

FACTS



Ministry
of the
Environment

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DELORO ARSENIC TREATMENT PLANT

July/83

The Ministry of the Environment has been active in the Deloro area since the early 1960s, when it began to monitor arsenic levels in the Moira River Basin. Arsenic compounds from a Deloro smelting company which shut down in 1961 had been detected in the ground water table and were passing into the river.

The village of Deloro grew out of the gold rush days in Hastings County. Following the discovery of gold at Eldorado in 1866, at least 25 mine shafts were sunk on the site of the village. The district came to be called Deloro, meaning "Valley of Gold."

From 1899 to 1904, substantial quantities of both gold and arsenic were mined. Arsenic is a byproduct of smelting arsenic-bearing ores of copper, gold and other metals.

Following the discovery of silver at Cobalt, Ontario, in 1903, a silver refinery was set up, with arsenic as an important byproduct. In 1914, the first cobalt metal produced commercially in the world was manufactured at the Deloro plant. During World War II, Deloro was the only cobalt plant on the North American continent. In 1961, a decline of silver mining in the area led to the closing of the site, and tons of arsenite refuse were buried. These arsenic remains are the source of the current contamination problem in the Moira River Basin.

Since early 1979, the MOE has been both testing and treating the arsenic contaminants at Deloro. The Ministry took over the original collection and treatment facilities from the present owners, Erickson Construction. The Ministry is upgrading the facilities to decrease levels of arsenic in the area.

Arsenic is a non-metallic, poisonous element which is found in a wide variety of natural organic and inorganic materials. While traces of the element can be found in most living organisms, and it is commonly absorbed into the body through ingestion or respiration, too high a level can result in arsenic poisoning.

Arsenic in water supplies is a potential health-hazard, and in the Moira River Basin, treatment facilities are being upgraded to decrease arsenic levels in the area to the acceptable levels of 0.05 ppm (parts per million) as a yearly average with a maximum at any given time of 0.2 ppm. These standards are meant to provide a margin of safety to consumers of drinking water. The standard of 0.05 ppm is the level at which arsenic levels in the body begin to rise.

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At the Deloro site, the Moira river and its watershed are monitored throughout the year. Last year, over 1,000 samples were collected and analysed for arsenic concentration. Arsenic levels taken at the various sites give a good indication of where arsenic is seeping into the water system. Once the trouble spots are pin-pointed, treatment will effectively reduce arsenic concentrations to acceptable levels.

The arsenic treatment facilities at Deloro consist of an 80 metre long concrete dyke along the river, an 11,300 cubic metre equalization pond, a collection system including five pumping stations, and an arsenic treatment plant.

Groundwater, containing 30-3,000 ppm arsenic, and some surface water, is collected by the concrete dyke 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 plant, ferric chloride is added in the first mixing tank at a ratio of 2.5 parts iron to 1.0 arsenic. From this tank, the mixture flows to the second tank, where lime is added to bring the pH of the water up to 10.0. This is the level at which ferric arsenate, a fine brownish particle, is formed. Next, this slightly thickened mixture flows through a third tank and a flocculant aid, polyelectrolyte, is added. This helps to form large particles.

These large ferric arsenate particles settle out quickly in the clarifier and are pumped from the bottom to holding tanks, in the form of a brownish ferric arsenate sludge. The clear water effluent, with 99.5% arsenic removal, flows to the Moira River. While arsenic concentrations can still be above objective in the river just below Deloro, the level decreases in a downstream direction, and reaches acceptable standards at downstream water supplies.

In July, 1982, construction began on the new collection, storage and treatment system at Deloro. Construction involved renovating the existing lab buildings, supplying and installing the new dyke, building the new equalization pond and installing a collection tile system in the pumping stations.

The consulting engineer for the Deloro Arsenic Removal Plant was Reid, Crowthers, and Partners, Limited, Toronto. The general contractor was Duntri Construction, Port Perry.

To date, the Ministry has spent approximately \$2.5 million, including the cost of the new plant, to clean up the site, and treat arsenic contamination. Until more accurate flow and arsenic data is obtained, an operating cost of \$250,000 per year has been estimated for the new treatment system.