Battling iron bacteria contamination

Mike Deed, the owner and Managing Director of Geoquip Water Solutions, outlines the need for regular maintenance of water supply systems to control bacterial growth and keep systems running efficiently. As he says, "mines rely heavily on groundwater sources and the quality and flow of that water have both operational and regulatory implications. The problem of mineral and bacterial contamination in groundwater sources can cause serious system failure, increase costs and have legal consequences.

"Mines rely heavily on groundwater to operate, using it in all steps of the mining process including equipment cooling, dust control, dredging and waste separation. If water yields decrease or dry up, work stoppages or mine shutdowns occur and there are also environmental considerations as toxic waste and mine effluents can be mobilised by water, causing regulatory, legal and reputational risks for companies. Mining companies have long been aware of these water risks and spend considerable time and effort addressing them. Recent analysis by the Water Resources Institute has revealed that the mining sector is one of the best when it comes to the reporting of water risks." [World Resources Institute. Sept 2010 http://www.wri.org/publication/mine-the-gap]

Iron oxide and iron bacteria contamination are specific issues, and can cause "deterioration of water quality, motor burn out of submersible pumps, clogging of the pump, column, bore casing, screens and reticulation systems, and ultimately reduction of the yield and bore capacity. Iron bacteria and iron oxide contamination is estimated to affect about 40% of the world's water bores and whether caused by naturally occurring bacteria or straight chemical means, anecdotal evidence indicates this number is steadily increasing. Whilst iron oxide residues can be completely removed it is impossible to completely eliminate iron bacteria and minimising their growth is the only way of controlling the problem.

"Tiwest, the world's largest integrated titanium minerals production and manufacturing company, has always worked closely with both the local authorities and local environmental groups to ensure it achieves maximum efficiencies in its water use and to impact positively on water resources and the environment.

The Tiwest mine at Cooljarloo in Australia produces more than 700,000 t/y of heavy mineral concentrate using a dredging operation and dry mining techniques. The site has 24 wells in two separate fields (north and south) and uses water in a diversity of processes and techniques, ranging from watering rehabilitation areas, to dust control, to dredging used in the mining process.

In 2008 iron bacteria contamination had started to become a serious problem at Cooljarloo. Breakdowns had increased, groundwater yields were consistently below target and cost overruns were a serious problem. However, the need for continual flow meant limiting bore and pump maintenance to a breakdown-only basis.

The maintenance team realised a new management strategy was needed and invited Kevin Wintergreene from Water Bore Redevelopers (WBR) to develop a new well management strategy. WBR recommended a phased rehabilitation treatment and ongoing maintenance program using BoreSaver treatments and a purpose built cable tool rig.

"BoreSaver treatments are manufactured by Geoquip's Australian partner, Aquabiotics Industrial, and are cleaning solutions for systems with mineral and bacterial contamination. [They] disrupt and dissolve iron bacteria cells and the associated iron oxide residues, whilst the BoreSaver components are converted to carbon dioxide and water. With the clogging and iron oxides dissolved it becomes a simple matter to remove them from the bore by either airlifting or pumping.

"At Tiwest, each well had the pump removed for inspection and service (where required) and the well fully cleaned out with BoreSaver Ultra C, brushing and surging for a day. The pump was then reinstalled and the well purged to waste.

"The wells were then monitored weekly for drawdown and flow amps and these measurements, together with the comprehensive historical records, were used to target the worst performing wells and implement an ongoing light rehabilitation program, on a planned rotation. As the crisis events stopped and flows increased, monitoring moved to every three or four weeks and this has continued for the last four years.

"To consider the effects of the maintenance programme, a comparison of the well field performance between 2008 and 2011 has been completed and the benefits have proved to be substantial.

"In 2008, a week before the rehabilitation program started and with all available wells in operation, the yield in the South field was down by 27,919 m^3 (an extraction variation of 46 litres/s). Three years on, in 2011, and with half the wells only running part time, 14,279 m^3 more water per week was being extracted. By running six of the 12 wells part time, it became a simple process to balance water flows to allow for maintenance without slipping below production targets. As well as reducing maintenance costs, operational costs, particularly power consumption, have been substantially reduced. The pumps are no longer clogged with iron bacteria, can run at peak efficiency and, importantly, breakdown incidents have been reduced to a minimum

"The outcome in the north well field was identical to the south – higher water yield at a lower cost and reduced down time. With water production 10,765 m^3 higher than in 2008, Tiwest is able to run three of the wells on a part time basis, allowing for an ongoing maintenance program to be implemented without any effect on operational levels.

This case study demonstrates the importance of an effective monitoring and maintenance program. "Regular proactive maintenance always proves to be most cost effective in the long run and businesses are urged to build in a programme rather than wait until a problem occurs," Deed concludes.

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