



A COMMERCIAL APPLICATION OF  
VIROMINE™ TECHNOLOGY

## CASE STUDY UK COAL, UNITED KINGDOM

*ViroMine™ Technology was effective in treating  
Maltby Colliery wastewater over a variety  
of soluble metal concentrations*



Virotec was commissioned to treat coal mine wastewater from Shaft No. 2 at UK Coal's Maltby Colliery using ViroMine™ Technology. The Maltby Colliery discharges pumped mine wastewater to a surface drainage and lagoon system. The mine wastewater is contaminated with varying levels of soluble iron, which precludes discharge of water to the local watercourse. Currently, mine wastewater is recycled back for coal washing, but under certain hydraulic conditions (i.e., wet weather) the existing mine wastewater lagoons fill and threaten to overflow to an offsite discharge point, with current discharge limits of 5.0 mg/L for soluble iron (Fe) possibly being exceeded.

A ViroMine™ column flow-through configuration was specifically designed for the treatment system in which coal mine wastewater was pumped from Shaft No. 2 directly to the filter containing Acid B™ media at a controlled flow rate based on optimum retention time for Fe removal. Treated mine wastewater was discharged directly to sewer. The column was a duty and duty/standby configuration with columns manifolded to allow switching of duty once the duty column was exhausted; pH monitoring of the treated water was used as an on-line measurement of column performance. The spent Acid B™ filter media was disposed as a mine waste on site to be used later for spoil heap remediation and revegetation.

The treatment configuration was simple, requiring no other chemical addition or equipment for sludge processing, and generated a non-leachable solid. This contrasts with the use of lime-based systems, which do not meet the "Best Available Technology" requirements of the United Kingdom's Environment Agency and have the following disadvantages:

- > For a similar system using limestone, a proportion of the limestone is spoiled because aluminium and iron/manganese-oxy-hydroxides precipitate onto the surface of limestone grains thereby reducing the system's capacity to neutralise the coal mine wastewater.
- > Even if neutralisation of wastewater is satisfactory in such systems, metal concentrations are not always reduced to acceptably low values because metals are mostly found at high concentrations in the extractable, bio-available carbonate phase of coal mine wastewater.
- > Lime added to acidic coal mine wastewater is partially soluble and thus leached out during periods of high rainfall, together with precipitated metal hydroxides, further reducing the long-term effectiveness of the system.
- > Lime treatment allows temporary re-vegetation of coal tailings but is not sustainable. Liming reasonably quickly stops neutralising acid and does not prevent metals from being taken up by plants, rendering reclaimed land generally unsuitable for agricultural purposes by re-releasing metals back into the environment or into the food chain. (Work conducted separately at another mine site suggests this reversal of lime-based approaches begins within six to 12 months as opposed to a ViroMine™ Technology revegetation program which is successfully neutralising acid and promoting plant and tree growth more than eight years after application.)



Site of ViroMine Technology treatment system at UK Coal's Maltby Colliery site

These conclusions are in contrast to ViroMine™ Technology treatment and remediation which can be used to remediate metal contaminated soils and help develop a sustainable soil cover with metals fixed in a non-leachable and non-bioavailable form.

Samples of coal mine wastewater were taken over a six-week period and Fe concentrations averaged 44 mg/L (sometimes as high as 80 mg/L) and pH averaged 6.0. As a result of the ViroMine™ treatment, as shown in Table 1, Fe levels were reduced to 0.5 mg/L and pH remained unchanged. When the Acid B™ media in the filter columns was tested for metal retention capacity, it was found the media bound in excess of 29 g of Fe per one kilogram of media after six weeks, with a predictive capacity of >50 g/kg.

**TABLE 1: VIROMINE TREATMENT OUTCOMES FOR UK COAL'S MALTBY COLLIERY IN THE UNITED KINGDOM**

Parameter	Before Treatment	After Treatment with ViroMine™ Technology	Regulatory Discharge Limits
pH	6.0	6.0	6.0-8.0
Iron (mg/L)	44	0.5	5.0

Table 1: Treatment results for Maltby Colliery mine wastewater using a filtration method.

The project concluded that ViroMine™ Technology was effective in treating Maltby Colliery wastewater over a variety of soluble metal concentrations (e.g., 20-80 mg/L) to achieve Environment Agency consent conditions or better. Assuming an average daily flow of 900 m<sup>3</sup>/day (or 137 gallons/min), ongoing treatment required a bed of 150 m<sup>3</sup> capacity containing 110 tonnes of pellets. With a trickling filter configuration the estimated bed lifetime for the system was 200 days with a treatment capacity of up to 180,000 m<sup>3</sup> (or 40 million gallons) at an average iron concentration of 25 mg/L.