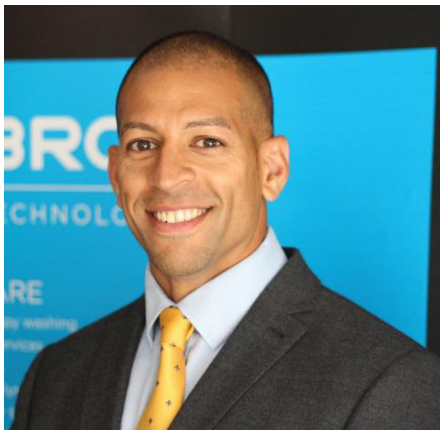
Health Check for Boiler Systems

Mark Hadaway advises hospital building services engineers on how water treatment can help to keep the boiler system operating efficiently and cost effectively



It may seem a long distance from the white-gowned surgeons in the operating theatre to the overalled maintenance fitters in the boiler house but, without the steam supply there would be no operations. The modern hospital is every bit as dependent on steam as were the mills of the industrial revolution. Steam is a vital source of space heating, high temperatures for autoclaves in sterile services departments, the laundry and kitchens, so the efficiency of the boilerhouse should be top propriety for the hospital building services engineer. And the key to boiler efficiency is water treatment.

Let's go back to basics. It's all about the boiler water; that's the stuff that is left behind when you take some of the water away as steam. Steam is pure water vapour, so the salts that were in the water entering the boiler become more concentrated in the boiler water. If the Total Dissolved Solids (TDS) concentration of the boiler water increases above a saturation point, it could cause carryover of water droplets, adversely affecting your steam purity. To control this concentration, we discharge some of the concentrated boiler water to drain as "blowdown". You can calculate the quantity of blowdown water quite easily if you know the TDS of your boiler feed water. The feedwater is made up of returned condensate (essentially pure water) and make-up water – usually mains water supply – which has been treated in your water treatment plant. These mix together in the hotwell, and this is where "conditioning chemicals" are usually added to control scale and corrosion in the boiler. So, the boiler water is a concentrated solution of the chemicals in the feedwater; you paid for the mains water, for the expensive conditioning chemicals and for the fuel needed to heat it to its boiling point at the boiler pressure. It's therefore quite expensive water that you are going to dump as blowdown – add in the cost of sewer disposal and you can reckon that the blowdown water costs at least £3/m^3. Hence, reducing blowdown is a priority.

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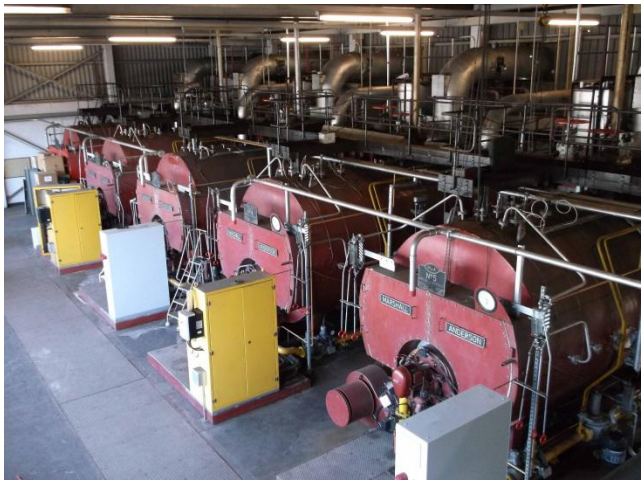
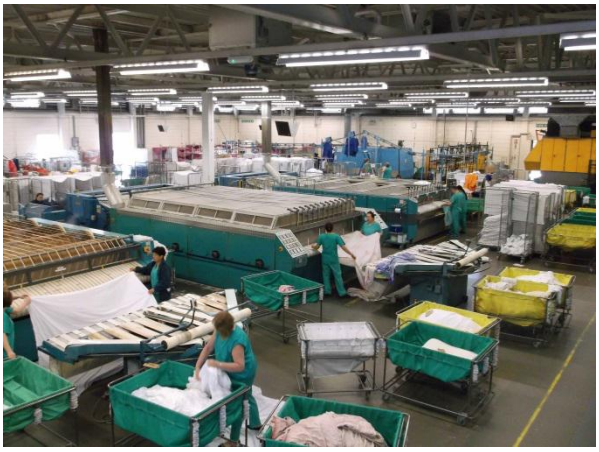


Minimising blowdown means minimising the TDS of the feedwater and there are two ways of achieving this. The first is to maximise your condensate return: the more condensate the lower the feedwater TDS. Sometimes it‘s not possible to recover condensate, but checking for steam leaks and collecting condensate from steam traps can be hugely beneficial. The next thing to look at is your make-up water treatment plant. The minimum treatment will be water softening to remove calcium and magnesium “hardness” salts that cause scale, but that doesn’t do anything to reduce the TDS. Reverse osmosis will reduce it by about 90% and ion exchange deionisation by 99%, but there is are operating costs associated with these processes. A water analysis from your water supplier will give the TDS as well as the hardness of your mains supply, so you can calculate the effect of reducing the TDS on the blowdown along with the financial benefits. Whatever type of plant you have, you need to make sure it’s working properly, and the best way is a service contract. Lubron supplied a reverse osmosis plant to the William Harvey Hospital in Ashford and took on a service contract. Neil Sayer, the hospital’s Maintenance Supervisor, subsequently extended that contract to include the water softeners in the laundry which serves not only William Harvey but also the Queen Elizabeth The Queen Mother Hospital in Margate and the Kent and Canterbury Hospital.



The feedwater TDS also includes the conditioning chemicals that you have added. The most common is sodium sulphite, which is an oxygen scavenger, and is added to remove dissolved oxygen in order to prevent corrosion. The dose is about 8mg/l of sulphite for every mg/l of dissolved oxygen in the feedwater. Hot condensate typically has very low levels of dissolved oxygen but make-up water may have a concentration of up to 10mg/l. A simple, low cost make-up water heater box can reduce this to 1mg/l, giving a significant saving in sulphite, and a more expensive deaerator, reducing the dissolved oxygen to 0.02mg/l may be cost effective if the condensate return is low. Once again, you can easily calculate the financial benefits.

The pH of the feedwater is an important factor in corrosion control. Typically this should be around 8.5 – 9.0, requiring alkali addition, but the alkali solution you use has to be selected depending on the make-up water chemistry. Other conditioning chemicals commonly employed include phosphate, dispersants and steam and condensate line treatments. Chemical conditioning needs careful control: under-dosing exposes the boiler to potential scaling and corrosion problems whilst over-dosing wastes money and, with some chemicals, can cause corrosion. This is best left to a specialist company who will carry out regular analyses of make-up, feedwater and boiler water and make any necessary adjustments to the chemical regime. Andy Rendall, Estates Manager at the Diana, Princess of Wales Hospital in Grimsby did just that. Under a three year contract, Lubron is responsible for the supply and supervision of conditioning chemicals for the hospital's three main boilers – two 10,000kg/h and one 5,000kg/h – and the waste heat boiler in the CHP plant. It's even more cost effective to combine equipment service and chemical supply as Barrington Goldson, Technical Operations Manager at Hampstead's Royal Free Hospital found. Here the water treatment plant and chemicals service contract covers three gas fired steam boilers, a heat recovery steam generator and four cooling towers.

Make-up water treatment and chemical conditioning are inextricably linked from both technical and commercial points of view, so it makes sense to use a single source for their control. A reputable supplier will be able to help you to do the calculations to optimise your boiler water treatment, improving efficiency and reducing costs.

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