A Penny for Your Cotts

Beverage container management in Nova Scotia

by Clarissa Morawski

This is the fourth article in a series on provincial beverage-container recovery programs in Canada. Of the programs reviewed to date, Nova Scotia's operates at the lowest cost; it recovers 76 per cent of beverage containers sold annually at a net system cost of less than a penny per container.

All beverage containers in Nova Scotia are on deposit except those used for milk and milk products The deposit-refund program—initiated in April 1996—was the first step in the province's waste reduction strategy that also includes aggressive curbside recycling and composting. By November 1998, specific material bans included: corrugated cardboard, newsprint, automotive batteries, leaf and yard waste, used tires, waste paint, automotive antifreeze, compostable organic materials, plastic film and bags, steel, aluminum, and glass containers.

The province's current diversion rate is 34 per cent, and it's striving for 50 per cent by the year 2000.

The Resource Recovery Fund Board (RRFB)—a private, not-for-profit company—administers both Nova Scotia's deposit-refund program and the bulk of its waste management regulations.

To recover non-alcoholic beverage containers, the RRFB has partnered with municipalities, more than 90 privately owned Enviro-Depots, regional processors, and cartage companies. Alcohol containers are returned to the Enviro-Depots and the Nova Scotia Liquor Commission's (NSLC) retail outlets. In March of this year, the NSLC will stop collecting and managing alcohol containers; the RRFB will assume these duties (via the depots) and refillable beer bottles will be managed separately by the breweries. Since the program was implemented two and a half years ago, the annual beverage container recovery rate has risen to 76 per cent.

Resource Recovery Fund Board Inc. (RRFB)
Income Statement April 1st, 1997- March 1st, 1998

Revenues		**Notes**
Gross revenues from deposits	$ 16,135,869	Unredeemed deposits contribute $4,043,535 to the system's revenues.
Material revenues from the sale of recyclable materials	$ 2,311,004	
TOTAL	**$ 18,446,873**	
Expenses		
Handling fees for deposit-bearing containers	$ 3,510,524	The handling fee is 2.5 cents per container.
Deposits returned to consumers	$ 6,166,817	Consumers returning containers receive 5 cents back.
Transportation	$ 995,796	
Processing	$ 885,517	
Administration	$ 1,698,128	Included in this figure is the administration for the scrap tire program. A separate deposit-return administration cost is not available
Non-deposit bearing materials (handling, transportation and processing costs)	$ 376,872	Non-deposit bearing materials include: milk containers till Aug 97,OCC and ONP. (handling: $179,570, transportation: $97,891 & processing: $99,411 = $376,872)
Opening inventory minus closing inventory	$ (23,922)	
TOTAL	**$ 13,609,732**	
PROFIT	**$ 4,837,141**	
Net profit per container recovered	**3.4 cents**	Net profit per container is calculated by dividing the profit by the total containers recovered. ($4,837,141/ 141,836,783 = 3.4 cents)
Net system cost per container recovered	**.77 cents**	Net system expenses: (handling fees + transportation + processing + administration + non-deposit bearing material costs + closing inventory) Net system revenues: (unredeemed deposits + material revenues) = $1,088,376 / 141,836,783 containers recovered = .77 cents/container

Note: All cost and revenue figures are net of HST.

Though milk is exempt from the deposit program, the RRFB encouraged the voluntary diversion of these containers through the depots from April 1996 to August 1997. Collection was terminated due to high costs. Instead, the dairy industry has signed a "memorandum of understanding" with the province to develop a stewardship plan that will support education, fund municipal programs, and develop more environmentally responsible packaging. To date, the level of support hasn't been determined.

Nova Scotia deposit-return system is a "half-back" program similar to that of New Brunswick. (*See the article on page page 47 in SW&R's October/ November 1998 issue.*) A 10-cent deposit is charged on non-refillable containers, half of which is refunded to customers upon their return to a depot. Of the remaining 5 cents, half (2.5 cents) is paid as a handling fee to depot operators and half is kept by the RRFB. (Refillable containers may be redeemed for the entire 10-cent deposit.)

In fiscal 1997, this system generated $4,837,141 (or 3.4 cents per container) for the province. The money accrued largely from the non-refunded half-back portion of the deposit on non-refillable containers (2.5 cents).

However, it's important to understand that per container system costs are calculated independently from the revenues associated with the unredeemed half-back portion because they are not used to off-set system costs. Net program cost is determined by subtracting the program's direct expenses from the revenues accrued from unredeemed deposits and from the sale of recovered materials. The net cost per container recovered is then determined by dividing this net program cost by the number of recovered containers. Doing this with the 141,836,783 containers recovered in fiscal 1997 results in a system cost of 0.77 cents per container. So, the province recovers 76 per cent of beverage containers for less than a penny each. (*See chart on page 24.*)

What's done with the program's $4.8-million net revenue? It supports other diversion efforts in the province. Fifty per cent is given to municipalities to offset their diversion costs. Municipal payments are based on credits that are calculated by assessing a municipality's current diversion rate against a 1989 baseline provided by the Nova Scotia Department of the Environment.

The other half is used for approved programs such as education and awareness, staffing (e.g., regional waste reduction coordinators), and the development of markets for materials that would otherwise be landfilled. For example, financial assistance was given to help establish Amherst-based Novapet Inc.—a company that handles the PET collected through beverage container programs in New Brunswick, Nova Scotia and Newfoundland. This "Maritimes solution" employs fourteen people and processes and sells about 800,000 pounds of PET each month.

Unredeemed deposits account for $4,043,535 of the RRFB's net revenues. Using this revenue to fund the operation of the system is consistent with the provincial *Environment Act* in which "polluter pays" is a fundamental principle.

When Nova Scotia's system was first introduced, some viewed it as a "thirst tax." However, current support for the system is high. Also, a 1998 public opinion poll revealed that 92 per cent of Nova Scotians support the principles of waste reduction and 97 per cent regularly participate in 3Rs programs and composting. The research also shows that 80 per cent of Nova Scotians are more aware of recycling issues today than they were a year earlier. Perhaps more importantly, in 1998 Clean Nova Scotia (a not-for-profit environmental agency) found 65 per cent fewer beverage containers during its provincial beach cleanups than in 1990.

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Biological Leachate Treatment

by Clarissa Morawski

As an alternative to conventional methods for processing organically contaminated wastewater, businesses and small municipalities may use systems modelled on natural ecosystems. Biological wastewater systems or artificial aquatic filtration systems are effective and cost-effective, but their application has only recently been extended to the treatment of landfill leachate.

In the first bed, the leachate is aerated to encourage bacterial growth.

The systems are essentially natural wetlands housed in energy efficient greenhouses. These "living machines" mimic a natural ecosystem in which biological waste materials are synergistically processed by a web of bacteria, algae, plants, snails and fish. They convert organic wastes into the living tissue of organisms within the treatment system. (The remainder is bound in gases associated with the respiration of the plants and animals within the system).

Leachate Treatment Expenses

	Artificial Aquatic Filtration System		Offsite
	half capacity 7,300m³	full capacity 16,000m³	11,300m³
Monitoring	$15,000	$15,000	Essex-Windsor pays a flat rate per cubic metre of treated leachate
Utilities	$6,000	$6,000	
Labour, parts, re-stocking of plants etc.	$10,000	$10,000	
Total / m³	$4.25	$1.94	$8.82
Transportation/m³	$-	$-	$3.80
Total cost/ m³	**$4.25**	**$1.94**	**$12.62**

In the summer of 1997, Essex-Windsor Solid Waste Authority (EWSWA) received a certificate of approval from the Ontario Ministry of Environment for an experimental onsite leachate treatment facility at its regional landfill in the Township of Colchester North. A certificate of approval was issued for pilot studies for three years.

"The systems are essentially natural wetlands housed in energy efficient greenhouses."

In 1998, the EWSWA used this natural technology to treat one quarter of the leachate generated that year (7,300 m³) at its landfill. The system can discharge 1,820 litres of water per hour or 43.7 m³ per day (16,000 m³ per year). At full capacity, the discharge potential is 5,455 litres per hour or 131 m³ per day (48,000 m³ per year).

The system was co-designed by Todd Pepper, the general manager of EWSWA and Boardwalk Aquatics. It's a freestanding greenhouse approximately 30 metres by 9 metres in size. Within the facility there are 3 one-metre-wide channels, each of which is 23 metres in length. Lined with a polypropylene geomembrane, these concrete channels contain the biological materials that comprise the aquatic ecosystem.

As with natural ecosystems, biological activity requires light, water circulation, and ventilation—all of which are provided by a 200 amp, single-phase electrical service. A complete lighting system allows photosynthesis to be extended during the winter months. Two natural gas units heat a closed hot water heating system that also warms the ambient air with forced air coils. Influent is received from a well pump capable of delivering between 1,514 and 4,542 litres of leachate per hour. Leachate entering the system passes through a heat exchanger that elevates its temperature to 25°C before introducing it into the first channel.

Hyacinths (commonly referred to as "nature's purifiers") populate the first channel where they actively consume phosphates, nitrates, and some chlorides as nutrients. At this point, the leachate is also aerated to encourage bacterial growth.

The second channel is coated with algae and microorganisms that convert complex molecules into simple nutrients. Oxygenating plants that also reside in the second channel immediately absorb these nutrients.

The third (and final) channel includes a mixture of floating plants, fish, and other aquatic biota from which the leachate flows to a marsh/bog area that contains a natural filter comprised of 103 square metres of pea stone bound with root fibres from hundreds of plants. Once discharged from the marsh, the former leachate is nearly potable water.

"The second channel (of three) is coated with algae and microorganisms that convert complex molecules into simple nutrients."

Water quality monitoring is performed by a flow calibrated automatic sampler installed at the final stage of the system. Weekly analysis is car-

ried out by the EWSWA for the following discharge parameters: BOD5, suspended solids, phosphorus, ammonia, *E. coli*, dissolved oxygen, pH, and temperature. Monthly composite samples are analyzed for nitrate, chloride, heavy metals, and organic materials.

If the effluent meets the environment ministry's discharge criteria, it's released into the storm water management facility located on the site. If it doesn't meet the criteria, it's either directed back into the front end of the process, discharged into a retention pond used for a leachate land application system (utilized in the summer months), or recirculated through a bioreactor.

Last year's monitoring results were very favorable. Except for three occassions, all major leachate constituents (except chloride) showed significant reductions after passing through the system and met the discharge criteria for all parameters. (It's important to note that low precipitation will result in elevated concentrations of certain discharge parameters in treated leachate.)

The system cost $150,000 to build,

Heat exchange boiler influent received from the well pump.

and can potentially treat 16,000 m^3 each year. With little precipitation and less-than-normal leachate generation, Essex-Windsor's system operated at only half capacity in 1998. The system's 1997-98 annual operating cost was $31,000 including monitoring, utilities, labour, and parts (*see chart*).

With moving parts largely supplied by Mother Nature, the cost to treat a cubic metre of leachate using

"With moving parts largely supplied by Mother Nature, the cost to treat a cubic metre of leachate using the system at full capacity is $1.94."

the system at full capacity is $1.94 versus an offsite conventional treatment cost of $12.62. Essex-Windsor is now working to achieve zero offsite discharge through the use of its biological system and other onsite leachate treatment systems. An annual report on the system's first year of operation is being prepared.

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