

Franklaw WTW - AMP4 Pesticides

pesticide removal by adsorption onto granular activated carbon

by
Peter T Ratcliffe and John Reader

Franklaw WTW, situated 10 miles north of Preston supplies up to 600,000 customers in Preston, Blackpool and surrounding areas. Pesticide is occasionally present in one of the four raw water sources. This project provided facilities for pesticide removal by adsorption onto Granular Activated Carbon (GAC). The sand media in the existing 12 No. 1st stage filters was replaced with GAC, the backwash protocol revised and the 25 years old Degremont filters fully refurbished. The project was constructed whilst keeping Franklaw WTW in service and was completed under budget and ahead of the contracted completion date.



Franklaw WTW: 1st stage filter refurbished with new nozzles, awaiting new filter siphons & GAC

photo courtesy of Integrated Alliance

Project need

Franklaw WTW has four sources of raw water, which can be used either independently, or more than one source can be blended. The four sources are:

- * Thirlmere Aqueduct which brings water from the Lake District;
- * Barnacre Reservoirs, which store water abstracted from the River Calder;
- * Boreholes local to Franklaw WTW;
- * Abstraction from the River Wyre.

A sampling study revealed that pesticide was occasionally present in the River Wyre; the other sources being free of pesticide. Pesticides such as the herbicides MCPA, Mecoprop and 2,4-D were detected mostly during the summer. The *Integrated Alliance* worked with the client to determine the concentration of pesticides in the raw water that would be used for design. The client determined the blends of raw water that would be used for design purposes.

Feasibility Study (Optioneering)

The Integrated Alliance North (IAN) Engineering Team, which comprises *United Utilities, MWH and KMI+ (a Kier, Murphy, Interserve, and Mouchel Parkmen joint venture)* considered four options in detail:

1. Replacing existing 1st stage filter sand media with Granular Activated Carbon (GAC);
2. Installing Powdered Activated Carbon Dosing;
3. Both GAC and PAC;
4. Detecting pesticide in the River Wyre using an on-line monitor and ceasing abstraction until the intake was free of pesticide.

The project Team initially favoured option 4, as this would have been by far the most cost effective and sustainable solution. However, detailed review and testing of the fluorescence instrument proposed to monitor pesticide showed that it could not detect the pesticides at the very low concentrations required. The suppliers of this



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instrument, *Achromatic Ltd* are continuing to develop the instrument. Option 1, replacement of existing 1st stage sand media with GAC, was then selected on the basis of lowest whole life cost and least change to the existing process. The client decided to take advantage of the outages of the individual filters to carry out a full MEICA and structural refurbishment of the filters.

Solution Development

The Option 1 solution was developed by *IA Engineering Team*, the GAC bed depth required to effectively remove pesticide and the new backwash protocol being specified.

It was necessary to change the backwash from a Combined Air Water to a Separate Air Water protocol, requiring the backwash flow rate to be increased - which in turn required the replacement of the three existing backwash pumps. The existing air blower duty did not change and the existing blowers were retained. Installation of weir siphons was specified to limit media loss during the wash stages.

Replacement of the existing 25 year old filter valves and penstocks was specified as they were no longer drop tight. The existing pneumatic actuators had been causing problems, so replacement with electric actuators was also specified. A new washwater control panel was specified to replace the existing panel which included a pneumatic section.

Detail Design / Construction / Commissioning

Two filters were taken off line during the Project estimating period to allow media to be removed and an inspection to be carried out of the filter structure. During the inspection it became apparent that the filter nozzles would need to be changed. At this point a change to a finer grade of GAC filter media was proposed by the filter sub contractor, AMT Systems, in order to improve bed expansion. With associated new filter nozzles, an appropriate finer grade was selected for manufacture and supply by Norit.

KMI+ were appointed Principal Contractor for the detail design, construction & commissioning phases. Detail design was carried out by teams working collaboratively. Overall detail design was managed in house by KMI+, with GHA Livigunn providing detailed Civil design, and sub contractors providing design in their own specialist areas. There was strong interaction and collaboration between all design teams, with input to detail design from the UU and MWH engineers who had carried out Solution Identification and Development.

The main issue in construction was keeping most of the filters on line whilst isolating some of the filters for refurbishment. The isolation valves normally used for this purpose were themselves to be replaced. Northwest Pump and Valve designed temporary bypass pipework, that enabled the on line filters to be supplied with backwash air and water. This was so successful that the client requested details be added to the Operation and Maintenance manual so that it may be employed during future maintenance.

During commissioning of the first filter it was found that when the air scour commenced the water level in the filters rose almost to weir level and there were concerns that media would be lost over the weir during the air scour phase. The commissioning team suggested extending the siphons nearer to the GAC media. The engineering team were consulted and it was agreed to try extending the siphons and making them side entry. This worked well and was adopted.

Safety, as always, was a prime concern; the project was completed without accident having worked over 51,000 site hours during construction.

Conclusion

The project was completed in February 2008, delivered safely and ahead of the target date at a cost of £4.9m, below the £5.4m budget. **The close collaboration of the design teams, the client's operators, the main contractors and sub-contractors forming the Integrated Alliance North has been key to the success of this project.**

The Project was delivered for client United Utilities Asset Management and Regulation by the Integrated Alliance North, comprising, *United Utilities Capital Programs, United Utilities Water Engineering Group, KMI+ and MWH.*

The sub-contractors were **GHA Livigunn (detailed civil and M&E design), AMT Systems (filter specialists), Norit (GAC supply), RE Elliot Ltd (concrete repairs), Northwest Pump and Valve (mechanical installation), LME Electrical (electrical panels and installation) and TCS (system integrators).**

Note: The Editor & publishers wish to thank Peter T Ratcliffe of MWH, Engineering Delivery Manager for the Integrated Alliance and John Reader of KMI+, Construction Manager for the Integrated Alliance for preparing the above article for publication.■



New backwash and air scour Valves

photo courtesy of Integrated Alliance