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Investigation into reheater drying during boiler shut down

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ABSTRACT

Boiler tube failures (BTF) are the leading cause of plant downtime and can cost utilities tens of millions of dollars. One of the mechanisms of BTF is pitting corrosion in the steam side of tubes of reheater and superheater tubes. Pitting corrosion in these tubes is a result of poor shut down and layup practices of the boiler leaving stagnant oxygen rich water in the tubes during the outage period.

Three methods of drying reheater tubes during the shutdown process exist within the South African environment. These are forced drying, vacuum drying and boil drying. This research looked at determining which of the three methods is the most effective, by analysing the moisture content of the fluid inside the reheater tubes at the end of the drying procedure. This was achieved by measuring the relative humidity and dew point of the air/water mixture within the reheater tubes at seven power stations.

It was found that forced drying is the most effective method as it produced a fluid within the reheaters dryer than ambient air. The fluid remaining in the reheater at Power Station A had a relative humidity of 13.7% at 31.5°C and a dew point of 0.9°C as compared to the ambient air of 47% relative humidity at 25.8°C with a dew point of 17.3°C. Forced drying allows a large volume flow of air through the reheaters effectively replacing the steam with dry air. Vacuum and boil drying leaves a fluid with 100% humidity within the reheater, which will cool and condense and will result in pitting corrosion. Vacuum and boil drying do not effectively replace the steam with dry air. The power stations making use of vacuum as well as the one making use of boil drying had a fluid in the reheaters with a relative humidity of 100%.

This research has shown that forced drying while the boiler is hot is an effective method of drying. Further, offline corrosion can be prevented by keeping the boiler in low humidity conditions. This is achieved by circulating dehumidified air through the boiler tubes.