Water Technologies & Solutions
Channel Partner

Green Watts (Private) Limited
10 MW Bio Mass Power Plant – Cooling System Inspection Report

BY

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INSPECTION OBJECTIVE:

Green Watts (Pvt) Ltd is a 10 MW bio mass power plant that located in Kumbukkana, Monaragala which using Dendro Wood as the fuel. The plant is having 6 Nos of Boilers, 3 Nos of Cooling Towers and 3 Nos of Steam Turbine.

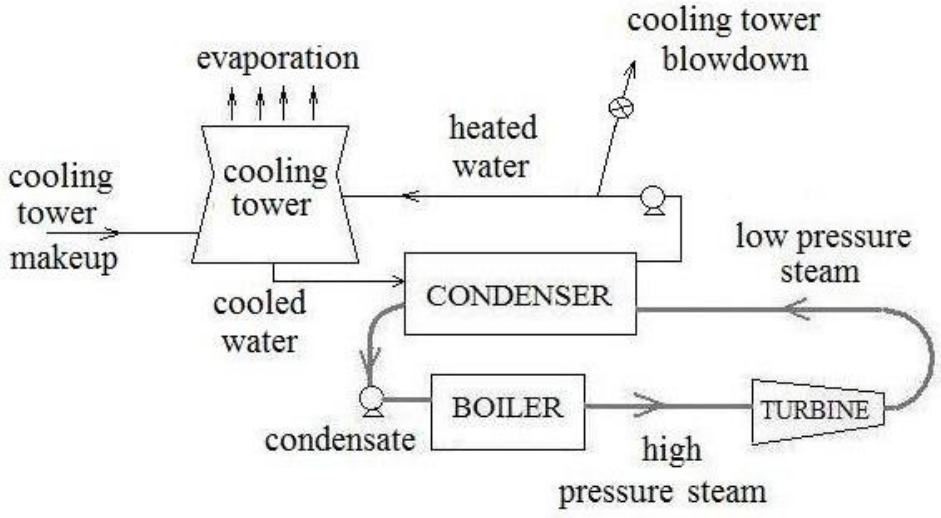
The inspection on Cooling System is conducted on Power Plant during a plant shutdown on 22nd March 2018 to evaluate the performance of actual water treatment program and what improvement could be done in the systems that SUEZ/WKT can involve.

COOLING SYSTEM - GENERAL INFORMATION

Introduction - Open Recirculating Cooling

The condensing unit is a crucial part of a steam power plant water circulation system. The condenser must have cooling in order to convert low pressure steam leaving the turbine to liquid condensate that can be pumped into the boiler. In Green Watts they are using the wet cooling tower that provides evaporative cooling.

An alternative cooling method that requires much less cooling water withdrawal from the source water body is the open recirculating cooling. The bellow diagram shows the general flow patterns. The heated water leaving the condenser passes through a cooling tower and is cooled by evaporative cooling. This type of cooling system withdraws much less water from the source water body, but it consumes much more water than the once through system, due to evaporation into the atmosphere.



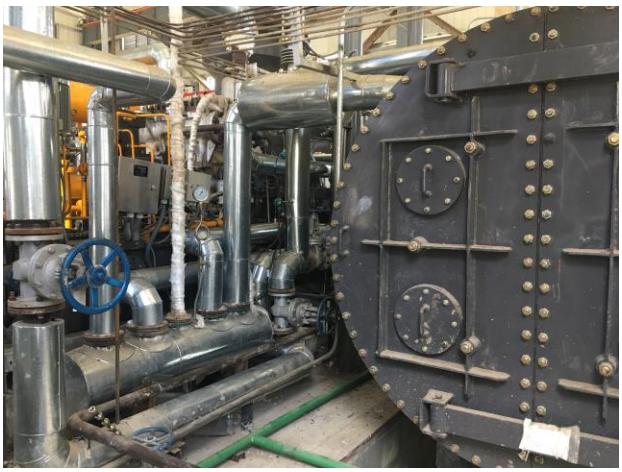


Figure 01 - Condenser

Figure 02 – Cooling Tower

Cooling Tower - Technical specification

Volume cooling system, m3	1198 (Approx.)
Condenser metallurgy	SS304
Piping metallurgy	MS
Recirculation rate, m3/hr	4250
Delta Temp, C	10
Cycles of concentration	4
Evaporation rate, m3/hr	67.2
Blowdown rate, m3/hr	12.6
Makeup rate, m3/hr	94
Makeup water source	Well Water
Tower type, fill material	Counter – current mechanical draft cooling tower

Condenser - Technical specification

No of Condensers	3 Nos
Type:	N-560-4
Model:	Split two pass surface regenerative type (split double flow path surface regenerative type)
Cooling area:	560 m2
Turbine exhaust pressure:	0.01MPa
Turbine steam exhaust flow:	17.71 t/h
Cooling circulating water flux:	1748 t/h
Cooling circulating water temperature:	33℃
Cooling circulating water pressure:	0.25 MPa
Cooling circulating water flow speed:	1.5 m/s
Condenser tube material:	0Cr18Ni9
Condenser tube size & Num.:	φ20×0.5×3800 - 1976 φ20×0.7×3800 - 412
Water resistance:	15.9 kPa

INSPECTION RESULTS

Findings - Cooling Tower

Figure CT01

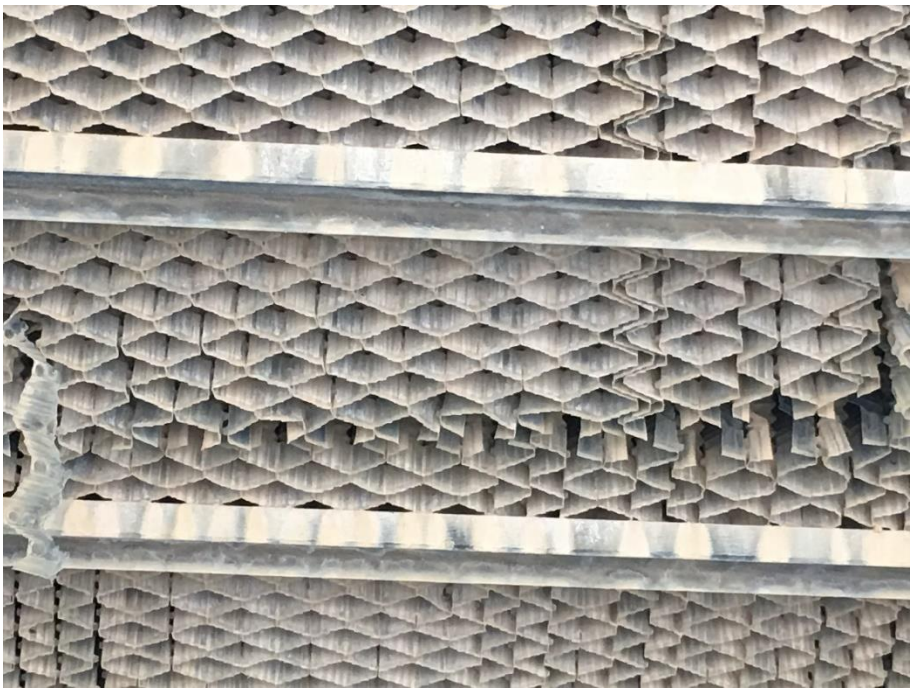


Figure CT03

- Some fills were unmounted and broken.
- Slight deposit was formed inside the Cooling Tower Fills surfaces.

Findings - Condenser

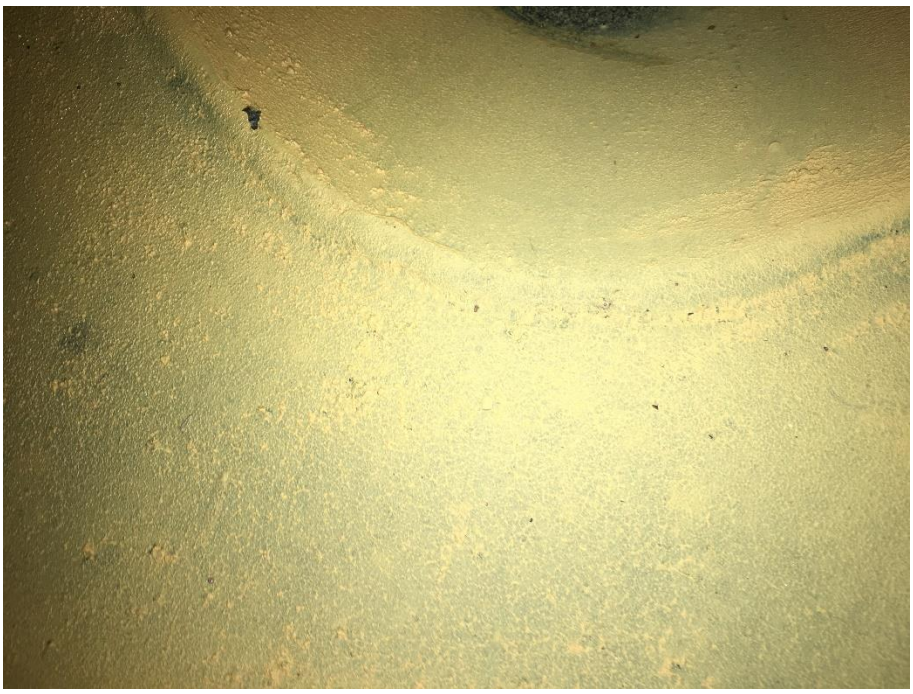


Figure CD01

Figure CD02

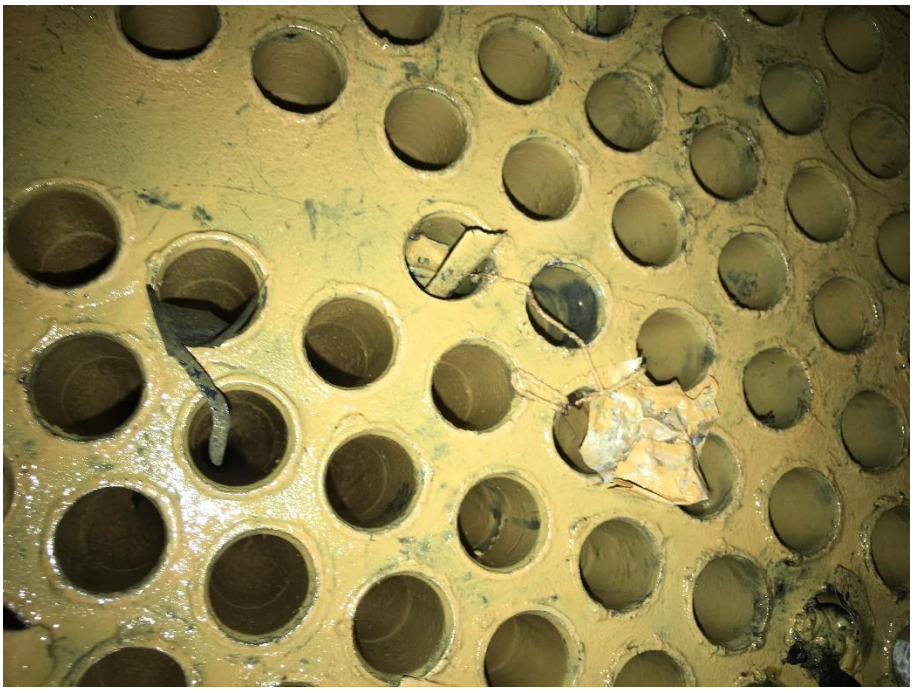


Figure CD03

Figure CD04

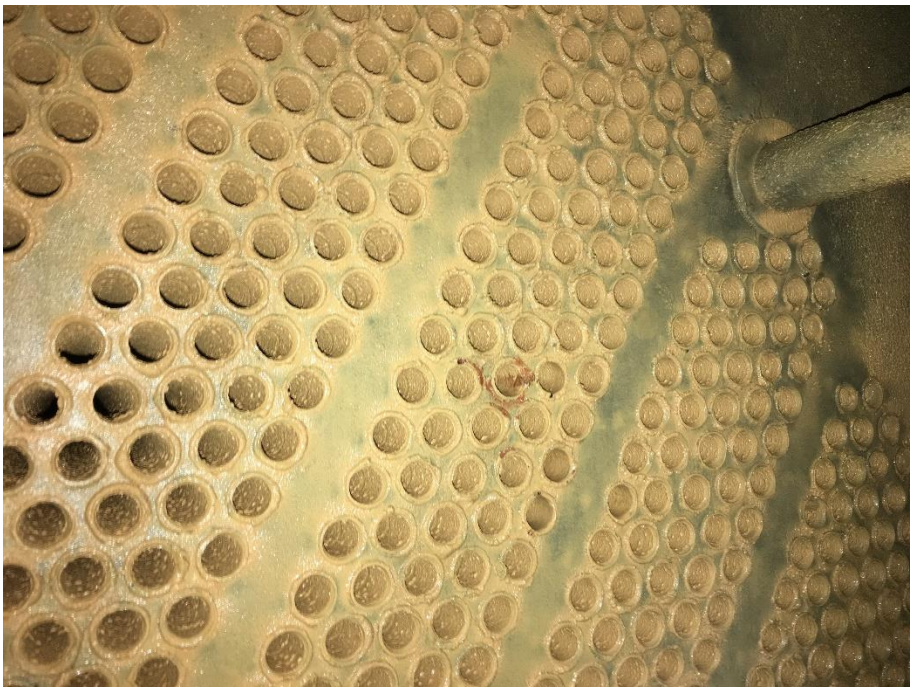


Figure CD05

Figure CD09

- Lot of suspended partials were accumulated inside the bottom pass of the condenser.
- Thin kind of slurry layer was formed inside the condenser including condenser tubs and shell walls.

- About 0.4 - 1.0 mm thick deposit layer was formed under above mentioned slurry layer. (In the site we did a simple magnetic test and observed this deposit layer has iron contamination also – Figure CD09)

DISCUSSION OF THE INSPECTION RESULT

The present condition of the cooling system cannot be considered as satisfactory. It required immediate attention & need to restore the Industry BEST-PRACTICES as soon as possible.

With the above mentioned observations we may able to highlight bellow points.

- System pre-cleaning & passivation were not completed properly before start the system (While the system commissioning). – When proper pre-cleaning & passivation was not done at initial commissioning stage, there is a possibility of causing solid deposition as fouling due to the mill rust, corrosion products, dirt & oil and grease which had deposited during transportation, storage & installation stages. Also once the fouling occurs, the possibility of scaling & under-deposit corrosion increases.
- Overall cooling system treatment program and the monitoring were also not up to the standard in terms of maintaining water chemistry, addition of chemicals & interpretation of test results as per our limited observations.
- Also we believe that the Cooling tower blowdown was not done as per the requirement (12.6 m^3/hr)

RECOMMENDATIONS AND COMMENTS

- Perform the system Pre-Cleaning & Passivation 2 – 3 times to remove the existing deposit and re-build the system passivation layer (Good passivation layer will help you to avoid any corrosion of the system.
- Make sure to maintain a good chemical and physical treatment for the system (Recommend to follow SUEZ guideline for the better performance of the system)
- Make sure to maintain a continuous monitoring for the cooling system chemistry.
- Install strainers to cooling tower recirculation pump suction to avoid, entering any suspended partials to the condenser.
- We wish to recommend to obtain expert services of Suez/WKT Chemical to assure overall plant chemistry, preferably on permanent basis or if not minimum once a week