suspended gypsum and limestone for the reaction with SO2.

Finally the formed sulfate and calcium ions crystallize in the absorber recycle tank as a gypsum.

Gypsum will be dewatered and the waste water will be again treated and reused in the process.

Final waste water will be again treated suitably and discharged with recommended quality.
Slurry Pumps

SLURRY RECIRCULATION PUMP HOUSE

SLURRY RECIRCULATION PUMP VIEW
Absorber System

Schematic diagram of the limestone scrubbing process.
Limestone Slurry System

precrushed limestone

L.S. day silo
mill new feed
typical 0-20 mm

weigh belt feeder

wet grinding on 1-stage classifier
for products 30μ < P80 < 90μ

hydrocyclones classifier

2-way distributor

density slurry meter for density control

slurry to FGD transfer tank

mill water

mill tank agitator
mill tank

mill pump
Limestone Slurry Process

• The Wet Ball Mill system ensures lime stone crushing upto particle size of 44 micron (325 mesh - 90%).
• Hydro cyclone is used to separate the limestone slurry at the wet Ball Mill outlet.
• Each set of mill is equipped with a group of limestone slurry hydro cyclones, and can meet the requirement of limestone slurry fineness.
• Concentration of limestone slurry can be correctly controlled in any concentration upto 25-30%wt.
Wet Ball Mills

WET BALL MILL WITH RECIRCULATION SYSTEM

WET BALL MILL
Gypsum Slurry Dehydration
Gypsum Slurry Dehydration

Vacuum belt Feeder

Cloth wash process

Hydro cyclone

Cake wash process
• The system is common for both units. The main equipments include 2 gypsum hydro cyclones, 2 vacuum belt filters, 2 vacuum pumps, 2 set of filter water system.
• Each vacuum belt filter and hydro cyclone will be based on the capacity of 100% BMCR worst coal condition.
• Gypsum Slurry from Absorber flows into the gypsum hydro cyclone to be concentrated. Moisture of the gypsum cake is about 10%.
• The overflow of hydro cyclone split into two categories: one part be transported to the filtrate water tank, the other parts flow into the waste-water tank and be transported to waste water hydro cyclone.
## Process water quality

<table>
<thead>
<tr>
<th>SI.NO.</th>
<th>Description</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Total Dissolved Solids (TDS)</td>
<td>Ppm</td>
<td>350-500</td>
</tr>
<tr>
<td>2</td>
<td>Calcium</td>
<td>Ppm</td>
<td>1.5</td>
</tr>
<tr>
<td>3</td>
<td>Magnesium</td>
<td>Ppm</td>
<td>3.5</td>
</tr>
<tr>
<td>4</td>
<td>Potassium</td>
<td>Ppm</td>
<td>6.5</td>
</tr>
<tr>
<td>5</td>
<td>Bicarbonate</td>
<td>Ppm</td>
<td>2.0</td>
</tr>
<tr>
<td>6</td>
<td>Chlorides</td>
<td>Ppm</td>
<td>215</td>
</tr>
<tr>
<td>7</td>
<td>Sulphates</td>
<td>Ppm</td>
<td>5.0</td>
</tr>
<tr>
<td>8</td>
<td>Nitrates</td>
<td>Ppm</td>
<td>0.1</td>
</tr>
<tr>
<td>9</td>
<td>Boron</td>
<td>Ppm</td>
<td>1.2</td>
</tr>
<tr>
<td>10</td>
<td>Silica</td>
<td>Ppm</td>
<td>0.1</td>
</tr>
</tbody>
</table>
## Process Water Requirements

**Process Water input : 100 TPH per FGD.**

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>TPH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process water</td>
<td>Waste water discharge</td>
<td>9.8</td>
</tr>
<tr>
<td>Process water</td>
<td>Gypsum Cake 10% moisture</td>
<td>1.7</td>
</tr>
<tr>
<td>Chemical water</td>
<td>Gypsum Cake</td>
<td>3</td>
</tr>
<tr>
<td>Saturated water</td>
<td>Clean gas - evaporation</td>
<td>39.6</td>
</tr>
<tr>
<td>Process water</td>
<td>Clean gas - Mist eliminator (evaporation or carryover)</td>
<td>0.155</td>
</tr>
<tr>
<td>Process water</td>
<td>Sludge treatment system Consumption</td>
<td>0.084</td>
</tr>
<tr>
<td>Chemical water</td>
<td>Water consumed by Dissolved soluble substances</td>
<td>0.071</td>
</tr>
<tr>
<td></td>
<td>Total break up</td>
<td>54.41</td>
</tr>
</tbody>
</table>

**Total Break up: 54.41 TPH**
Other details…

Total Auxiliary power consumption for the FGD plant at 100% TMCR condition on firing worst coal is less than 23902 KW, for the two FGD units with common auxiliary facilities.

Limestone consumption per FGD at 100 % TMCR Condition on firing worst coal is less than 3.8TPH.

Gypsum production per FGD 6.0 TPH
## Lime Stone Quality

<table>
<thead>
<tr>
<th>SI.NO.</th>
<th>Constituents</th>
<th>Unit</th>
<th>% by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Silica as SiO2</td>
<td>%</td>
<td>4-6</td>
</tr>
<tr>
<td>2</td>
<td>Iron as Fe2O3</td>
<td>%</td>
<td>1.5-2.2</td>
</tr>
<tr>
<td>3</td>
<td>Aluminium as Al2O3</td>
<td>%</td>
<td>1.8-2.8</td>
</tr>
<tr>
<td>4</td>
<td>CaCO3</td>
<td>%</td>
<td>85-89 (CaCO3&gt;85%)</td>
</tr>
<tr>
<td>5</td>
<td>MgCO3</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Acid Insoluble</td>
<td>%</td>
<td>Below 1%</td>
</tr>
<tr>
<td>7</td>
<td>Others</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Inherent Moisture Content</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Bond Work index</td>
<td>KWH/T</td>
<td>13</td>
</tr>
<tr>
<td>10</td>
<td>Raw limestone size</td>
<td>mm</td>
<td>≤20</td>
</tr>
</tbody>
</table>
FGD system will produce a small amount of waste water. The main task of the waste water treatment plant is to adjust the pH and to remove the heavy metals and suspended solids.

The final output of WWS will be as below always

**DESIGN:**

- **pH**: 6-9
- **Residual chlorine**: 0 ppm
- **Oil and grease**: < 1 ppm
- **Effluent quantity discharge for 2 units**: < 24 m3/h
THANK YOU