

Cleaning



by John Nicholson, P.Eng., and James Sbrolla

up with biotech

Tough new legislation, technological advancements in bioremediation, and Ontario engineers repair the environment.



Public concern over the environment has caused sweeping legislative changes in Ontario recently. There is now greater awareness of air pollution. Many are concerned about the generation, transportation and disposal of hazardous waste. And by now, every person in the province has thought about his or her drinking water.

Stringent regulations and standards challenge industry to come up with new solutions to reducing pollution and cleaning up problems from the past. The changes in environmental legislation have helped fuel technological advancements that protect the environment and provide health benefits.

The water we drink

The events in Walkerton in May 2000 made all Canadians realize how essential clean water is. Seven people died and thousands fell ill because of the contamination. Many people took drinking water for granted before the tragic incident caused by the deadly *E. coli* bacteria. In response, the Ontario government moved swiftly to ensure that a similar situation

would not occur again. It ordered the inspection of over 600 drinking water treatment plants and promulgated the Drinking Water Regulation that specifies the requirements for treating and testing drinking water.

A key aspect of safe drinking water is the treatment of wastewater. One company specializing in biotreatment of wastewater is Concord-based CMS Group Inc. Since beginning operations in 1974, CMS has been involved in the design, development and manufacture of Rotating Biological Contactors (RBCs) and has registered several patents for these and other waste treatment systems. China, Israel, and Jamaica are among the many countries where these bioreactors are working successfully.

Closer to home is the leachate treatment facility at Mississauga's Britannia landfill, points out Audrius Vaidila, P.Eng., vice president, special projects, for CMS. Leachate is produced when groundwater or rainwater pass through refuse. The water that passes through can absorb contaminants, so allowing the leachate to enter the water table is unacceptable.

An RBC is a biological treatment system that comprises a series of discs or media blocks mounted on a shaft, which is driven so that the media rotates at right angles to the flow of wastewater. The discs are normally made of plastic and are contained in a trough or tank so that about 40 per cent of their area is immersed. The biological growth that becomes attached to the media assimilates the organic material in the wastewater. Aeration is provided by the rotating action, which exposes the media to the air after contacting them with the wastewater.

It's in the air

Recognizing the serious health concerns associated with air pollution, the Ontario government is moving forward with a number of air initiatives. On May 1, 2000, it implemented a regulation requiring the electricity sector to monitor and report on 28 air pollutants. The plan is to expand the regulation to require other industrial sectors in Ontario to monitor and report on air pollutants, including greenhouse gases. Once in place, the government believes this system will provide incen-



tives for generators to reduce their emissions above regulated limits.

In March 2001, the Ontario government proposed strict emission limits for the electricity sector. It also proposed that the Lakeview Generating Station in Mississauga cease burning coal by April 2005. At the same time, Queen's Park announced it is updating or developing 145 air standards in the first major overhaul of environmental standards in more than 20 years. The government announced that it would implement a new provincial guideline for commercial and industrial boilers and heaters as well, which would impose limits on nitrogen oxides (NOx) emissions by large boilers and heaters.

Meeting the new air pollution controls may prove difficult for some industries. But the use of biotechnology could make things easier. Biofilters can remove contaminants from the air without transferring the problem to water or soil.

Biofiltration uses naturally occurring microorganisms to biologically break down such organically based air pollutants as solvents and volatile organic compounds

(VOCs). The byproducts of biofiltration are carbon dioxide and water. The process is completely natural and does not employ chemicals or produce waste. Founded in 1991 by former University of Waterloo research engineers, Guelph-based Biorem Technologies Inc. is one company that tackles air pollution problems by utilizing such biotechnology.

Derek Webb, P.Eng., operations manager, feels biotechnologically based solutions to environmental problems are the way of the future. "Our challenge is to harness the natural forces of nature to work at cleaning up industrial air streams," he says. "Some people mistakenly think that the microorganisms are genetically altered, but they are, in fact, naturally occurring. We just engineer conditions that allow them to grow and prosper. They do the rest by eating the contaminants from the air and sending water vapor and carbon dioxide up the stack."

Biofiltration is a relatively new pollution control technology that treats organic gases like volatile organic compounds or hydrocarbons or inorganic air toxins such as ammonia or hydrogen sulfide. The basic component of the biofilter is the filter bed and a piping system that forces the gas to pass through the biofilter. A typical biofilter comprises one or more beds that are usually about one metre in height.

When waste is a hazard

In November 2000, Queen's Park passed the toughest hazardous waste regulation in the province's history. The changes to

Ontario's Waste Management—General Regulation (Reg. 347) aimed to strengthen and modernize the rules governing hazardous waste management and to protect the air, water and land. They took effect on March 31, 2001.

The new regulation requires the use of the Toxicity Characteristic Leachate Protocol (TCLP) to determine if a waste is hazardous. This procedure is more advanced than the leach test now being used in Ontario. The regulation also introduces a new "derived from" rule stating that any listed hazardous waste will keep this classification until it can be clearly demonstrated that it is no longer hazardous.

Petrozyme Technologies Inc. develops and supports innovative biological processes to treat petroleum industry sludge and oily wastes. William Mullin, P.Eng., says treatment is on-site so that hazardous waste does not need to be transported. The waste is rendered non-hazardous through biological degradation with the byproducts being carbon dioxide and water.

The company's process uses a bioreactor that enables indigenous bacterial populations to efficiently consume waste hydrocarbons in a batch process. The aerated bioreactor is supplied with a proprietary nutrient blend and bacterial culture. Reactor design and process operating conditions promote growth of highly active populations of bacteria that rapidly degrade the hydrocarbon sludge to water and carbon dioxide. Typical oil concentration input to the reactor is in the 10 to 30 per cent range.

"Our technology is exported to the United States and Venezuela. When bidding these projects, we were competing against some tough international players. It feels good to know that our technology is competitive and at the same time that we are cleaning up the environment throughout the world," says Mullin.

Protection of the environment has become a priority for all engineers, regardless of their area of practice or their area of expertise. Bioremediation offers a solution to solve some of the challenges associated with cleaning our air, water and hazardous waste. As these three examples illustrate, engineers and technologies from Ontario are reshaping the way that environmental challenges are being dealt with, here, and abroad. ♦

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No contamination: A Rotating Biological Contactor built by CMS Group Inc. can help protect the water table.