



Water Hygiene & Treatment, Air Hygiene, Pre-Commission Cleaning, Commissioning, Gas & Electrical Works
Unit 2, 10 Tything Road West, Arden Forest Industrial Estate, Alcester, Warwickshire, B49 6EP
Company Registration No: 02902353

Remote monitoring data

Rationale

Remote monitoring sensors were put in at a care home environment due to ongoing out of specification legionella results.

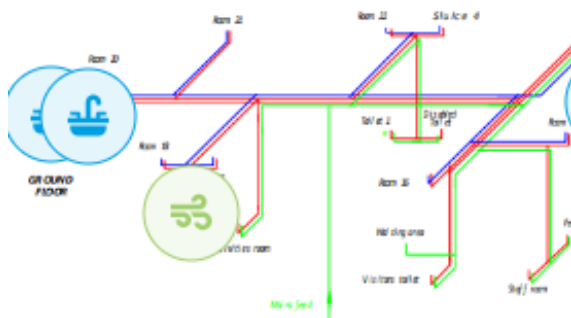
Site history

There is a chlorine treatment system on site (in order to address the out of specification results), and recently all the plant had been replaced with cold water tanks rationalised to one tank, and new hot water cylinders installed in the main boiler room. The existing pipework remained in situ from the old system.

As a result of the ever increasing spend, the client required a diagnostic approach to identify route cause.

Monthly monitoring (taken by site maintenance) indicated temperatures ranging from 55-58 degrees in the hot and all below 20 in the cold.

Remote monitoring was then installed on the system (and mapped onto the schematic drawing – example snapshot below)



Type of sensors

Pipework sensors were put on predominantly for the purpose of monitoring the water pipework. Additional air monitoring sensors were also put in both the clinic room and the bookcase by the main lounge in order to test the air quality. These were to demonstrate the capabilities of the system.



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Calibration

At the time of the sensors being fit they are calibrated – this allows the sensors to be set to the temperature of the water at a set period, but also has the benefit of being able to add 2 degrees on to the overall set data at the time of calibration to ensure that the levels we are seeing are inclusive of the 2 degrees addition as per temperature monitoring policy on pipework (see below example).

The screenshot shows the configuration page for a sensor named 'First floor Cal 2 Flow'. It includes a description field, navigation tabs for Data, Event log, Alert log (0), Permissions, and Configuration & Details. The details section shows Sensor ID, Battery (100%), Sensor kit (jtc-14-dmh), and Model (Temperature Sensor (2nd Gen) EU). A note states 'No cloud connector data available.' The sensor configuration section shows a temperature offset of 1.85 °C with a 'CHANGE OFFSET' button.

The units can also be recalibrated at any point. Whilst there is no need to amend the calibration, if there was a sensor that proved difficult to calibrate then this can be amended ‘post install’ with real time data to ensure we have the most up to date calibration. We can also monitor the sensor offset data to trouble shoot any locations that show a difference exceeding 2 degrees to help ascertain the most problematic areas.

Dashboard

When logged into the system this gives a very quick indication of the locations that are not achieving compliance over the last 7 days

The dashboard screenshot is divided into two main sections. The 'Pipe Monitoring' section features a table with the following data:

	TOTAL SENSORS	TOTAL FAIL COUNT	FAIL PERCENT	WATER MOVEMENT FAIL COUNT	TEMP FAIL COUNT
Cold	8	1	12.50%	0	1
Hot	6	2	33.33%	0	2
Calorifier flow	2	2	100%	0	2

The 'Indoor Air Quality' section shows a bar chart for 'Overall' performance from Tuesday 11 Oct to Tuesday 18 Oct. The chart displays green bars for all days, indicating compliance. Below the chart, it shows '2 Sensors' and 'Last 7 days rolling' data.



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On the pipe monitoring this shows the following as not having hit compliant levels:

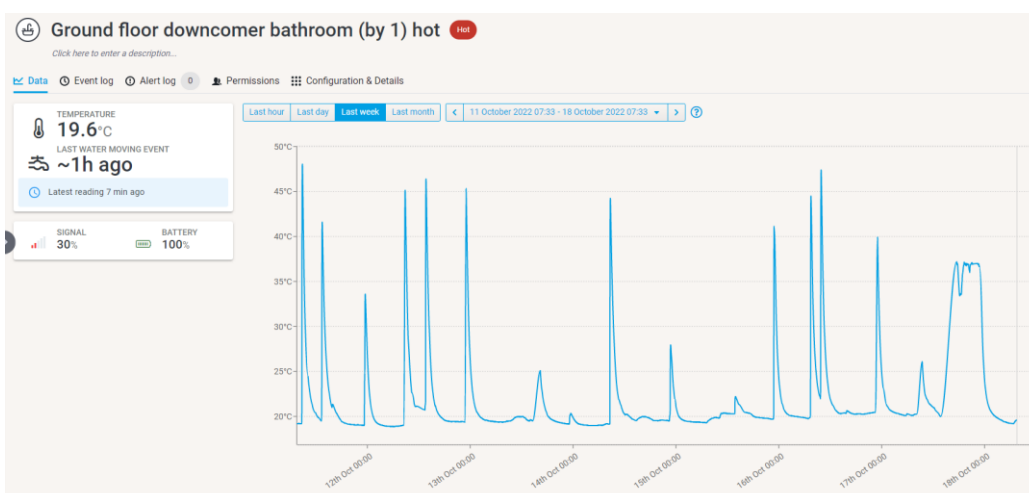
Cold

Downcomer by bathroom 1 cold. Clicking on this then shows the data over a longer period of time – as you can see from the graph it is repeatedly not hitting below 20 degrees



Hot

This indicates the downcomer by 1 and room 19 (both on the ends of the system) have failed to hit compliant levels in the last week – ie. see below the downcomer hot



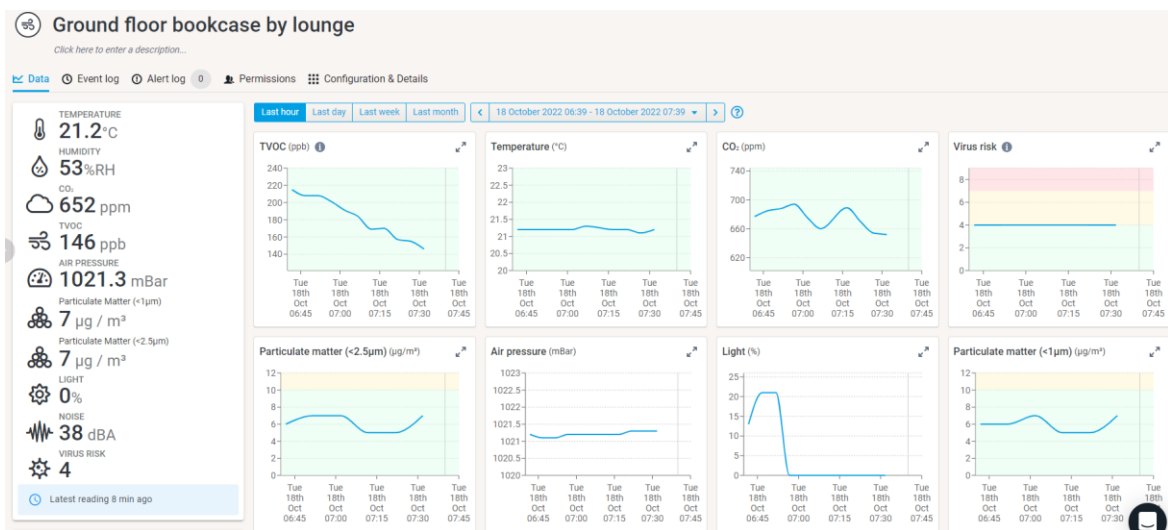
Calorifiers

Whilst the calorifier flow temperatures are currently compliant, there have been times where the minimum levels are dipping below 60 degrees on site – see below



Air monitoring

See below screenshot of the aspects being monitored on the air monitoring system (noise and humidity are also graphed but this is out of the screen shot).





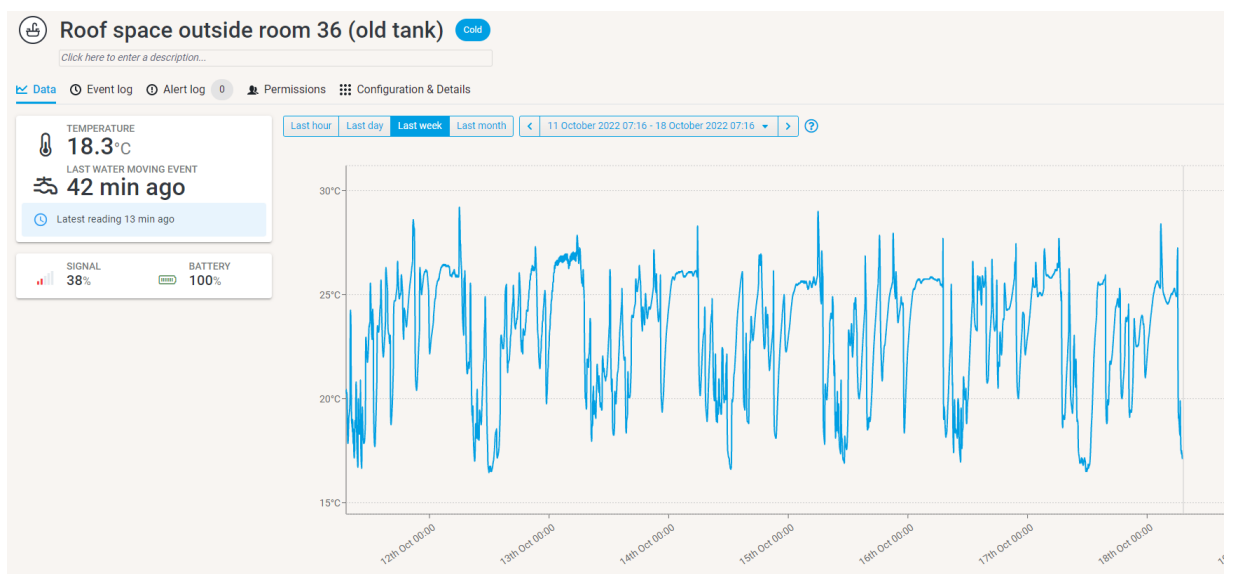
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The previous graph is set to an hour, however altering the widget to go over the last week indicates the CO2 level at points exceeded 1400ppm, far exceeding 1000ppm on four separate occasions.



Cold water system

The cold-water pipework feeds up to the roof space on site to then distribute via the old cold water tank network on site. This causes warming of the cold pipework in the roof space – this is not also the height of summer (tested in October) – see below graph on that probe.

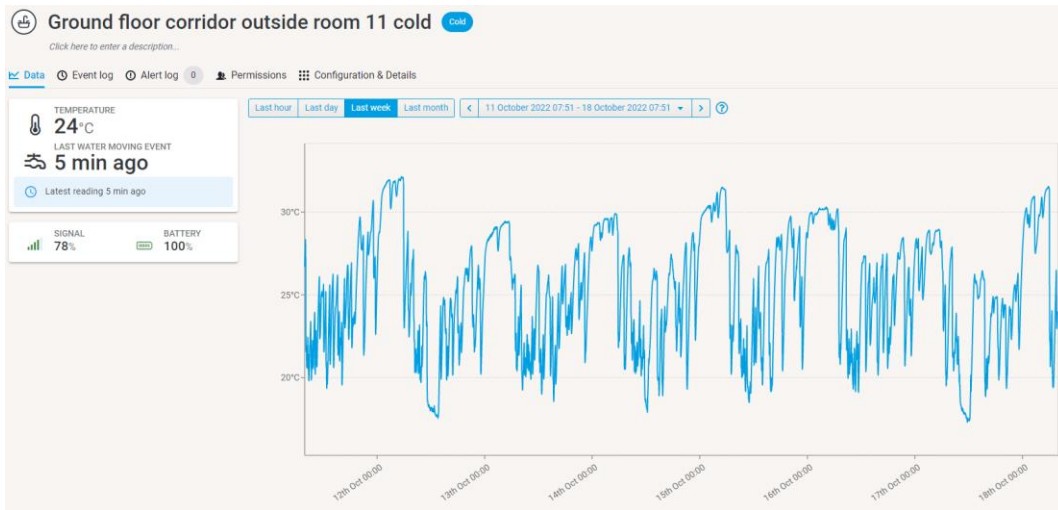




ROCK COMPLIANCE

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A temperature probe was also placed on the main pipework run on the ground floor that's within the boxing (see picture on the next page) – below indicates the thermal gain occurring on this pipework run.



The cold water system temperatures also help indicate the movement through the pipes and vindicate the flushing programme. Below is imagery for room 14, which is under a daily flushing programme at the moment due to ongoing counts. The tap appears to be being opened at multiple times per day, but the graph helps illustrate the limited time the pipework will be sat below 20 degrees (though helps illustrate this is preventing temperatures from increasing to the same levels as the roof space).

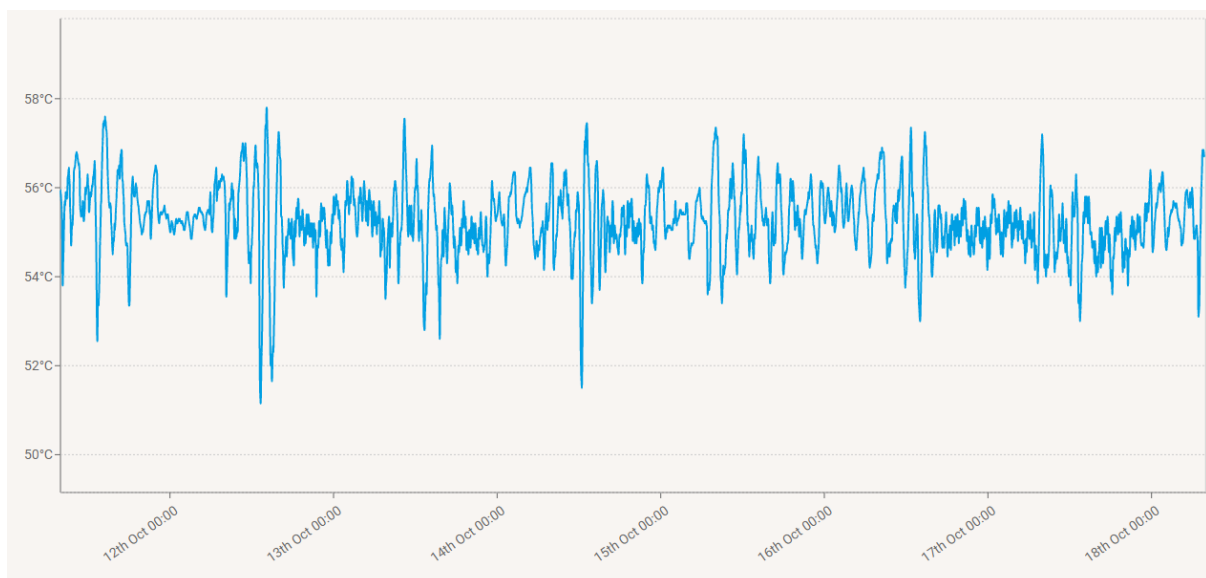


Hot water system

Where possible the intention of the monitoring on the hot water system was to install the probes at the hot water recirculation on site. See below imagery for where the installations were made in both the recirculation pipework by room 1, and the main recirculation pipework void by room 11.



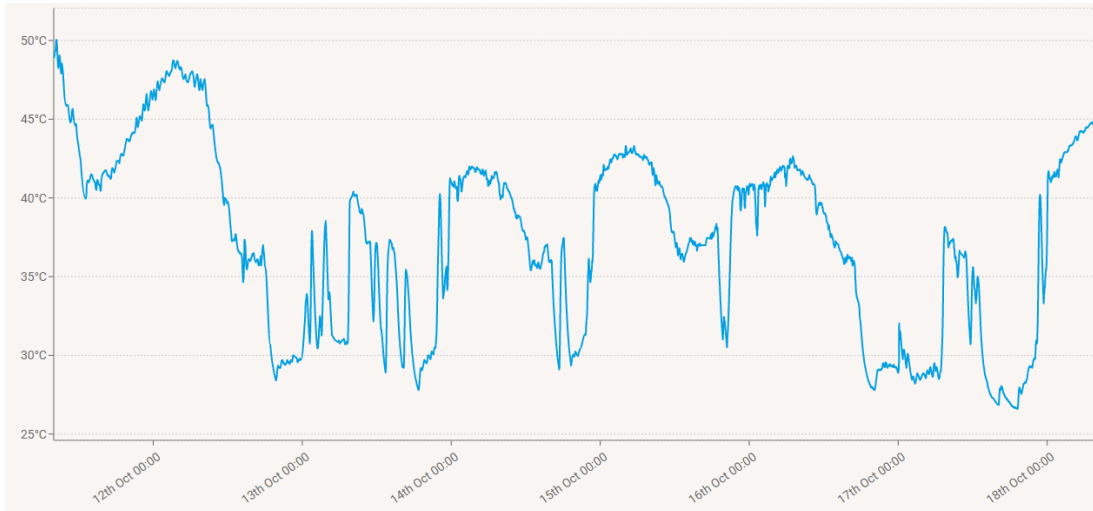
The recirculation pipework temperatures are below, first for the corridor outside room 11 and then also the pipework monitored in the second picture near room 1 (next page). The temperatures in the main pipework run appear to be reaching 55, however they are not staying above this level. The probe by room 1 shows temperatures well below this.





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The recirculation pipework temperatures were also monitored at the connection to room 9 – these indicate the leg off the main pipe run is achieving consistent temperatures, but that they are below the 55 degrees required.



For room 14 – the only location with the outstanding legionella count. The temperatures have recently improved so that during flushing temperatures are at times achieving 60 degrees, however there remains a large amount of time where temperatures sit within the ‘growth zone’. Off the back of this it would be beneficial to ensure that when flushing known areas with bacterial counts, the instruction goes out to ensure that the temperatures are monitored and the flushing period only starts after temperatures are at the point where thermal kill is being achieved.





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Future reports

The system can be set up to deliver routine reports via an excel template to those that would need it – we can also control the distribution list so that reports can be sent out detailing non-conforming locations to a set amount of people (ie. property managers could have alerts on multiple sites). You can set timeframes to receive the reports for and it will trigger the temperatures that are out of threshold – see below an example of a few of the monitoring locations

Sensor name	Water moving result	Sub-type	Max temp (°C)	Min temp (°C)	Temperature result	Result
First Floor Cal 1 Flow	Within threshold range	Calorifier flow	62.45	54.55	Outside of thresholds	Outside of thresholds
First floor Cal 2 Flow	Within threshold range	Calorifier flow	62.15	54.3	Outside of thresholds	Outside of thresholds
First floor Calorifier common return	Within threshold range	Calorifier return	60.65	52.7	Within threshold range	Within threshold range
Ground floor bathroom (by 1) downcomer cold	Within threshold range	Cold	28.35	20.3	Outside of thresholds	Outside of thresholds
Ground floor corridor outside room 11	Within threshold range	Hot	57.8	51.15	Within threshold range	Within threshold range
Ground floor corridor outside room 11 cold	Within threshold range	Cold	33.2	17.3	Within threshold range	Within threshold range
Ground floor downcomer bathroom (by 1) hot	Within threshold range	Hot	48.05	18.85	Outside of thresholds	Outside of thresholds
Ground floor recirculation pipework by room 9	Within threshold range	Hot	52.05	46.05	Within threshold range	Within threshold range
Ground floor recirculation pipework corridor v	Within threshold range	Hot	50.3	26.6	Within threshold range	Within threshold range
Ground floor room 14 cold	Within threshold range	Cold	24.35	18.1	Within threshold range	Within threshold range
Ground floor room 14 hot	Within threshold range	Hot	63.75	26.55	Within threshold range	Within threshold range
Mains in to cold water tank	Within threshold range	Cold	23.55	15.95	Within threshold range	Within threshold range
Roof space outside room 36 (old tank)	Within threshold range	Cold	29.25	16.45	Within threshold range	Within threshold range
Room 19 Cold Flow	Within threshold range	Cold	26.8	15.8	Within threshold range	Within threshold range
Store room tank supply	Within threshold range	Cold	18.55	15.8	Within threshold range	Within threshold range

Summary

In summary, the following actions were identified in direct relation to the pipework monitoring system a week after install – the progress of these actions will be monitored moving forwards:

- Calorifier temperatures need to rise at source to ensure the flow temperatures are 60 degrees as a minimum
- Extend the flushing period at the outlets to ensure that there is thermal kill via the flushing regime (monitor temperatures as part of this process)
- Review the hot water circulation towards the end of the system with consideration given to reviewing the sizing of the recirculation pump and potential re-balancing
- Insulate the existing pipework to prevent potential heat gain/loss on the pipework. This is particularly prevalent in the boxing on site as well as in the roof space