

FACTS



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SITE REHABILITATION REDUCES ARSENIC LOADING TO MOIRA RIVER

Arsenic in water is a potential health hazard.

The Ministry of the Environment first monitored arsenic levels in the Moira River basin in the Deloro area in the early sixties.

Arsenic was slowly but steadily leaching into the Moira River.

Today's contamination problems can be linked to gold rush fever in Hastings County in the late 19th century, which sparked the birth of the Village of Deloro.

Arsenic compounds were the useful but dangerous byproducts of mining and smelting operations carried out by many companies. These operations started in 1873 and shut down in 1961.

About 25 mine shafts were sunk on the village site following the gold discovery at Eldorado in 1866. Large quantities of gold and arsenic were mined from 1899 to 1904.

The area became known as the "Valley of Gold."

A silver refinery was set up at Deloro in 1903. In 1914, the first cobalt metal produced commercially in the world was manufactured at the Deloro plant. Deloro was the site of the only cobalt plant in North America during World War II.

Arsenic, a byproduct of smelting such arsenic-bearing ores as gold, copper and other metals, was used to produce pesticides. Arsenic is also a major byproduct of silver refining.

Slumping demand led to a decline of silver mining in the area and forced the closing of the Deloro site in 1961.

Tons and tons of arsenite waste--refining slag, tailings, calcium arsenite, arsenic pesticides--were buried on the site when the operation closed its doors.

This waste is the source of the present arsenic contamination in the Moira River basin.

The ministry has collected, tested and treated Deloro's arsenic contaminants since April, 1979. The ministry took over the operation of the arsenic removal plant when the present site owner, Erickson Construction Ltd., declared a lack of operating funds.

The ministry has so far spent \$5 million to clean up the site and treat arsenic contamination. A \$250,000 figure has been estimated for the yearly operation of the arsenic treatment plant.

The treatment facilities are continually being upgraded in the Moira River to decrease arsenic levels to the acceptable level of 0.05 parts per million as a yearly average, with a maximum at any given time of 0.20 ppm.

These standards provide a safety margin for consumers drinking downstream water.

The ministry operation has substantially reduced arsenic contamination of the Moira River. Treatment facilities collect an estimated 80 to 90 per cent of arsenic-contaminated leachate.

Average daily arsenic loadings have decreased from 35 kilograms for the period 1979-82, to 4.9 kilograms in 1985-1986. This represents an average reduction of 86 per cent since 1979.

The early spring and fall peak loading rates have shown the greatest arsenic loading reductions. And the summer arsenic loadings, which have the largest impact on Moira River arsenic concentration, have declined by 44 per cent since 1979.

Arsenic concentrations in the Moira River downstream of the Deloro site have plummeted from an average of 0.33 mg/L in 1979 to 0.16 mg/L in 1983 to 0.08 mg/L in 1984. Peak summer concentrations have also been reduced and were less than 0.2 ppm in 1986.

The ministry monitors the Moira River throughout the year at the Deloro site. Over 1,000 samples are collected from seven sampling stations and analysed for arsenic concentrations every year.

These arsenic samples indicate locations where arsenic is leaching into the water system. The pinpointing of these sources is followed up by treatment to reduce arsenic concentrations to acceptable levels.

Deloro's arsenic treatment facilities include an 80-metre-long concrete dike along the Moira River, an 11,300-cubic-metre equalization pond, a collection system including six pumping stations, plus the arsenic treatment plant.

The ministry started construction on the new collection, storage and treatment system in July, 1982. This included renovations to the old lab buildings, installation of a new dike, and construction of the new equalization pond and a collection tile system in the pumping stations.

In 1984, a pumping station was built near the southwest bank of the Moira River and a collection system installed to remove a significant source of arsenic contamination to the river. A pumping station was constructed near the new equalization pond to attempt further arsenic loading reductions.

Other 1984 improvements included: sludge dewatering studies and a freeze-dry sludge pilot study examined potential methods for the ultimate disposal of arsenic treatment plant sludges; one acre of the ferric hydroxide tailing area was revegetated, using lime and sewage sludge.

A pumping station was built in 1985 in the Tuttle Shaft to collect another major source of arsenic contamination.

In 1985 the arsenic baghouse was removed and the area covered, sealed and seeded. A sludge-storing lagoon was added, and hydro seeding of the potentially high arsenic concentration areas was completed to attempt to improve water runoff.

In 1986 and 1987 eight hectares of red mud tailings were covered to a depth of 0.5 metres with 76,000 tonnes of crushed limestone. This will eliminate wind and surface-water erosion. The limestone will also resolve the acidity problems and bacteria action in the red mud tailings. The east and west dams were stabilized.

The cleanup of the west side of the Moira River will include a ferric arsenite sludge concentration and disposal method, site rehabilitation and calcium arsenite containment. The mining area will also be secured. Additional safety features have also been implemented in 1986.

Here's how the system works:

Groundwater, containing anywhere from 5 to 3,000 mg/L arsenic, plus some surface water, is collected by the concrete dike and collection piping and pumped to the clay-lined equalization pond. The water is then pumped from the lagoon to the arsenic treatment plant.

At the treatment plant, ferric chloride is added in the first mixing tank at a ratio of 2.5 parts iron to 1.0 arsenic. The mixture flows from this tank to a second tank, where lime is added to bring the pH level of the water up to 9.5.

Ferric arsenate, a fine, brownish precipitate, is formed at this pH level. This mixture flows through a third tank; where polyelectrolyte, a substance of high molecular weight, is added to help the ferric arsenate form larger particles.

These larger particles settle out quickly in the clarifier, in the form of a brownish, ferric arsenate sludge. The sludge is then pumped from the bottom of the clarifier to holding lagoons.

The treated effluent, with 99.5 per cent of the arsenic removed, flows to the Moira River. Arsenic concentrations may still be above the 0.05 mg/L objective in the river just below Deloro, but meets acceptable standards at downstream water supplies.

Senior ministry officials are now exploring other measures to further reduce the amount of arsenic contaminating the Moira River. All possible solutions will be examined.

The ministry will continue to closely monitor the Moira River and maintain and upgrade arsenic abatement measures.