OSIL
Air Pollution Control +

CASE STUDY

Thames Water, Mogden STW

OCU REFURBISHMENTS 2021

What was the problem?

Various refurbishment works required on several of the odour control systems at Mogden STW to reinstate the systems to their operational requirements and upgrade the OCU performance where possible.

Under the Construction (Design and Management) Regulations 2015, a principal contractor is appointed by the client (Thames Water) to control the construction phase of any project involving more than one contractor.

OSIL were appointed as Principal Contractor to manage health and safety risks during the refurbishment/construction phase and have the skills, knowledge, experience, and organisational capability to carry out the refurbishment work.

How did OSIL approach the challenge?

OSIL developed detailed project programmes for each of the four refurbishment packages, engaging with the customer closely. Thames Water advised which OCU package was to be prioritised. The refurbishment works were then planned and executed as closely as possible to the agreed outlined programmes between OSIL/Thames Water.

Weekly updates along with before/after photos were sent to the client as refurbishment work items were completed on the OCU's as well as monthly project programme updates and an overview summary.

OSIL programmed, procured and carried out all refurbishment works and CuCarb® filter media changes.

Welfare and storage facilities were provided onsite by OSIL.

Electrical works were subcontracted and overseen by OSIL.

All Chemical refurbishment works were carried out by OSIL qualified technician.

All Site and Government COVID regulations were adhered to by all employees.

Scope of Works

Package 1 - OCU 12 refurbishment

Replace deformed inlet ductwork.

Replace inverter fan panel mesh.

Repairs to water softener.

Reposition replace existing support.

Install condensation points various.

Repairs to ductwork.

Clean quench tower internals.

Install larger in-line filters to Biofilters.

De-scale chemical scrubber.

Replace dosing cabinet (Caustic) race heating panel heater.

ph. redox probes.

Package 2 - East Side OCU refurbishment

Repairs to inlet screen ductwork and dampers.

Repair to bypass Damper gearbox.

Replace PH and Redox Probes.

Expansion joint fitted to critical ductwork lines storm tank area (2 off).

Clean fan impellors.

Survey/Inspection of Fan No. 3.

Package 3 - Thickening OCU Refurbishment

Remove pump local isolators out of zoned area.

Completely remove pumps and connect water supply direct from effluent main.

Repairs to biofilter inlet manifold ductwork.

Thickener building replace temporary ductwork.

Repairs / replace flow switch.

Local Isolators for sump pumps.

Change media in CuCarb units.

Re-Inoculate LavaRok Unit.

Package 4 - PS14 OCU Refurbishment

Remove pump local isolators out of zoned area.

Auto control logic check.

Local isolators for sump pumps.

Delivering the Solution

Package 1 – OCU 12 Refurbishment

Replace inverter fan panel mesh

Fan and vent filter mats swapped for 2-off fans and 4-off dosing pump MCC inverter cubicles including washing the outer finger guard grills. Please see below before and after photos:

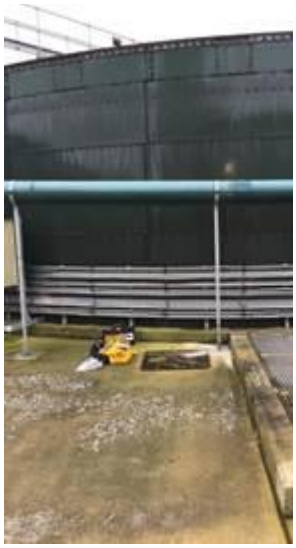
Repairs to water softener, new Salt Level Switch

New level switch assembly fitted and connected to existing local level switch control unit. Low salt alarm level set at approximately 600mm below brine tank lid. Tested new switch, correctly generates alarm on local control unit and on OUC12 HMI.

Reposition existing support

Existing support post baseplate was too large to be fixed down in the area the original manufacturers had attempted to position, we therefore changed the baseplate for a new smaller version to suit the ductwork line. Please see below before & after photos.



Install various condensation points

Within the OCU 12 ductwork there was previously points where condensate was escaping from two holes. One hole was allowing condensate to release from ductwork and the second hole was allowing condensate to drip on to cable tray. Two condensation points have been added, one to allow condensate to drain and the other to avoid cable tray. Please see below before & after photos.


Clean Quench Tower Internals

On Monday 15th February, we had an MTS tanker & site operatives attend site to assist OSIL with the cleaning of the internal packing media inside of the quench towers, this work was then followed with a Caustic IBC setup to circulate the chemical around the quench tower.

Please see below photos for your records:

De-Scale chemical scrubber

Further to the above the MTS tanker and site operatives carried out a pressure jetting from outside of the chemical scrubber vessel at high level from the top hatch, once the jetting was completed from above, the team then moved to empty and jet wash the scrubber sump to remove waste washings. Also, during these works, OSIL setup a chemical IBC of Sulphamic Acid to carry out the de-scale of the chemical scrubber.

Please see below photos:

Quench Tower Internals

The cleans on Quench Tower #1 and #2, respectively, went smoothly using our chemical transfer pump to recirculate the cleaning solution, this provided enough flow and pressure to get a decent spray pattern over the packing media, the below photos highlight the effect the clean had within the towers:

All the quench tower packing media was fully exposed to the caustic cleaning solution so coupled with the jet washing that MTS carried out we can be confident that the overall cleaning efficiency is as good as it could be.

The below photos show visually via the clear see through hoses, the different stages of clean on towers 1 & 2 over 2½ hours:

#1 about an hour through the 2½ hours clean:

#1 at end the 2½ hours clean:

#2 at start of the 2½ hours clean:

#2 about hour through the 2½ hours clean:

#2 at end of the 2½ hours clean:

Based on resultant colour of the cleaning solutions Quench Tower #1 was definitely a lot dirtier than #2 thanks to water damaged FE actuated valve, means #1 had been in service for a lot longer than #2 and hence will have become far dirtier.

No significant change observed in tower DP values:

#1 DP before clean = 14.1mBar

#1 DP after clean = 16.2mBar

#2 DP before clean = 14.0mBar

#2 DP after clean = 16.7mBar

This suggests that there was **not** any significant fouling restricting air flow and the contra intuitive slight increase in DP is likely to be down to cleaner pressure transmitters giving a truer reading and/or increased FE throughput from cleaned spray nozzle giving rise to slightly increasing airflow resistance over the packing.

OSIL also took the opportunity to calibrate the FE flow switches zero (with FE supply isolated) and 100% flow values (adjusted to FE flow immediately after quench tower cleans and boll filter service) and to test the FE low flow alarms which all work OK.

Caustic POU heater install

100W enclosure heater with Integral ‘stat (Intertec CP MULTITHERM DNNA 100 TS10 100W 230V, 10C / 18C stat) mounted at side of caustic POA enclosure using manufacturer’s mounting kit and stainless-steel machine screws drilled and tapped into enclosure rear wall:

Integral cable routed out of enclosure via M20 IP68 stuffing gland (side wall of enclosure drilled and tapped to accept gland thread), through existing finger trunking containment up to trace heating power supply terminal box located at rear of caustic + hypo' POA enclosures.

Integral cable terminated in spare main 'stat controlled 230V supply in trace heating power supply terminal box.

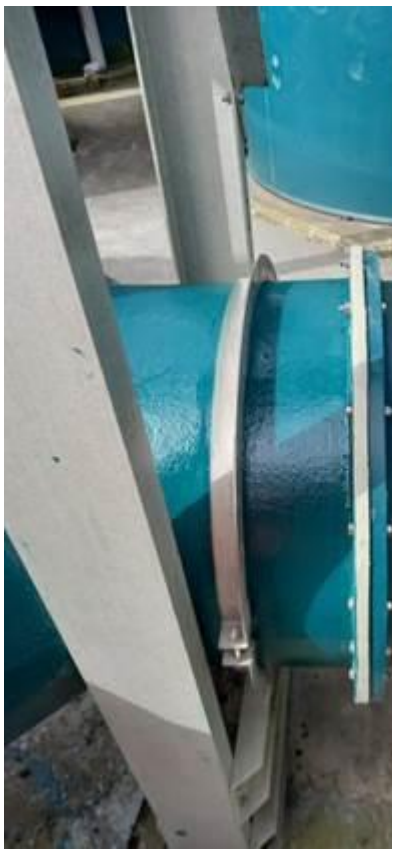
Ambient temperature approximately 12°C. Temporarily adjusted main trace heating 'stat to 20°C to energise trace heating circuits but new caustic POA heater didn't heat up as ambient temperature above the integral 'stat low temperature switch on point of 10°C. Wrapped ice pack around integral 'stat to drop temperature below the low temperature switch on point of 10°C and new heater quickly heated up showing that it will provide frost protection for the caustic POA enclosure soon as ambient temperature drops to less than 10C. Main trace heating 'stat readjusted to correct 10°C.

Replace deformed inlet ductwork

Further to the shutdown requests between 7:30 a.m. to 5 p.m. on Tuesday 23rd & Wednesday 24th March the OSIL site team were able to remove the existing deformed Y-piece ductwork on the outlet of the fans and install a new Celmar/GRP Y-piece in place, the below photos show the newly installed ductwork which has been strengthened to stop future deformation from happening.








Repairs to ductwork

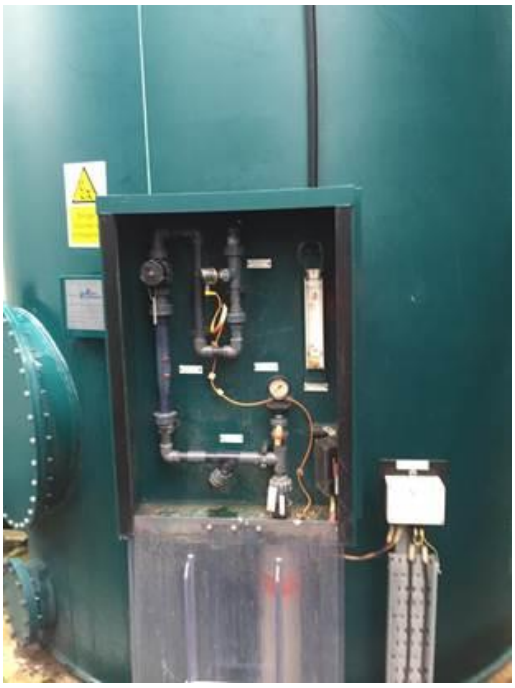
On the ductwork where the PAS airstream comes into the Quench Towers there was a damaged flange where previously you could hear the air whistling into the cracks that had formed. The site team cut away the damaged flanged connection and installed new flange piece complete with

internal slips to repair the ductwork which is now completely sealed. Please see below photos of the repair:



Install larger in-line filters to Biofilter

Since OCU 12 was initially installed at Mogden the effluent feeding the Biofilters has consistently had issues with snail larvae within the irrigation stream which resulted in the existing Y-strainers in the 8-off Biofilters becoming blocked almost always within a few hours after cleaning. OSIL therefore upgraded the existing in-line filter setup, the logic for our selection of the 1½" basket strainer is that the existing y-strainers have a capacity of around 25ml whereas the new basket strainers have a capacity around 2,500mm i.e. will hold around 100 times as many snails and extend the couple of hours to clog to couple of hundred hours so maybe a weekly clean by Thames would ensure continuity of FE irrigation (and hence bio-filter performance) i.e. hours now become days.

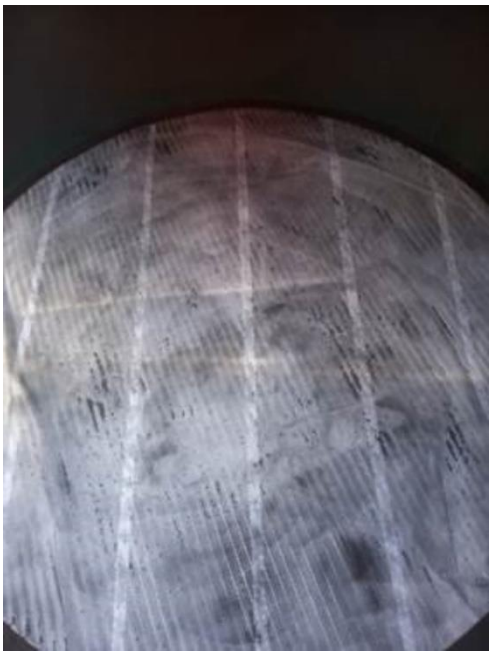


OCU 12 – Carbon Media Change

Monday 19th April – Disab Vacuum Tanker setup and suction hoses setup to remove the existing spent carbon media within the 4 filters – approx. 43m^3 of media was removed in total (4 filters, with 5.38m^3 in top & bottom section). The new carbon media was then also delivered & offloaded via curtain sider on this day.

Tuesday 20th April – New carbon media refill with bulk bags completed in top section of filters, these works were assisted by Emerson Crane Hire who were used to carry out a contract lift to aid with refilling of the carbon media bulk bags.

Wednesday 21st April – Completion of the new carbon media refill works with small (20kg) bags in lower section of filters.



Bollfilter Service on OCU 12

During our chemical cleaning works of the OCU 12 scrubber & Quench Towers, OSIL found that the FE supply pressure for OCU12 was low and not consistent and this was down to the boll filter being sat constantly cleaning and dumping to drain (so a significant percentage of the incoming pressure was being lost to drain). Due to the submersible pumps staying on the Thickener system, it was agreed to use these budgeted works to undertake a Bollfilter service on OCU 12 to resolve the reported issues, this was completed on Friday 26th February with Bollfilter service engineer Liam Fitzpatrick. Photos below from Bollfilter service:

Delivering the Solution

Package 2 – East Side OCU Refurbishment

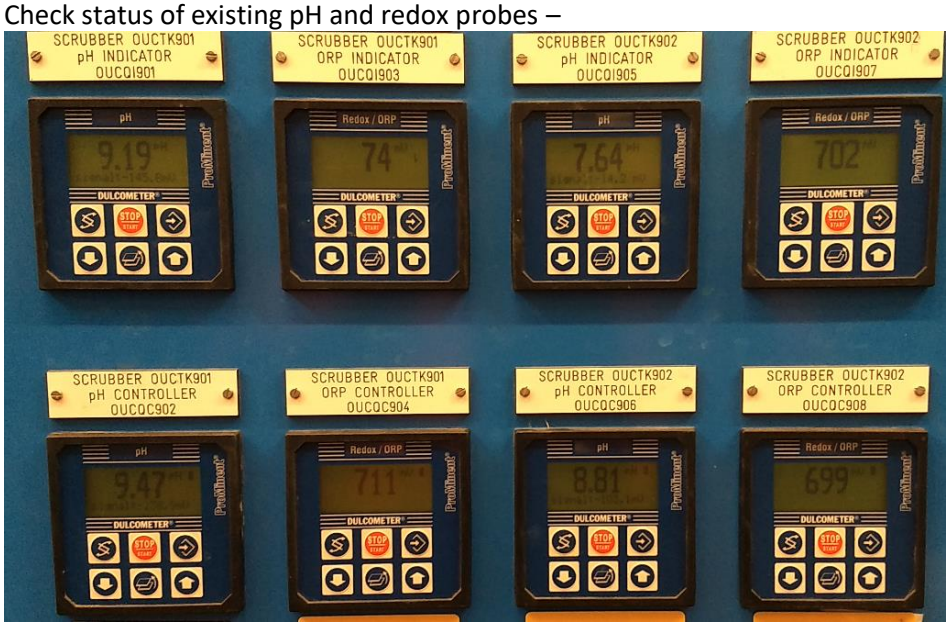
Clean Fan Impellors

Wednesday 24th February, prior to the cleaning our Team recorded the significant scale that had built up on the impellor blades, photos below for reference show pre-cleaning:

The site team then used an industrial scraper, wire brush and hot pressure washer to then remove the scale from the impellors, photos below for reference show post-cleaning:

OCU pH and redox probe swap

Check status of existing pH and redox probes –



Scrubber #1 pH – two instruments showing 0.28pH difference, not ideal but not sufficient to inhibit automatic dosing.

Scrubber #1 redox – two instruments showing 637mV difference with OUCQ903 reading very low, automatic hypo' dosing inhibited by this large difference (>50mV alarm setpoint).

Scrubber #2 pH – two instruments showing 1.17pH difference, automatic caustic dosing inhibited by this large difference (> pH 0.5 alarm setpoint).

Scrubber #2 redox – two instruments showing 3mV difference which is almost perfect correlation suggesting probes are in perfect condition.

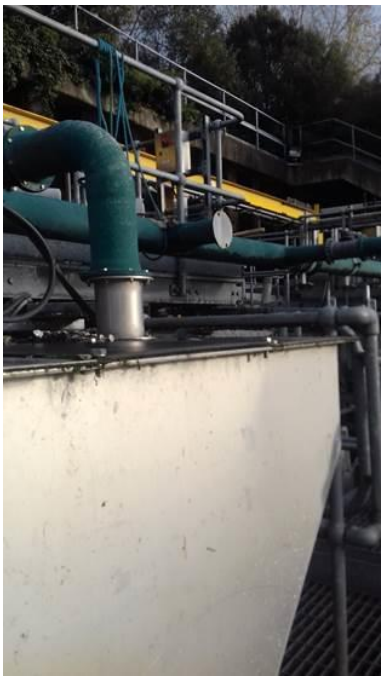
- Removed existing pH probes from Scrubber #1 (Note OUCQC902 had wrong probe installed (Grundfos) and installed replacements (Prominent PHER 112 SE). Calibrated using single use sachets of pH 7 and pH 10 buffers (Note OUCQI901 incorrectly set to use pH 7.06 as buffer #1 and OUCQC902 incorrectly set to use pH 10.15 as buffer #2, reset to correct pH 7 and pH 10 values, respectively). Both Calibrated OK (OUCQI901 : Zero = 9.8mV, slope = 59.67mv/pH and OUCQC902 : Zero = -6.2mV, slope = 57.57mv/pH).
- Removed existing redox probes from Scrubber #1 and installed replacements (Prominent RHER PT SE). Calibration check undertaken with fresh 465mV redox standard. OUCQI903 read 74mV (as with old probe) and reported as a defective sensor. However, given than both the old probe and the new replacement gave exactly the same reading I suspect the fault actually lies elsewhere in the redox measurement circuit. Our gut feeling is that the module that screws onto the redox probe and converts the redox value to a 4-20mA signal which is measured by the instrument in control panel is faulty. This will be easy to prove by replacing the probe and module with a 4-20mA loop simulator. If the result redox value varies correctly in response to simulated 4-20mA signal then the module is faulty. If it sticks at 74mV then the fault lies in the instrument itself.
- After Scrubber #1 probe replacement, automatic hypo' dosing was still inhibited due to incorrect low reading from OUCQI903 giving rise to difference between redox values > 50mV alarm setpoint. Temporarily changed redox difference alarm setpoint to 1,050mV to mask the issue with OUCQI903 and hence to allow automatic hypo' dosing to recommence. Please note that in doing so, the control system will no longer be able to detect an issue with OUCQC904 and so there is a finite risk of under or overdosing hypo' until the issue with OUCQI903 is addressed and the redox difference alarm setpoint restored to correct 50mV setpoint value.
- Removed existing pH probes from Scrubber #2 (Note OUCQC902 had wrong probe installed (Grundfos) and installed replacements (Prominent PHER 112SE). Calibrated using single use sachets of pH 7 and pH 10 buffers (Note OUCQI905 incorrectly set to use pH 10.07 as buffer #2, reset to correct pH 10 value). Both Calibrated OK (OUCQI905 : Zero = 14.7mV, slope = 55.44mv/pH. OUCQC906 : Zero = -18.7mV, slope = 57.34mv/pH).
- Removed existing redox probes from Scrubber #2 and installed replacements (Prominent RHER PT SE). Calibration check undertaken with fresh 465mV redox standard. Both read correctly (OUCQI907: 460mV and OUCQC908: 456mV).
- After Scrubber #2 probe replacement, automatic caustic dosing was correctly reinstated as pH difference was now < pH 0.5 alarm setpoint. So on completion of probe swap auto dosing has been fully restored to both scrubbers.

Old probes left safe in scrubber sample / blowdown enclosures (in storage solution in packaging from the replacement probes) as emergency spares along with the used redox solutions for future use.

Repairs to inlet screen ductwork and dampers

Various ductwork sections & volume control dampers were previously removed from the inlet screens, the OSIL team reinstated these sections/dampers and re-fibre glassed the ductwork to further protect from UV deterioration.






Expansion joint fitted to critical ductwork lines - storm tank area (2 off)

Further to works carried out on previous refurbishment schemes at Mogden, two more flexible expansion have been installed into the storm tank area ductwork lines, we have also manufactured two GRP supports to support the new expansion joints, please see below photos:

Delivering the Solution

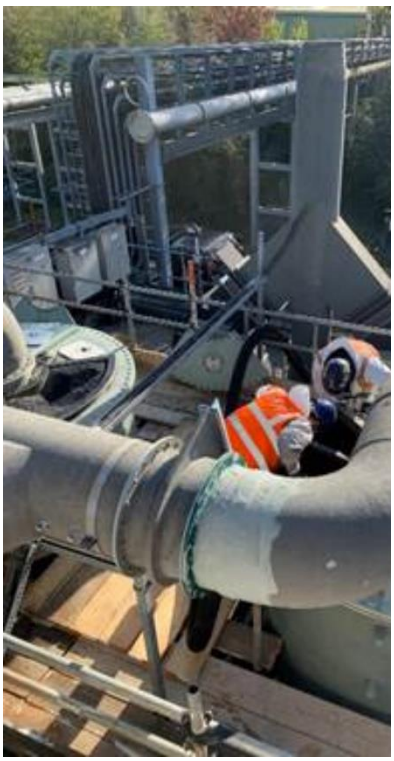
Package 3 – Thickening OCU Refurbishment

Change carbon media in two CuCarb units

Thursday 22nd April – Disab Vacuum Tanker setup and removed the existing carbon media from both the Thickening OCU carbon filters – approx. 14m^3 in total (2 filters with 7m^3). Curtain Sider and flatbed transport also came to collect all the bagged waste media removed from the Thickening OCU to return to the regen plant. The new Thickener OCU media was also delivered & offloaded.

Friday 23rd April – New carbon media was refilled with bulk bags via the top access hatches on the filters and distributed evenly in the filters until full, again these works were assisted by Emerson Crane Hire who were used to carry out a contract lift to aid with refilling of the carbon media bulk bags.

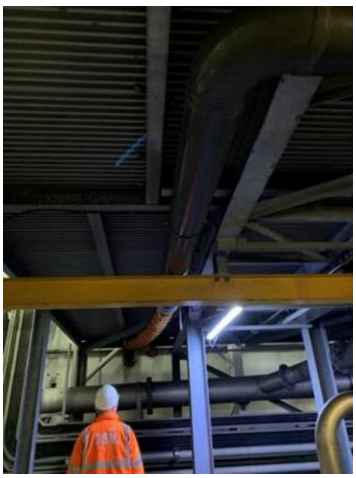
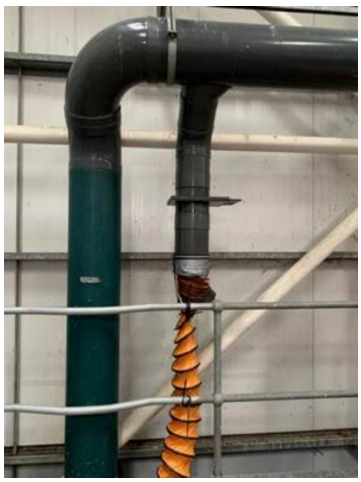
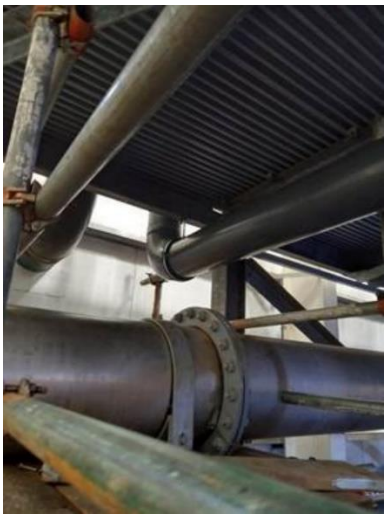
- In addition to the above, OSIL were also audited on site during the works and provided Thames with all documentation as requested i.e. crane permits, TWOSA, signed daily activity briefing and signed RAMS, ensuring everyone who was involved in the task had worked to the correct procedures and the appropriate work permits were in place.
- Photos of Thickening media change works as below:





Thickener building - replace temporary ductwork

Temporary ducting which had been installed by others was replaced by the OSIL site team with new uPVC ductwork sections to fit the existing plastic pipe within the thickener building, please see below before & after photos:


Delivering the Solution

Package 4 – PS14 OCU Refurbishment

Auto Control Logic Works – PS14 LCP

During OSIL's initial attempt to implement a modified control logic in the existing LCP it was discovered that both the PS14 control panel & fan motor had suffered from extreme heat & burn out. The software modification has been implemented into the control logic however could not be tested at the time due to heat damage found within the panel & fan motor.

OSIL then programmed two engineers from TES Controls Ltd alongside us to then carry out the required panel remedial works and cabling/testing of the new fan motor.

The following work and observations were then completed on site:

1. All 3 phase cables replaced within Fan No. 1 cubicle. Contactor replaced with a 12 Amp 110vAC coil, Thermal overload Relay replaced.
2. 7 core 2.5mm cable replaced with new and ATEX glands between Isolator and Motor.
3. It was noted when testing that the Motor Isolator had a pole not operating. This was used for the Heater 230v supply line. Also, the lid was leaking.The Isolator body and lid were replaced with an unused Isolator off the Thickener Fans.
4. The Contactor within Fan 1 starter cubicle was fitted with a 100vDC coil, whereas it should have been 110vAC. Not sure if this would of / or has ever worked.
5. Fuses within the Cubicle Isolator have been changed to 32M40, Motor rated fuses. The schematic diagrams state these should be 16Amp.
6. Updated software loaded and Fans tested for rotation and operation on failure.

Photos from Site Works:




How did the Client win?

All OCU's onsite have been refurbished to a high standard to allow for improved operation and reduced maintenance.

Additional works encountered during refurbishment were also carried out utilising the existing budget.

Additional works carried out:

- Biofilter Service.
- Damaged Fan flexibles were replaced on OCU12.
- Fan motor on PS14 replaced.
- Control panel repair works carried out.

No formal testimonial was received from client. However, positive feedback was received throughout the project.

For more information: 01543 506855 sales@osiltd.com

OSIL Air Pollution Control +

Odour Services International Ltd, Unit 14, Morston Court, Kingswood Lakeside, Cannock, Staffordshire. WS11 8JB
Registered in England No. 07213978.