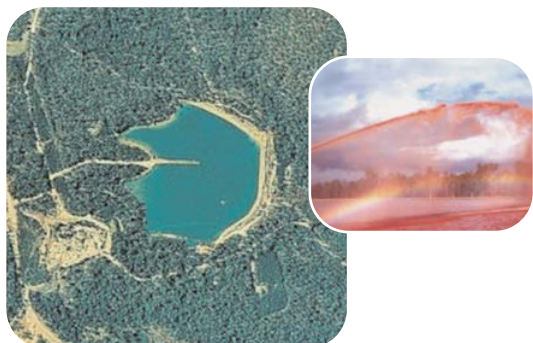




AN APPLICATION OF VIROMINE™ TECHNOLOGY

CASE STUDY: MT CARRINGTON TAILINGS DAM

*“Following treatment using ViroMine™
Technology, the treated water... was
100 times cleaner than drinking water.”*

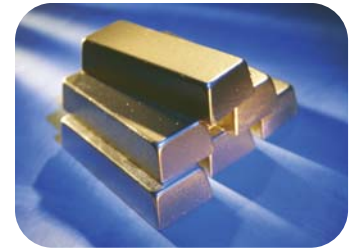


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PROBLEM

Following the closure of Mt Carrington Gold and Silver mine in the early 1990's, a legacy of over 100 years of mining was left in the form of a severely contaminated tailings dam. This 14 ha tailings dam had been the storage facility for all the contaminated water generated on the site.

After prolonged rain the dam threatened to break its banks and spill hazardous water into the largest water catchment in Northern NSW, Australia. The acidic water was laden with heavy metals and its release into the local environment would have been a catastrophe. The risk of dam overflow or complete dam collapse was imminent.



Gold and silver was mined at Mt Carrington from the late 1800's until 1990.

VIROTEC TOTAL SOLUTION

The potential disaster was averted by the application of ViroMine™ Technology. The Virotec total solution proved to be innovative, efficient, effective and immediately applicable during the treatment of Mt Carrington tailings dam.

ViroMine™ Technology application converted the hazardous water into a reservoir of clean water by simultaneously extracting the contaminants, and creating and maintaining an isolating blanket over the tailings deposit. This prevented the escape of contaminated pore water interfering with the treatment of the surface water.

The Virotec ViroMine™ Technology total solution components included design, engineering, application and ongoing monitoring. Application of the Virotec total solution resulted in 350 megalitres of water being released to the local catchment with a quality that exceeded heavy metal levels of the stringent ANZECC water quality guidelines.

BACKGROUND

The Mt Carrington region is extremely rich in mineral deposits. The region had been mined since the late 1880's. The original small scale mining was subsequently upgraded to large scale open cut mining and carbon-in-pulp gold extraction techniques. The mineralogy of the region was characterised by gold and silver ores containing significant heavy metal sulphides. A by-product of the mining operation was mine waste rock, high in sulphur content and capable of generating significant quantities of acid.

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To control the AMD, containing toxic levels of heavy metals, contaminated water generated on the site was pumped to the now decommissioned Tailings Dam. After several seasons of heavy rains during the 1990's, the dam had almost filled to its designed capacity. In late 1999, the tailings dam was near overflowing and posed a significant potential threat to the environment.

At the time where corrective action was necessary, there was no economic commercial treatment available to clean the contaminated water. This forced the owners of the mine to investigate ViroMine™ Technology.



An aerial shot of the Tailings Dam.



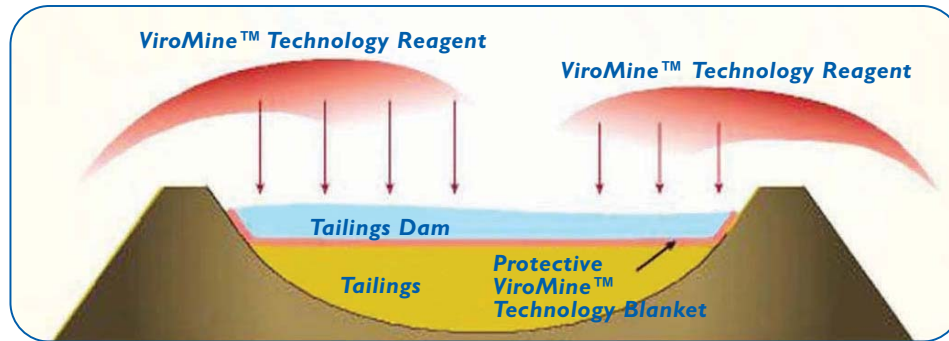
The Tailings Dam was severely contaminated and in danger of overflowing.

TREATMENT METHODS

After extensive testing and monitoring of the tailings dam water quality, a suitable reagent was developed and applied. ViroMine™ Technology Acid B™ reagent was chosen for this treatment.

The toe dam, located adjacent to the tailings dam was initially treated to quantify laboratory testing results. The Toe Dam had a capacity of 1.6 million litres and proved to be a logical progression between laboratory testing and full scale treatment of the tailings dam. After successful treatment of the toe dam, ViroMine™ Technology was applied successfully to the much larger 1,600 million litre capacity tailings dam.

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Acid B™ reagent was initially mixed into a slurry using water from the tailings dam. This slurry mixture was 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 an extremely thin and dense sediment on the floor of the dam. This sediment subsequently acted as a passive barrier for treatment of further ingress of acid mine drainage water.

The treatment method involved was an in-situ treatment which was characterised by no expensive capital infrastructure and a simple application method.



Acid B™ reagent was applied as a slurry mixture and sprayed onto the surface of the dam.

RESULTS

Following treatment using ViroMine™ Technology, the treated water from Mt Carrington tailings dam met the stringent ANZECC standards, in regards to heavy metals, for the protection of aquatic ecosystems – 100 times cleaner than drinking water. As a result approximately 350 million litres of water was released to the local Clarence River catchment. This was released at the rate of 1 million litres a day for a period of a year.

See Table: Heavy Metal and acidity levels before and after treatment with ViroMine™ Technology.

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TABLE: HEAVY METAL AND ACIDITY LEVELS BEFORE AND AFTER TREATMENT WITH VIROMINE™ TECHNOLOGY (all values in ppb)

| | Before ViroMine™ Technology | After ViroMine™ Technology |
|----------------|-----------------------------|----------------------------|
| pH Level | 5.2 | 8.1 |
| Aluminium (Al) | 1,060 | 13 |
| Arsenic (As) | <1 | <1 |
| Cadmium (Cd) | 310 | <1 |
| Copper (Cu) | 1,510 | 3 |
| Iron (Fe) | 108 | 20 |
| Lead (Pb) | 16 | <1 |
| Nickel (Ni) | 185 | 1 |
| Zinc (Zn) | 11,570 | <1 |



Treated water from the Tailings Dam being independently tested by government officers and released into local catchment.

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TESTIMONIALS

“The technology of using ViroMine™ Technology reagents is innovative and entirely new. The resulting cleaned effluent waters can be safely discharged to the environment. It may be the only acceptable and sustainable solution from an economic as well as environmental point of view to solve acid mine drainage.”

PROFESSOR DR R.D SCULLING
*International Institute of Environmental Engineering
Delft, Netherlands*

“It can be concluded that the treatment of the 1.6 million litres of contaminated mine water in the toe dam at the Mt Carrington mine site was effective and that the Virotec treatment neutralised the acidity and removed trace metals from the water.”

PROFESSOR GAVIN BIRCH
University of Sydney

“I know of no other practical and economic technology in the world today that could achieve such conclusive and wide-ranging results. The new technology and application procedures are able to reduce the concentration of many environmentally hazardous trace metals by over one hundred thousand times.”

PROFESSOR DAVID MCCONCHIE
Southern Cross University



CONCLUSION

ViroMine™ Technology has proven to be applicable for the treatment of heavy metal and acidity problems associated with tailings dams.

Acid Mine drainage water and contaminated tailings dams can now be economically treated to pristine environmental standards.

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