



**Case Study:**  
**Building no. 6 - 24/7 monitoring vs sampling and corrosion coupons**



**The project**

Building no. 6 had a heavily contaminated Chilled Water (CHW) system, with high levels of dissolved iron (108mg/l) and suspended solids (138mg/l) identified. A large, occupied building, implementing a full flushing or re-cleaning programme was deemed impractical as there are over 500 Fan Coil Units and only limited out of hours' access would be available. Any works carried out ran the risk of destabilising the system.

Guardian combined its industry-leading water treatment solutions with the Hevasure monitoring system to firstly bring the site back to a stable condition, and then provide a period of monitoring. Over two-weeks in July/August 2017 the system was continually checked to ensure corrosion was kept at bay, as well as identifying and rectifying additional issues.

Working alongside traditional corrosion coupons and sampling, the Hevasure unit proved itself to be a far more responsive and thorough solution, allowing problems to be immediately flagged up and therefore dealt with, while giving peace of mind that Guardian's water treatment programme had been successful.



**The solution**

Guardian proposed a balanced flush via the main plant, with as many valves on the system open as possible in order to leave it in a clean and stable condition. The majority of the debris was removed to slow the spread of corrosion.

One of the concerns raised was how to ensure the system was stable after the flushing and passivation, as the introduction of fresh water can sometimes lead to oxygenation and further damage. To keep on top of this issue, corrosion monitoring was employed.

Water treatment consultants had advised the use of sampling and/or corrosion coupons post flushing, however Guardian opted to install Hevasure, which provides real-time, 24/7 monitoring, to deliver a more accurate picture of the system over a period of time.

The independent consultants continued with a sampling programme and corrosion coupons were also installed.





# The findings

## Initial data

Following the flushing works, water quality was shown to be within BG29 guideline limits. The Hevasure system immediately recorded that the dissolved and total iron content was less than 1mg/l.

The laboratory sampling confirmed these results, but took one week to come back. Hevasure provided information straight away, including the fact that system had slightly higher than desired levels of Dissolved Oxygen(DO), at 0.33ppm. Despite this, all corrosion sensors were stable.

## Hevasure data

Within the first two weeks of installation the Hevasure system tracked pressure spikes and the actions and system conditions that had caused them. At the time, the site engineers noticed noise and possible air in the system – an indication that a previously non-circulating area had been re-opened and was introducing air. Due to the identification of this pressure spike, the unit was isolated temporarily until the cause was deduced.

Once the pressure spike issue had been resolved, DO returned to 0.33ppm and the corrosion sensors remained stable.

## Conductivity showing as stable after the pressure surge incident.

Following the pressure surge, around 400 litres of water had to be introduced to the system, causing a light drop in conductivity (28th August).

## Corrosion data:

Providing readings every 15 minutes, all the indications from the Hevasure unit showed that the system was stable and that corrosion had been passivated, with the three different corrosion sensors showing non-activity following the flushing works.

On the 29th August, two weeks after the Hevasure installation and four weeks after the flushing works were completed, independent laboratory sampling was carried out for a second time. The results showed very low dissolved and total iron levels, with the consultant commenting, “iron levels and copper levels are remaining at low levels which is encouraging.”

## Corrosion coupon data

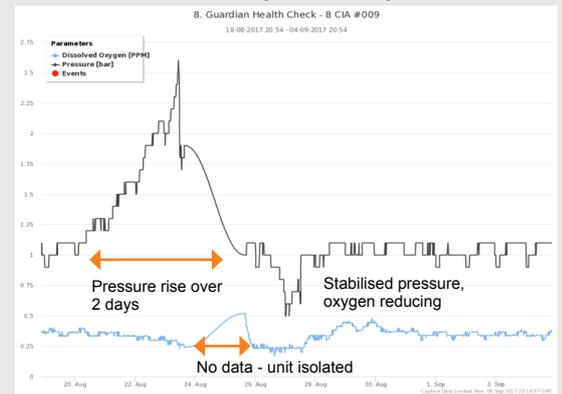
Corrosion coupons were installed alongside the Hevasure system at the request of the consultants. The results from both the copper and mild steel corrosion coupons confirmed that the data from the Hevasure unit was correct, and the metals in the system were indeed stable – well below the recommended ‘good’ levels.

- Mild steel corrosion coupon - 0.012 mpy – recommended levels for good control 0.2mpy.
- Copper corrosion coupon – 0.0159 mpy – recommended levels for good control 0.1 mpy

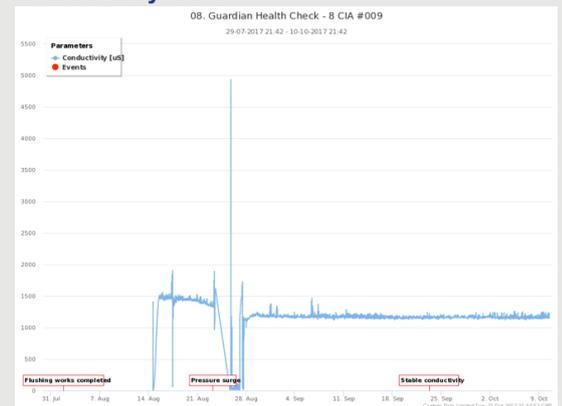
## Identifying additional issues

Despite the fact that the Hevasure unit showed the system to be in reasonably healthy condition, free from corrosion and water losses, it did detect a consistent level of DO at around 0.33ppm. Recommended levels for a healthy “aeration free” system is less than 0.2ppm. The pressure, which was being measured close to the top of the system, was also lower than it should be, occasionally dropping further.

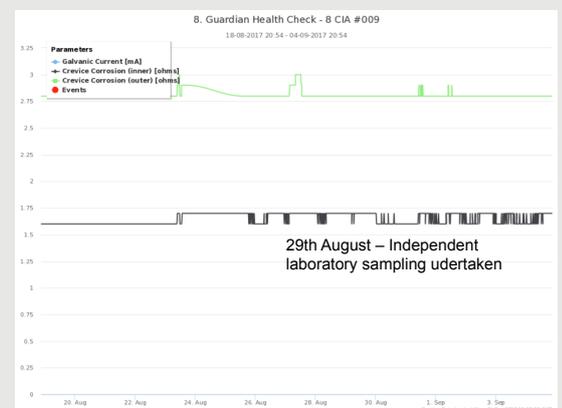
## Data before and after pressure spike



## Conductivity data



## Corrosion data



After some investigation into the layout of the system, including an additional section of pipework which was added to the roof area, very low pressures were noticed. Sections of the systems were also noisy with what sounded like air in one or two areas.

The site engineer team checked this and when the original drawings were compared they discovered around 20 Air Auto Valves (AAVs) missing from the top of the system.

Eight new AAVs were subsequently installed and the aeration noises have now disappeared.



## Conclusion

### Independent laboratory testing – conclusion corrosion under control

In the six weeks following the flushing works, independent sampling of the system at an estimated cost of £2,400, provided 12 sets of chemistry readings that showed stable iron and copper levels, as well as a consistent conductivity. There was also one reading of dissolved oxygen taken. A leading independent consultant who took these samples concluded that the “iron and copper were remaining at low levels.”

### Corrosion Coupons – conclusion corrosion under control

Corrosion coupons were installed on the 17/8/2017 and taken away for analyses on 10/10/2017. These showed that iron and copper corrosion was very low during this period.

### Hevasure Monitoring – conclusion corrosion under control

Within one day of installation the Hevasure unit was reporting slightly low pressures and slightly high DO readings but, most importantly, controlled corrosion rates. Despite the pressure changes, and the continued DO presence the corrosion sensors informed us that the system was stable.

The anomalies in pressure and DO lead to the rectification of other issues in the system, issues that may not have been identified from sampling alone.

At the end of the period the Hevasure unit had collected over 35,000 data points and helped to identify an installation issue with missing AAVs – as well as confirming the system metals were indeed stable after the flushing and passivation works were carried out.

## Reference data

**GUARDIAN PRE-COMM** Chemistry Certificate of Analysis Job No : 17-58981 **LATIS SCIENTIFIC** Issue : 1

Guardian Pre-Commissioning Units 9 & 10 The Capricorn Centre Cranes Farm Road Basildon Essex SS14 3JJ

Sample No: 1543700 Order Number: Not Declared Sample Type: Solid  
Sampled By: [Redacted] Date Sampled: 10/10/2017 Time Sample Taken: Not Declared  
Date Received: 10/10/2017 Sample Deviations: N/A

Sample Point: Mid Steel Corrosion Token

Test Name	Result	Units	Method No
Date Installed	17/08/2017	*	Supplied
Date Removed	10/10/2017	*	Supplied
Initial Dry Weight	10.6355	g	MISC
Final Dry Weight	10.6363	g	MISC
Weight Loss	-0.0008	g	MISC
Corrosion Rate	-0.0121	mpy	MISC

**GUARDIAN PRE-COMM** Chemistry Certificate of Analysis Job No : 17-58981 **LATIS SCIENTIFIC** Issue : 1

Guardian Pre-Commissioning Units 9 & 10 The Capricorn Centre Cranes Farm Road Basildon Essex SS14 3JJ

Sample No: 1543707 Order Number: Not Declared Sample Type: Solid  
Sampled By: [Redacted] Date Sampled: 10/10/2017 Time Sample Taken: Not Declared  
Date Received: 10/10/2017 Sample Deviations: N/A

Sample Point: Copper Corrosion Token

Test Name	Result	Units	Method No
Date Installed	17/08/2017	*	Supplied
Date Removed	10/10/2017	*	Supplied
Initial Dry Weight	12.8820	g	MISC
Final Dry Weight	12.8832	g	MISC
Weight Loss	0.0012	g	MISC
Corrosion Rate	-0.0159	mpy	MISC

INDEPENDENT WATER TREATMENT ADVICE [Redacted]

London [Redacted]

**WATER ANALYSIS REPORT**

Site: 6 [Redacted]

Date samples taken: 29 August 2017 Report Ref: [Redacted]  
Sample Type: Chemical  
System Type: Closed

Comments on Attached Results:

**LTHW**  
Inhibitor levels are low and require reinstatement as soon as possible.  
Copper levels are significantly elevated, a dose of azole is recommended.

**Chilled Water**  
The molybdate level is satisfactory but nitrite portion of the inhibitor is low and requires reinstatement.  
**Iron levels and copper levels are remaining at low levels which is encouraging.**

While suspended solids are low in the samples taken this is likely to be a reflection of the locations chosen as opposed to a change in overall conditions in this respect.

Please ensure that full circulation is achieved routinely through all areas of the systems.

Please do not hesitate to contact us if you have any queries.

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