



A COMMERCIAL APPLICATION OF VIROMINE™ TECHNOLOGY

CASE STUDY: FOX RESOURCES, RADIO HILL TAILINGS DAM

“Virotec’s ViroMine™ Technology using its Acid B™ reagent provided a cost-effective way to lower the concentrations of all heavy metals in the tailings dam to well below target concentrations.”



Fox Resources Processing Plant (left), Acid B™ reagent slurry being applied (above).



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PROBLEM

Fox Resources had a highly contaminated tailings dam of about 50 ML. The waste water was too contaminated to be reused in the processing plant and the tailings dam was filling up. Space restrictions precluded using another tailings dam and hence, Fox resources had to find a way to treat the water in the existing dam so that it could be pumped out. The tailings dam was still in use and both tailings sludge and contaminated water were constantly being pumped in. The key objectives were to remove heavy metals from the water and to achieve concentrations that would enable it to be reused in the floatation process to extract copper and nickel sulphides. The water conservation that will result from reuse of the waste water following the application of ViroMine™ Technology is particularly important in arid zones such as the Pilbara region of Western Australia.

VIROTEC TOTAL SOLUTION

Virotec was contracted by Fox Resources to implement ViroMine™ Technology to treat the contaminated water in the 50 ML tailings dam so that it could be reused in the process plant.

Virotec's ViroMine™ Technology application, using Acid B™ reagent, converted the contaminated water in the tailings dam into a clean reservoir of water by extracting the heavy metals, and creating an isolating blanket over the settled tailings to prevent the escape of contaminated pore water that could interfere with treatment of the surface water. The Acid B™ reagent was able to treat the existing contaminants in the tailings dam as well as the constant inflow of contaminated water and tailings.

Virotec's ViroMine™ Technology total solution components included design, engineering, reagent application and treated water analyses at a NATA-certified laboratory. Application of the Virotec total solution resulted in all of the water being treated to well within the limits that would allow it to be reused in the processing plant on site. This water treatment approach not only eliminated the need to find a way to dispose of highly contaminated water but also substantially reduced water consumption at the plant by enabling waste water to be reused as process water.

BACKGROUND

Fox Resources acquired the Radio Hill mine, 35 km south of Karratha in the Pilbara region of Western Australia, and established a treatment plant that can produce up to 200,000 tonnes of nickel each year. Processing the copper and nickel ore to produce a concentrate uses water and after use the metal contaminated water is pumped into a tailings dam about one km away.

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Figure 1: Contaminated tailings dam at Fox Resources before being treated with Acid B™ reagent.

TREATMENT METHODS

ViroMine™ Technology, using Acid B™ reagent, was selected for this treatment. The Acid B™ reagent was mixed into a slurry using water from the tailings dam and the slurry was then sprayed onto the surface of the dam. The good dispersion properties of this reagent ensured that there was an even coverage for the entire dam. The treatment produced a thin cover of high-density sediment on the floor of the dam instead of the low density sludge that usually results when other treatment reagents are used. This procedure ensured that the tailings could be reprocessed in the future if it became technically and economically viable to do so. The *in-situ* treatment method used was simple to apply and required no expensive capital infrastructure; the few items of equipment required would normally be available or could be readily manufactured on most mine sites.

Samples taken during the treatment process, to monitor progress of the treatment, were analysed on site and showed a steady decline in metal concentrations as the reagent was applied. Samples of the treated water were also collected for treatment validation testing and analysed by the NATA-certified Richmond Water Laboratory to measure copper, iron and nickel concentrations. The results are listed in Table 2.

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Figure 2: Addition of Acid B™ reagent into a mixing tank to produce a slurry that can be sprayed onto the tailings dam.



Figure 3: Acid B™ reagent slurry being applied to the tailings dam.

RESULTS AND DISCUSSION

The treatment targets are shown in Table 1 and the metal concentrations achieved by the treatment are presented in Table 2. The metal concentrations in the treated water were well below the treatment targets, showing that the Acid B™ reagent provides an effective way to remove heavy metals in mine waters and to retain the metals so that they cannot leach back into the water.

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TABLE 1: TREATMENT TARGETS FOR TAILINGS DAM.

Contaminant	Raw (mg/L)	Treatment target (mg/L)
<i>Copper</i>	<i>0.76</i>	<i>1</i>
<i>Iron</i>	<i>45</i>	<i>1</i>
<i>Nickel</i>	<i>8.89</i>	<i>5</i>

TABLE 2: METAL CONCENTRATIONS BEFORE AND AFTER TREATMENT WITH ACID B™ REAGENT.

Metal	Raw (mg/L)	After Treatment with Acid B™ Reagent (mg/L)		
		Sample 1	Sample 2	Sample 3
<i>Copper</i>	<i>0.76</i>	<i>0.01</i>	<i>0.01</i>	<i>0.03</i>
<i>Iron</i>	<i>45</i>	<i>0.06</i>	<i>0.05</i>	<i>0.12</i>
<i>Nickel</i>	<i>8.89</i>	<i>0.46</i>	<i>0.32</i>	<i>0.84</i>

The results show that despite the tailings dam continuing to receive metal-contaminated water and tailings, the Acid B™ reagent was still able to produce treated water with a metal content well below the target concentrations. Furthermore, the Acid B™ reagent bound the metals in such a way that they cannot be released back into solution under existing geochemical conditions or under conditions that are ever likely to exist in the future. The high quality of the treated water made it possible to reuse the water in the mineral processing plant thereby greatly reducing the consumption of scarce natural water resources.

CONCLUSION AND RECOMMENDATIONS

Virotec's ViroMine™ Technology using its Acid B™ reagent provided a cost-effective way to lower the concentrations of all heavy metals in the tailings dam to well below target concentrations. The treatment was ecologically safe and produced a thin stable sediment cover on the tailings and not the unstable gelatinous sludge commonly associated with more conventional treatments. The treated water was suitable for reuse in the ore processing plant, thereby helping to conserve water in an arid environment.

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TESTIMONIAL

Virotec were contracted by Fox Resources to implement ViroMine™ Technology to treat a tailings dam. After the implementation of ViroMine™ Technology the water in the tailings dam was able to be recycled and reused in the process plant. ViroMine™ Technology has proven to be a viable and environmentally friendly solution to treating contaminated water.

“Virotec offered a quick response time and a quick treatment time. They provided an interim solution to our problem, and I would recommend the use of ViroMine™ Technology to any company that has similar requirements.”

Mark Eccleston- Safety, Health and Environment Manager