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Boiler Feedwater O_2

COVEY CASE STUDY

One of our clients had started up a new pulp mill, including a high pressure recovery boiler. After all the usual challenges of getting a new mill up and running, it was noticed that the oxygen in the boiler feed water was, at times, well above the specified maximum. An online oxygen sensor had been installed as part of the boiler package, and it was quite clear that there was an ongoing problem.

The boiler suppliers were still on site, and were not happy with this situation, and pointed out that if this problem continued, it would void some of the boiler guarantees.

The theory at that stage was that the evaporator condensate pump was the problem. The condensate on the suction side of this pump was well below atmospheric pressure, so it could easily be sucking in air, and overloading the feed water deaeration system. A check on this pump showed that it was in good condition, but the theory was tested by diverting the evaporator condensate away from the feed water tank. The oxygen content then wandered around erratically for some time, but eventually drifted down to zero. The exercise was repeated twice more with the same result. These tests obviously were compatible with the air leakage/overloading theory.

A deaeration tank is a pressurised vessel that has steam injected at the bottom at several points, which is intended to strip out any dissolved oxygen. The oxygen is then vented out at the top of the tank via a small steam bleed. The steam bleed was obviously working, but increasing the bleed rate did not seem to achieve anything.

There was still something about the oxygen trends that looked strange to us. When we thought about it clearly, it was the erratic nature of the oxygen trends – a tank with steam bubbling up through it should be well mixed. This implies that the dissolved oxygen should drift up smoothly when the evaporator condensate return pump started, and drift down smoothly when the pump is stopped.

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One possibility was that there was no steam being injected into the deaeration tank. A check on the operating instructions showed that the operators were running the steam injection at the specified pressure of 5 bar. This seemed suspiciously low, as the pressure in the deaeration vessel appeared to be about 5 bar anyway, although this was a bit hard to tell with the available instrumentation.

What had been happening was that no steam at all was being injected. The 5 bar pressure specified in the instructions had referred to the steam pressure required to heat the tank up from cold, but a higher pressure was required to do the deaeration once the boiler was up and running. The evaporator condensate did contain a small amount of oxygen, but nowhere near enough to overload the deaeration system.

However, the boiler was supplied by a European company, and it was also clear that the English translation left quite a bit to be desired. So, we reasoned that it was worth trying the effect of injecting the steam at a higher pressure. We did this, and the problem vanished almost immediately.