1.) **Implant Training :**

I did my Implant Training at Visakhapatnam Steel Plant in Blast Furnace Department. The duration for the Implant Training was 3 weeks and I along with 4 of my batch mates underwent the training in June 2014. Here, we had a hand on experience on how the liquid metal was produced in one of the largest and biggest Blast Furnace in the history of Steel Plants across Asia, which has a capacity of 2.5 Million Tones of Liquid Steel apart from the other two Blast Furnaces in the Steel Plant, which produce the half of it. The new Blast Furnace, BF-3 was constructed as a part of the expansion programme of RINL (Rashthriya Ispat Nigam Limited) for increasing the plant production capacity to 6.3 Mt per year liquid steel. The project is being executed on a complete turn-key basis by the Consortium formed by Paul Wurth, Italy (PWIT), Larsen & Toubro (L&T) and Paul Wurth, India (PWIN).

The new blast furnace, BF-3 has many new features as compared to the existing BFs of VSP and other steel plants in Asia as listed below:

- Rectangular flat cast house with full castable runner system and hydraulic mud-gun and drilling machine for two independent cast house.

- Double cardan type of tuyere stock.

- Division of the total cooling system into 3 closed circuits with soft water and one open circuit with industrial water with different circuits catering to the cooling needs of different areas of the furnace.

- Stave type coolers are used for furnace cooling. Copper staves have been installed in the high heat zones of the furnace i.e. Bosh, Belly & lower stack zones while the remaining areas are installed with cast iron staves.

- Heat flux measurement of cooling system

- Above burden probe for measuring gas temp. above the stock line.

- In burden probe for analysis of gas distribution in the furnace.

- Profilometer for scanning the burden profile.

- Hydraulically operated bleeder valves (4 nos.)

- Top gas ignition equipment for burning the top gases during blast furnace shut down.

- Stoves with ceramic burner and waste heat recovery system.

- Pulverized coal injection system, which includes coal preparation, distribution and injection through blow pipe.

- INBA slag granulation system using cold water technology with one dewatering station for each cast house side.

- Slag dry pits for each side of cast house to take care of slag in case of SGP failure.

- Centre coke charging system. New type of calibration system in stock house.

- New GCP with of annular gap scrubber arrangement, where top pressure can be controlled in case of TRT failure.

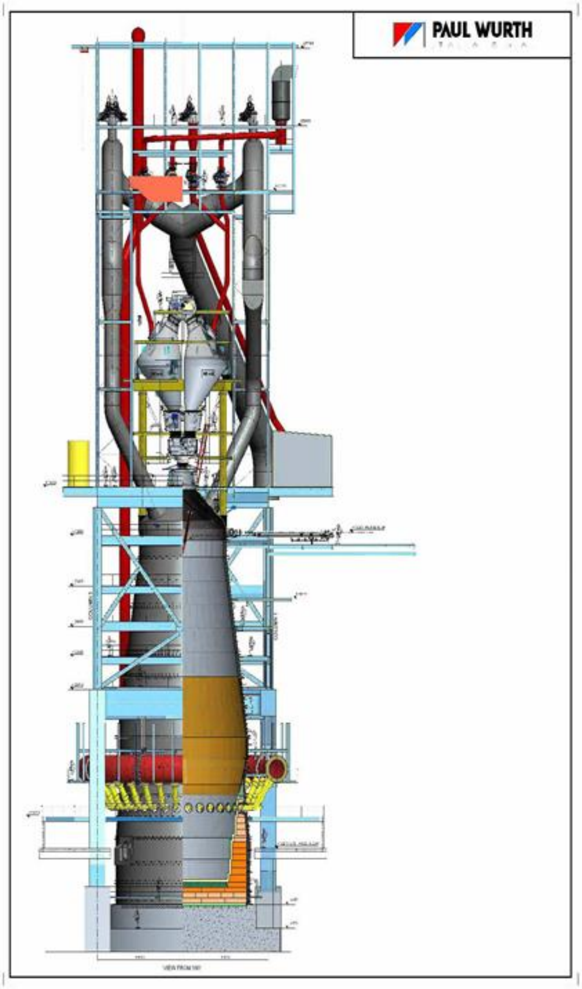
- The total automation system is based on DCS (Distributed control system), which is much faster and reliable than the existing PLC based automation of BF1&2.

- The power distribution of the (HT&LT) is completely automated known as SAS (Substation Automation System) which is very advanced system of control.

- Level-2 automation System (Sachem)

Description	BF No. 3	BF No. 1 & 2
a) Capacity		
Useful Volume	3800 Cum	3200 Cum each
Rated Production Capacity / day	7150 Mt	4860 Mt
Production Capacity / Annum	2.5 MT	1.7 MT each
Working Volume	3243 Cum	2785 Cum
Productivity (as per Design)	2.21	1.75
b) Salient Features		
Cast Houses	Rectangular	Circular Cast House
Hot blast stoves	3 Nos	4 Nos
Tuyeres	34 Nos	32 Nos
Hearth Dia	13000 mm	12000 mm
Fuel Rate	<535	<535
Coke (Kg/tHM)	< 385	< 535
PCI (kg/tHM)	150	Nil
Top Pressure (Bar)	2.5	2
Granulation System	INBA System (Cold Granulation)	Slag Granulation Plant (Russian design)

The above table shows the salient features of the state of the art entirely hydraulically operated Blast Furnace (BF-3) and the conventionally operated BF-1&2 are the other two BF in Vizag Steel Plant with the same technology as in other steel plant in Asia. The final graphical image of the Blast Furnace is as below:



2. **<u>Project Based Internship:</u>**

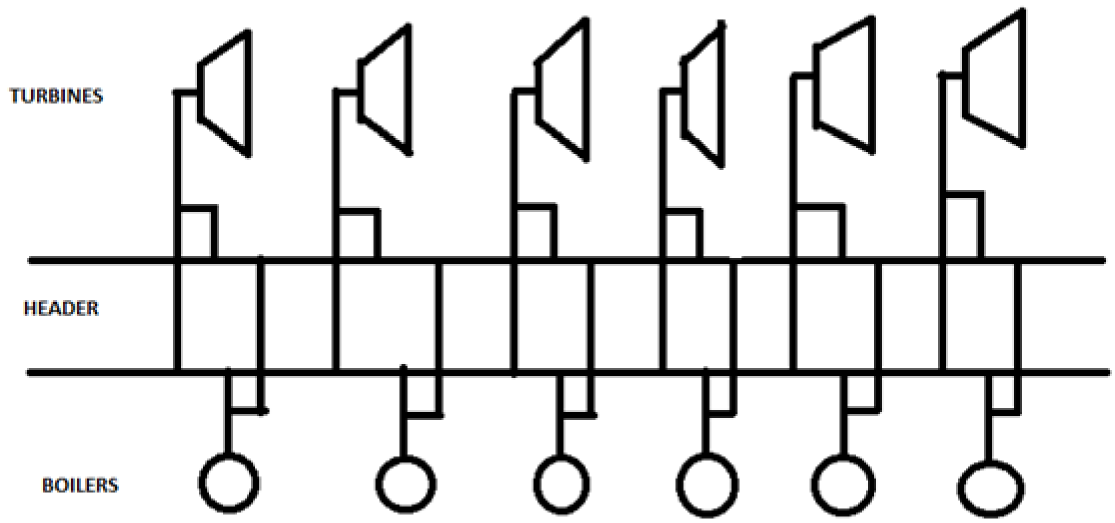
I also underwent my Internship here again at Visakhapatnam Steel Plant but this time at Thermal Power Plant Department during the Winter Vacations in December 2014 and continued till January 2015 (1 month) . In this internship, I did a project on "Boiler Tube Leakages and its analysis", where I observed and gained fruitful knowledge on how a boiler functions and when on shutdown due tube leakage, how the problem is analysed and rectified.

The average power demand of all units of VSP when operating at full capacity will be around 230 MW. The captive Generation capacity of 286.5 MW is sufficient to meet all the plant needs in normal operation time. In case of partial outage of Captive Generation Capacity due to brake down/ shutdown/ or other reasons, the short fall of power is availed from State Grid. The captive Generation capacity comprises of

- TPP : 247.5 MW (3 X 60 MW + 1 X 67.5 MW)
- Back Pressure Turbines (C&CCD): 2 X 7.5 MW
- Gas Expansion Turbines (BF) : 2 x 12 MW

Power plant also meets the Air Blast requirement of Blast Furnaces through 3 Turbo Blowers each of 6067 NM3/Min capacity. In addition to the above, Power Plant also supply process steam, DM Water, Chilled Water, Soft Water to various units of VSP.

Header system of Thermal power generation is distributing type path of steam from various boilers to different turbines (even all) via a long interconnecting pipe called ‘Header’, i.e., every boiler in the TPP that produces steam is distributed to all turbines in the plant for efficient power production.



The Header type system is followed in limited industries which require power to run their equipment other than getting power from electricity boards as well to distribute power for other use. Vizag Steel Plant uses the Header system in its own Thermal Power Plant to generate power non-stop by not depending purely on AP Transco. Thus this makes the Thermal Power Plant in Vizag Steel one of the most Indigenous plant in India.

VSP’s TPP general info:

- No. of Boilers : 6
- No. of Turbines : 5
- No. of Turbo-Generators : 5
- No. of Turbo-Blowers: 4
- Amt. of steam generation per hour : 330 T/hr X 6=1980 T/hr ~ 2000T/hr

- Power Generation: ~315 MW

Salient design features of Boilers:

- Boiler Capacity: 330T/hr
- Fuels fired: Pulverized coal, BF gas, C.O gas and oil
- Steam pressure: 101 ata
- Steam temperature: 540°C
- Feed-water temperature: 230°C
- Furnace type: Fused Welled dry bottom
- Boiler: Single drum, Natural circulation, balanced draft and dry bottom.

One of the boilers (Boiler No.6) in the Thermal Power Plant at Vizag Steel is one of the most sophisticatedly designed boiler and is different in many aspects than any other boilers in the steel plant or any other thermal power plant in the country.

The new boiler in the Thermal Power Plant has a drum height of 48.6m, Furnace volume of 2588 cubic metres, 5 coal mills and PA fan to generate 750KW power, which many of the existing boilers in the country don't have. This proves that the Thermal Power Plant in Vizag Steel in indeed indigenous.

About the project-

Boiler tube leakage as the leakage of steam from the boiler tubes when the tubes undergo deformation or fracture or rupture. It has an adverse effect on the life of boiler tubes.

BOILER TUBE SPECIFICATIONS:

1. Water pipe made of Carbon Steel alloy by BHEL and named as SA192
2. Outer diameter= 63.5
3. Tube thickness= 5.6 mm

CAUSES OF TUBE LEAKAGE:

- **PITTING**
- **STRESS CORROSION CRACKING**
- **CORROSION FATIGUE**
- **SUPERCRITICAL WATER WALL CRACKING**
- **ACID ATTACK**
- **OVERHEATING**

CASE STUDY:

On 18th December 2014, Boiler no. 6 was shut down due to boiler tube leakage. The Thermal Power Plant control room immediately shut down the boiler when it was observed that a difference between input amount of water, air and fuel mixture and output amount of steam. It was observed that this sudden difference occurred due to leakage of high pressure water in one of the boiler tubes.

The boiler was immediately shut down and the maintenance officials investigated the boiler from inside. It was observed that a huge hole was formed in one of the boiler tubes and was propagating in size so as to damage the surrounding boiler tubes.

A file picture of the boiler tube failure is shown below:

Welding workers immediately removed the defective tube by cutting and replacing it with a fresh tube. The new tube was welded in the same proportion so as to minimise the difference at the welded joint.

After the replacement was done, the boiler was started and tested by Hydraulic Testing for efficient functioning and was checked for further leakages.

On 19th December 2014, the boiler was declared as functioning.

The following precautions are to be taken to prevent or avoid leakage of boiler tubes.

- Hydraulic testing of boilers should be regularly one by taking cold demineralized water at a high pressure and by closing the valve so as to check for any leakage.
- Thickness measurement- The thickness of the boiler tube should be checked regularly by electronic diameter measuring instrument.
- S.S. Shields- They are pasted on the weak points of the boiler tube so that when water at high pressure is passed through it, the material should not get corroded. These shields should be regularly replaced.
- Metal spray- It is a form of boiler tube leakage prevention method where the tube is sprayed with metal paint at sensitive points.
- The quality of the demineralized water should be regularly checked for the required parameters.