

Flue Gas Desulphurisation -Commissioning & Operation

"A New Beginning in NTPC"

By

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Background

In continuing efforts to safeguard the environment and reduce emissions from power sector, India has made the following commitments in COP 21 (Conference of the Parties, **COP 21** was held in Paris, France, from 30 November to 12 December 2015.)

- India intends to reduce the emissions intensity of its GDP by 33 to 35 % by 2030 from 2005 level.
- To achieve about 40 percent cumulative electric power installed capacity from non-fossil Fuel based energy resources by 2030 with the help of transfer of technology and low cost International finance.
- Introducing new, more efficient and cleaner technologies in thermal power generation.

Further, to reduce emissions from Thermal Power Stations, Ministry of Environment, Forest and Climate Change has also issued new environmental norms in December 2015 regarding suspended Particulate matter (SPM), SO_x, NO_x, Mercury which will directly impact, the present installed capacity of coal based thermal power plants in India which is 1, 88967 MW as on 31.12.2016.

Why FGD for Vindhyachal Stage-V ?

The Environment Clearance issued by MOEF for Vindhyachal Stage-V (1X500 MW) has one of the specific condition as the "FGD shall be installed" in the Unit for Limiting the Sox Emission from the stack. Further on 07.12.2015 as per MOEF notification So_x emission limit from stacks of all thermal power plants in India has also being fixed at less than 200 mg/Nm³ as per table 1.

Emission parameter	Thermal power plants (units) installed before 31.12.03	Thermal power plants (units) installed after 31.12.03 to 31.12.16	Thermal power plants (units) Installed from 01.01.17
Particulate Matter (PM)	100 mg/Nm ³	50/Nm ³	30 mg/Nm ³
SO ₂	600 mg/Nm ³ for units less than 500MW capacity 200 mg/Nm ³ for units 500MW and above capacity	600mg/Nm ³ (for less than 500 MW Units). 200mg/Nm ³ (for 500 MW & Above Units)	100 mg/Nm ³
NO _x	600 mg/Nm ³	300mg/Nm ³	100 mg/Nm ³
Mercury (Hg)		0.03mg/Nm ³ (for 500 MW & Above Units)	

Fig.1 Table .1

In line with MOEF environment clearance for Stage-V, FGD Plant was awarded on 09.12.13 and is now expected to be commissioned in March-17. The Installed FGD plant is designed for limiting SO₂ in flue gas to less than 200 mg/Nm³ by treating 100 % of flue gas coming from boiler.

Types of FGD

In order to extract SO₂ from flue gas different mechanism of extraction can be used which can be in dry & wet form. Types of extraction also depend upon the cost effective input available for capturing the sulphur dioxide from flue gas.



Fig.2 Types of FGD systems.

Vindhychal FGD system – Overview

Vindhychal being in close vicinity of Limestone rich area of Maihar & Satna , Wet open Spray tower lime stone based FGD system has been selected for SO_x emission control. This system is supplied by M/S GE-ALSTOM. The Input for FGD plant is therefore Limestone and the output is Gypsum. The plant is designed to treat 100 % flue gas having 0.49 % sulphur in coal and SO_x removal efficiency of 90.6 % and thereby limiting SO_x content in flue gas to less than 200mg/Nm³.The output from FGD plant is chemical gypsum having minimum 90% purity. This gypsum has many commercial uses in cement industry, bricks manufacturing etc.

Overall System Description

The entire WFGD System can be divided into the following process systems:-

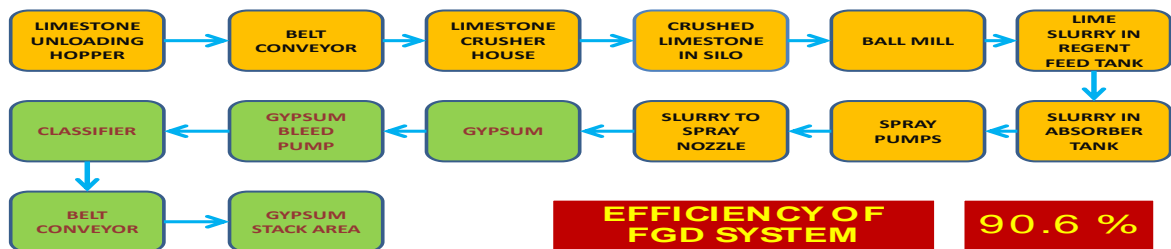
- Flue Gas Handling System.
- Limestone Handling System & Reagent Preparation System.
- Absorber / Oxidation System.
- Secondary Dewatering System & Gypsum Handling System.

PROCESS FLOW DIAGRAM FOR WFGD

1. FLUE GAS FLOW



2. LIMESTONE AND GYPSUM FLOW

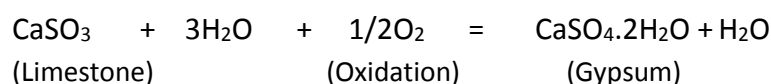


EFFICIENCY OF FGD SYSTEM

90.6 %

FIG.3 Process flow diagram for Vindhychal WFGD system.

- The Following Chemical reaction takes place in the above process inside the Absorber tower (16.5X32 metres)



- The designed consumption of limestone in FGD system for full load --6.25 T/Hr (4500 MT/month)
- The designed Production of Gypsum from FGD system for full load -- 11.31 T/Hr (8000 MT/month) (The gypsum guaranteed parameter –purity 90 % minimum, moisture 10% maximum. and chlorides 100 PPM max).
- Due to non flow ability of Gypsum, its transportation is envisages by loading trucks with the help of backhoe loader (JCB).
- Limestone will also be transported at site in trucks

Acceptance of FGD expenses by Regulators as per order dt. 31.08.2016

- Capital cost – Rs 16104 lakhs
- Additional 1% increase in APC.
- Limestone Consumption @ 6250 kg/hr
- O&M expenses on actual basis.

All the above are subjected to revision at the time of truing-up of tariff or the separate norms specified by the commission, if any later on.

Commissioning Sequence of Vindhyachal WFGD.

Vindhyachal FGD system commissioning as shown in fig .5 is divided into Six steps:-

- Motor No load trials –183 drives including 09 No's of HT motor.
- Equipment Commissioning - For critical equipment the commissioning is being done By OEM As per table 2.

Sl.no	Equipment name	Vendor	Country
1	Aborber Recirculation pump	Duchting pumpen	Germany
2	Ball Mills	Christian Pfeiffer	Austria
3	Vaccum belt Filter & hydrocyclone	Xuhe	China & Japan
4	Oxidation blower	Siemens	Italy, Germany
5	GGH (Gas to Gas heater)	Arvos group	USA
6	Mist Eliminator	REA Plastik tech GmbH	Berlin, Germany
7	Agitator	Ekato GmbH	Germany

Fig.4 Table-2

- COLD Commissioning –System trial with water.
- FGD Inlet, outlet & Bypass damper Commissioning.
- Interface between Main plant boiler & FGD checking & commissioning.
- HOT Commissioning – System trial with limestone slurry.

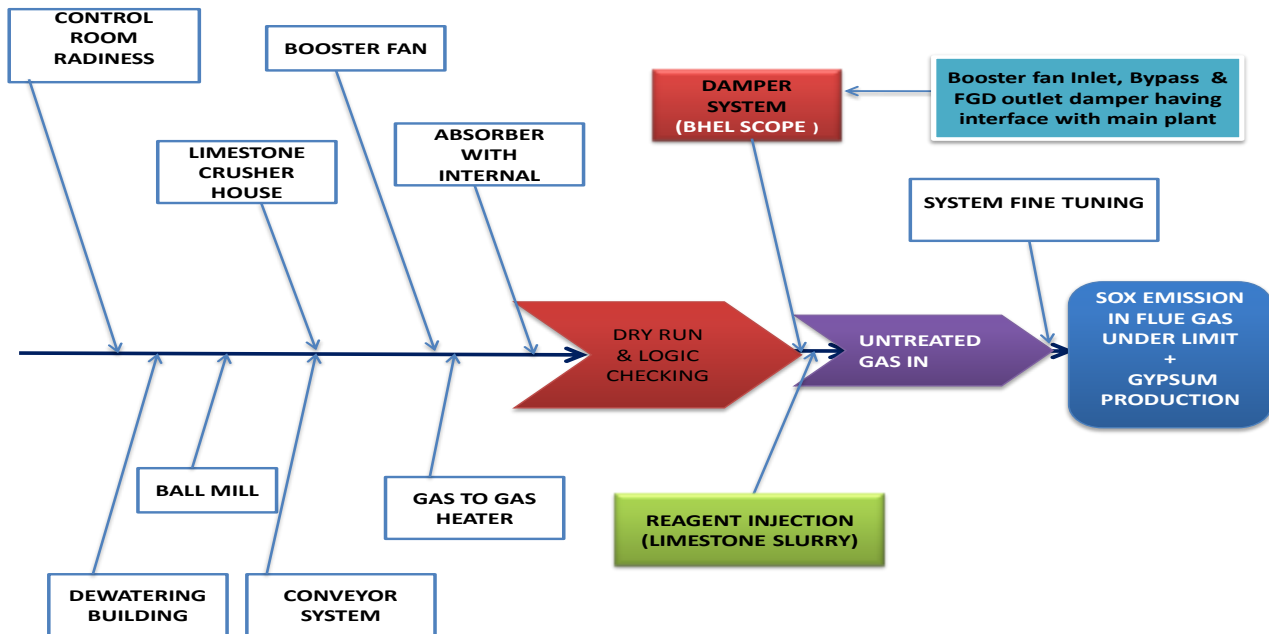


FIG.5 Commissioning sequence for Vindhyachal WFD system

System & Procedures Development for O&M of FGD

VSTPS Stage-V FGD plant is the first such plant of NTPC. This is the standalone system having separate control room for its operation and interface with main plant boiler at ID fan discharge.

In absence of any system, guideless and procedures for O&M of the FGD system, there was a brainstorming at the station to finalize the modus operandi for O&M of the system and the following was arrived.

- Regular monitoring of FGD activities by HOP exclusively and also in daily HOD meeting, SMC meeting etc.
- Identification of Executives for FGD commissioning activities and formulation of the System.
- Visit of High level team from site to Udupi thermal power station, the only operational limestone based wet FGD plant in the country to Study their operation system and procedure.
- Creation of New department with reporting to head of O&M.
- Sensitizing and updating the various corporate departments like OS, ERP, Commercial, Finance etc. with regard to status of commissioning and requirement for the same.
- Creation of web page for FGD in Vindhyachal intranet which is the source of Information & learning.
- Creation of departmental code, Cost centre, GL account, purchasing group etc. for the department.
- For separate control room of FGD operation it was decided to operate FGD by diploma Engineers @ 2 per shift and assisted by outsource manpower. Accordingly Diploma Engineer and trainees are identified and given training by.
 - a) NTPC FGD executive.
 - b) OEM-Alstom training : 8 days training at Site EDC.
 - c) On job training for 10 days at Limestone based Wet FGD plant at Udupi thermal power station.
 - d) These Diploma engineers & trainee are posted in FGD department 6 month before expected commissioning period of FGD system and are actively involved in various FGD commissioning activities.

- Expression of Interest for sale of gypsum was issued in national newspapers & positive response from cement industry was received. Subsequently with the help of MSTC bid for sale of gypsum was also initiated.
- For Gypsum having purity less than required by cement industries, It can be used for in-house brick manufacturing in place of cement due to which the cost of brick manufacturing is also expected to come down.
- Limestone of required specification as per OES is available in Satna (M.P) region and procured.
- Identification & finalisation of Applicable taxes for sale of gypsum.
- In absence of any reference for sale of Gypsum in DOP, A Policy for sale of Gypsum is under preparation.
- SAP module is under development for proper accounting of material handling i.e. Gypsum & Limestone, billing of Gypsum etc. and issue of gate pass system for sale of Gypsum.
- Initiation of proposal and Award of 06 No's of annual contract for material handling, mechanical maintenance, C&I maintenance, electrical maintenance, chemistry offline testing, Housekeeping etc.
- Identification and collection of drawings, documents and manual.
- Preparation of schematic diagram, technical dairy and protection interlocks.
- Preparation of attributes and codification of spares with help of corporate ERP group. This was the huge task as it requires development and approval of new scheme and codification.
- Creation of functional location and mapping of equipments for raising PTW & notification in SAP.
- Identification and Availability of consumable required for commissioning and subsequent top up.
- Identification of HIRA and control.
- Expediting the erection and commissioning activities of FGD bypass and outlet damper which are in the scope of Main plant by M/S BHEL to match with the Main plant Overhaul activities.
- Interfacing & Synchronisation of Main Plant with FGD system for maintaining boiler furnace draft by finalisation of logic, schemes and control among various agencies like BHEL, Yokogawa, Alstoms & Petron.

Challenges Ahead

- Measure to be taken to offset & maintain merit order rating for Stage-V due to increase in tariff on account of installation & operation of FGD.
- Spare & service Management: The critical equipments being Low in numbers but are from different manufactures and countries, there will be great difficulty in procuring specialised services and spares from original equipment manufacturers, Actions for making Purchase requisitions for the same has being initiated.
- Creating awareness and building confidence for use of Gypsum in cement industries- After commissioning of FGD system vendor meet is proposed to showcase our gypsum quality and plant.
- Alternate use of Gypsum as a Green building material other than Brick Manufacturing etc.
- Plan for future O&M of FGD-
 - a) For better management & rationalisation of man power there will be one service provider by Integrating operation, chemistry, Mechanical, Electrical & C&I Maintenance.
 - b) To mitigate the supply & disposal uncertainty and cost effectiveness there should be one service provider for supply of limestone & take off gypsum through MSTC.
- Scheme for Finalisation of partial operation of FGD and its ZLD (Zero liquid discharge) scheme are under process.
- Limestone & Gypsum Storage capacity enhancement- At present design storage capacity is for 10 days both for limestone and gypsum however as sale of gypsum and procurement of limestone are from parties located at far distances to mitigates any eventuality. Proposal for additional 30 days storage capacity each has been initiated.

- Procurement of offline laboratory testing equipments-For ensuring the quality of limestone & gypsum for purchase and sell to the parties, relevant offline instrument purchase Proposal has been initiated.

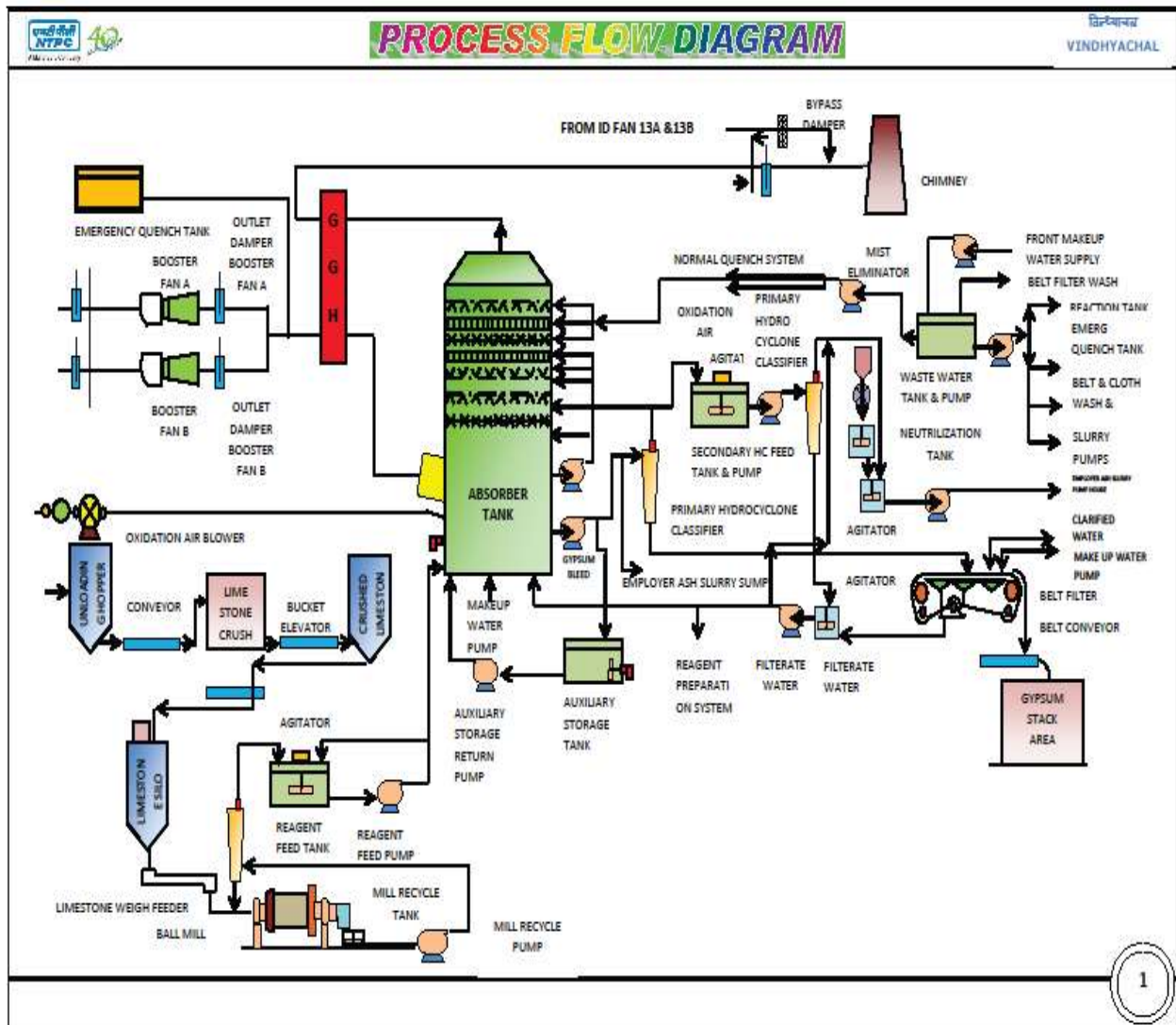


FIG.6 Process Flow diagram for Vindhyachal WFD system

After Commissioning of FGD system NTPC's commitment, Towards Green & Clean Power will be further Strengthen.

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Acknowledgements

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